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New Business and Regulatory Strategies in the Postal Sector

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Preface

This book is a result of the 26th Conference on Postal and Delivery Economics, which was held on May 30–June 2, 2018, in Split, Croatia. The Conference was a joint effort of the Florence School of Regulation—Communications and Media (FSR C&M) at the European University Institute and of the Center for Research in Regulated Industries (CRRI) at the Rutgers Business School.

Since the first conference was organized in July 1990, almost 4000 participants have had the opportunity to discuss evolving trends in the postal and delivery economics sector. This Conference continues to be a crucial opportunity for the relevant stakeholders to share knowledge and best practices, following the tradition established by Michael Crew and Paul Kleindorfer when they held the first conference in 1990.

The Conference on Postal and Delivery Economics is a testament to the evolution in the postal and delivery sector over the last 25 years: from high letter volumes to a progressive increase of parcel delivery, from the start of the liberalization process to the disruptive impact of digitalization and the Internet, and from sector-specific activities to new business differentiation and to new customer-friendly solutions. At the same time, the Universal Service Obligation remains a central element of the regulatory, policy, and economic debate.

The Conference was made possible by the contribution of generous sponsors. We would like to thank them not only for financial support. In addition, they provided helpful advice in their service on our organizing committee as well as, along with others, intellectual contributions, advice, and encouragement: Virginie Alloo, Kamak Arzhangi, Bruno Basalisco, Claire Borsenberger, Stephen Brogan, Claire Carslake, Mindaugas Cerpickis, Alberta Corona, Peter Dunn, Blandine Eggrickx, Colm Farrelly, Lucia Fioravanti, Jean-Paul Forceville, Jimmy Gårdebrink, Marina Gibbs, Adam Goodman, Stefano Gori, Annegret Groebel, Philip Groves, Fiona Hamilton, John Hearn, Adam Houck, George Houpis, Alison Jessop, Denis Joram, Olaf Klargaard, Marine Lefort, Leonardo Mautino, Anna Möller Boivie, Eleanor Monaghan, Henrik Ballebye Okholm, Michela Raco, Philippe Régnard, Frank

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Contents

Postal Operators as "Ground Based" Online Platforms?

Paula Gori and Pier Luigi Parcu

1 Introduction

Postal services may look old fashioned, especially to the online generations, but postal operators (POs) historically were the first "communications companies", with the largest customer bases and as stated in Title 39 of the U.S. Code, it was the PO that "binds the nation together".[1]

In the twentieth century, voice telecommunications challenged but did not displace postal services. However, yesterday's challenge of voice telecommunications to postal operators appears minor compared to the disruption now caused by online communications. That the Internet is having a disruptive impact on many, or maybe all, business models is obvious. What is less clear is if, and how, sectors affected by online services can react to the disruption and survive by transforming it into an opportunity.

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[1] Article 39 (a) "The United States Postal Service shall be operated as a basic and fundamental service provided to the people by the Government of the United States, authorized by the Constitution, created by Act of Congress, and supported by the people. The Postal Service shall have as its basic function the obligation to provide postal services to bind the Nation together through the personal, educational, literary, and business correspondence of the people. It shall provide prompt, reliable, and efficient services to patrons in all areas and shall render postal services to all communities. The costs of establishing and maintaining the Postal Service shall not be apportioned to impair the overall value of such service to the people."

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The European Commission, analyzing the digital revolution, has listed a number of essential features of the so-called online platforms that are key to understanding the opportunities they present. Online platform create and shape new markets (substituting or integrating traditional ones); they operate in a multi-sided market environment; they exploit direct and especially indirect network effects; they rely on ICT to constantly reach users; they create digital value (European Commission, 2016). Among the key ingredients for the affirmation and success of online business models, no matter the specific type, is the ability to gather and exploit large amounts of data and to acquire the trust of consumers.

Historically, because of their intermediary role, POs fare well on both of these dimensions: they have developed and used large databases and have established a long-term relation of trust with consumers. POs have additional strengths that follow from owning a series of other important assets such as a widespread presence of physical locations, a large work force, a multitude of vehicles, and so on—elements normally either missing or secondary in the business model of online platforms.

The aim of this paper is to understand whether POs could restructure their business models by transforming themselves in a new kind of ground-based online platforms or, at least, by creating strategic alliances with other major online platforms by virtue of having somewhat complementary assets. To this purpose, after a brief review of the disruption created by online platforms, we will examine behaviors and intentions of some important POs active within the European Union. We then look at the assets and strengths that may facilitate a move toward a stronger online role for POs and sketch risks and opportunities they face as they attempt to redefine themselves as a possible new *genus* of online platform.

After this introduction, Sect. 6 contains a literature review of the digital opportunities offered to POs that are analogous to those we plan to explore in this chapter. Section 3 describes the PO business dilemma presented by digitalization. This is followed in Sect. 4 by a brief presentation of the most recent digital strategies of five large European POs: Royal Mail, Deutsche Post DHL Group, Le Groupe La Poste, Poste Italiane and Correos Group.[2] By describing their reactions to the online challenge, we aim to understand if best practices are emerging that lead to a new major role for POs in the online world. In Sect. 5, we sketch our idea of POs as new kind of ground-based online platform. Finally, we conclude with a summary of our argument and suggested leads for further research.

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[2]The authors would like to thank the five operators for having shared their feedback as a follow-up of the presentation of the draft version of this paper at the 26th Conference on Postal and Delivery Economics. Their input was key for finalizing this chapter.

2 A Short Survey of the Existing Literature on POs Digital Role

Most of the previous literature treating the relation between Internet and the postal sector seems to agree that notwithstanding the disruption, POs can profit from online services and go into a "Version 2.0" of their business model. Asher, Callan, and Marsh (2011), analyzing the role of the postal service in the digital age in the United States, concluded that USPS could continue to "bind the nation together" by embracing technological development and digitalization, if it is able to identify a functional area where it could design and implement a digital strategy. In this regard, Asher et al. mentioned a number of privileged spaces for action such as e-Government platforms, identity validation, privacy protection, transactions' security, e-commerce enabling, hybrid and reverse hybrid mail (RHM).

On the other side of the Atlantic, Jaag, Stahl, and Stroelin (2011) analyzed the potential advantages of RHM with a focus on Switzerland, underlining important cost savings. A key characteristic of RHM is that the receiver can preview the envelope and, if interested in the content, can agree on a physical delivery or eventually accept the electronic version of the document, forgoing its physical delivery. The direct consequence of RHM would be to reconsider the Universal Service Obligation (USO) and, in the words of the authors, to go for a "technologically neutral formulation of the USO" (Jaag et al., 2011, p. 8).

Borsenberger, Joram, Klargaard, and Régnard (2016) stressed POs' historical role as trusted intermediaries that protect the legal principle of confidentiality of correspondence, which they could use to present themselves as "Personal Data Stores". The power of the postal brand, trust and the physical network as an asset that can bridge the offline and the online world (e.g. digital literacy) were the main elements on which this recommendation was based. The same study also analyzed how POs could leveraging the trust and direct contact with the community to offer themselves as managers of digital identities.

While in the physical world, identity is a unique civil status recognized by a public authority, in the digital world an individual can have several digital identities. This makes online markets more anonymous and heavily dependent on reputation and verification. The multiplication of digital profiles, usually on social networks or global online platforms, allows for gathering of a large set of data but can also have a complex impact on privacy and data protection. According to Borsenberger, Klargaard, and Régnard (2017), POs, could be the most obvious actors to collaborate with governments in creating unique state-sponsored platforms to redefine the digital identities of citizens.

In 2012, the MIT Center for Digital Business issued a study (Parker & Van Alstyne, 2011, p. 13), commissioned by the International Post Corporation, aimed at providing a roadmap to establish what they called "digital postal platforms". The approach was to start by introducing examples and definitions of online platforms and then to outline the opportunities for the postal sector by identifying the "platform elements" of the postal actors themselves. Their suggestion was not to start from what the Internet has disrupted in the postal world and look for a response, but instead to start from the key features of online platforms and then move to the

opportunities and advantages that POs have. This philosophy of how to respond to digitalization is similar to what we are proposing here. Again, the need to re-define the Universal Service Obligation (USO) emerged as a key element of the analysis.

POs could not only embrace digitalization; they could also become pivotal facilitators of digital inclusion. A digital divide exists between urban and rural areas. A significant portion of the population still lacks elementary digital skills because of age, literacy, interest etc.[3] Many businesses have remained off-line. Sheedy and Moloney (2015) examined the potential for a collaboration between Postal Operators and national and local authorities to assist communities in using digital services and providing digital literacy, both medium and content-related. The authors presented survey results showing that local communities, including local businesses, would be eager to have a Community Infopoint platform. Such a platform would act as an assistant for digital services, provide online space for businesses, serve as communication tool for the local authorities, as well as offer other services. Sheedy and Mahoney stated that National Postal Operators would be the natural managers of this type of platform.

The common strand of the literature on the relation between digitalization and the postal sector is the importance for POs to exploit the postal "brand" and its unique assets, especially when confronting the major weakness of online platforms: lack of trust (Asher et al., 2011). We develop this line of reasoning below.

3   The Impact of the Internet on Postal Markets

The impact of the Internet revolution on the postal markets was quite profound. Emails, i.e. the e-substitution of direct mail, were the first online services that most citizens benefitted from. Besides emails, other phenomena such as online newspapers and online advertising contributed to the rapid e-substitution for other main traditional postal products.

Furthermore, if the primary mission of postal operators was to facilitate written personal, administrative and commercial, communication between citizens—including with the government and other private and public institutions—almost all these exchanges appeared exposed to being systematically replaced by online services. It seemed just a matter of time for digital transition to take complete effect, with the acquisition of a widespread digital literacy. Table 1, produced by (Copenhagen Economics, 2018) report for the EU Commission, shows the potential extent of the e-substitution process in relation to most essential public communications.

Notwithstanding the potential for the Internet to be entirely disruptive, postal operators so far have essentially survived the tempest of e-substitution, but definitely not the postal markets *tout court*. Keys to POs' resilience were perhaps their legacy of continuous direct contact with costumers and the historical role of POs in the

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[3]See the European Commission DESI index, https://ec.europa.eu/digital-single-market/en/human-capital.

Table 1 *E*-Government substitution from paper to digital format

Electronic communication with public institutions, 2016
Share of countries (21 countries)

■ Mandatory ■ Possible ■ Future plans ■ Not possible ■ Other

Tax returns	5% 95%
Change of residency	62%
Hospital appointments	63%
Registrations to educational institutions	5% 84%
Pensions information	68%
Other welfare benefits' information	68%
Judiciary notifications	45%
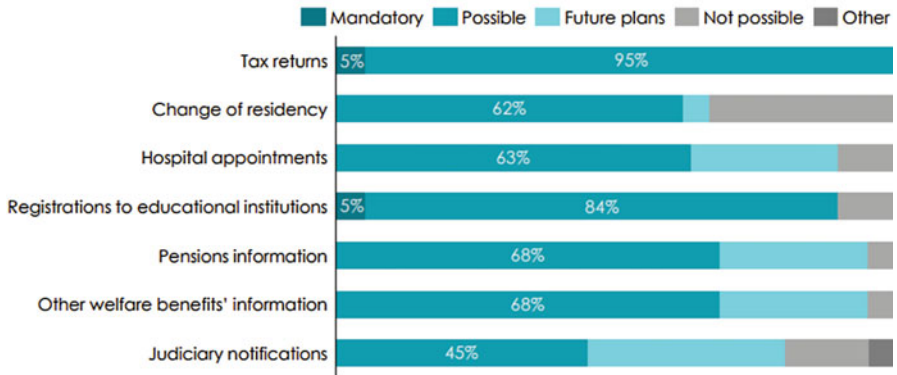
Source: Questionnaire to USPs

Copenhagen Economics

Main Developments in the Postal Sector 2013-2016

community, including being an element of the state, employing large numbers of workers, widespread physical points of presence and vehicles, and, very important, a bond of trust with the community built across decades or even centuries. All these assets are to some degree missing in the online world, a lack that probably constitutes so far one of its main weaknesses. An interesting example of how digital companies may react to this lack of presence and contact is the Dutch e-commerce online platform "Bloei", that recently added its own delivery service just to have a direct contact with its users.

In any case, the net effect of Internet disruption in the postal sector is ambiguous. On the one side, emails and other e-substitutions have largely replaced physical mail, thus triggering the rapid decline in letters volumes.[4] But on the other side, the spread of e-commerce has strongly increased the parcels delivery business of POs, especially in the Business-to-Consumer (B2C) and Consumer-to-Consumer (C2C) segments. Moreover, even if other services also traditionally provided in part by POs, such as payment services, can easily be done online, POs and their widespread net of post offices keep an advantage through a key feature still partially lacking in the online world, again trust.[5]

POs, therefore, remain in that particular position in which they can stick to their historical role and accept the decline in letter volumes and other traditional activities, or they can attempt to evolve toward a business model in which the digital world

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[4]Emails are the same product, but superior in many dimensions, offered for free through a different channel.

[5]On this point compare the interesting survey on the Community Infopoint introduced in Sheedy, C., & Moloney, M. (2015). *Digital inclusion: A role for postal operators in a smart world, postal and delivery innovation*. Berlin: Springer.

assumes an ever-increasing space. The comparison between the destiny of Polaroid (belated move to digital photography) and Netflix (immediate move from DVD delivery to online content distribution) shows that the timing of reaction can be a key to emerge as actors of the digital disruption rather than victims (Asher et al., 2011).

4 Digitalization and Diversification: The European Reaction

Many postal operators were quick to react to the Internet revolution, but they started almost immediately to diverge in their response. Essentially, POs moved along two main dimensions: a first group embracing primarily digitalization and technological development with the aim to improve their traditional business model, and a second group choosing a radical diversification of the business models toward adjacent market areas as the main driver (Parcu & Silvestri, 2017).

For the first group, facing digitalization essentially meant introducing additional services like tracking and tracing, notification of the status of the delivery, hybrid mail, reverse hybrid mail, and new e-government services. Probably at the beginning, this was perceived as a first step in the modernization of the postal markets, but for some operators it remains today the main reaction to pressure from the online world. Other POs instead went decisively for a more radical change, betting on business diversification and moving to adjacent areas, primarily finance, banking and insurance. A consequence of these two strategies in response to e-substitution is that despite different histories of postal service in different countries, there was a common global identity of the services offered by Postal Operators around the world. We are today in a situation where each PO, by exploring and mixing the two main business strategies already mentioned, has created its own original profile (Jaag, Parra Moyano, & Trinkner, 2016).

To confirm this observation, we examined the 2016 yearly reports of Royal Mail (Sect. 4.1); Deutsche Post DHL Group (Sect. 4.2); Le Groupe La Poste (Sect. 4.3); Poste Italiane (Sect. 4.4) and Correos Group (Sect. 4.5), with a specific focus on their digital business model strategies and on "where the money is coming from" method of analysis. A synthesis of the origin of 2016 revenues of the five operators is presented in the following Table 2.

4.1 Royal Mail

The focus on traditional delivery services (letters and parcels) remains the key characteristic of Royal Mail's strategy, which has "a clear vision to be recognized as the best delivery company in the UK and across Europe" (Royal Mail plc, 2017, p. 16) and whose main actors are UKPIL and GLS (respectively concentrating on Letters and Parcels delivery). Royal Mail's strategic priorities are defending letters, winning in parcels and geographic expansion in both services.

Table 2 Operating revenues of five EU major postal operators, percentages

Royal Mail			
UKPIL (letters and parcels)	Express	GLS (parcels)	Other services
78.3	0.0 (included in UKPIL and GLS)	21.7	0.0
Deutsche Post DHL Group			
Post, E-commerce, parcels	Express	Global forwarding—freight	Supply chain
28.7	24	23.4	23.8
Le Groupe La Poste			
Services mail-parcels	GeoPost	La Banque Postale	Digital services
47.4	26.2	24.0	2.1
Poste Italiane			
Postal and business services	Financial services	Insurance services	Other services
11.5	16	71.8	0.7
Correos Group			
Postal, telegraph and parcel services	Services to third parties and of banking services	Money transfer	Other
95	1.2	1.4	0.9

In its business case, the disruption of the Internet is transformed in an opportunity mainly primarily related to e-commerce. Consequently, Royal Mail is improving its parcels delivery service by strongly improving customer experience (e.g. same day delivery) and using digitalization both to improve its internal flow and to interact with costumers (e.g. the LoveToPost app). In parallel, the group is expanding in other geographical areas of the globe, both by buying other delivery companies (e.g. the acquisition of the next-day delivery company GSO in California) and by setting up strategic partnerships with retailers and network partners to increase cross-border volumes (especially in Asia). Royal Mail is also working on e-Government initiatives. It is one of the certified companies that offers GOV.UK Verify, a government digital ID program.

To summarize, the online world is leading Royal Mail, to pursue the parcels market as a new growth opportunity, continuously improve quality of service on its traditional business, and expand geographically to ride the wave of the increase in global demand for parcels' delivery.

4.2 Deutsche Post

Deutsche Post DHL Group strategy is similar to Royal Mail in focusing primarily on delivery and logistics. In the words of the 2016 Annual Report: "We are focusing on

our core mail and logistics" and "intend to benefit from growth in the e-commerce segment and in developing and emerging markets" (Deutsche Post DHL Group, 2017, p. 30). Deutsche Post DHL Group is organized into four divisions: Post-eCommerce-Parcel, Express, Supply Chain and Global Forwarding and Freight. The revenues coming from each of these different divisions are almost equal.

Deutsche Post interprets the online challenge as a trigger to boost parcels delivery, overall technological development, an opportunity to introduce new tailored services (within the Express division, Time Definite International and Medical Express) and to improve logistics services, particularly within the Supply Chain division. Within this digital strategy, Deutsche Post is also seeking opportunities for geographic market expansion and, according to the 2017 Annual Report, aims to have a minimum of 30% of the group revenue in emerging markets (for example Malaysia, Vietnam and Chile) by 2020. In addition, DHL Group is exploring acquisitions of industry expertise in new sectors such as life sciences, health care, automotive, electric mobility and food logistics.

The core businesses of Deutsche Post remains delivery and logistics but interpreted more broadly. The company is seeking to play a new role in so-called smart cities and, more generally, in the digital society. Tailored solutions, express services, involvement in automotive and health care, food logistics, are all areas where Deutsche Post is seeking to find a space as an enabler of change, without abandoning its primary mission in delivery. Its strategy towards innovation is also translated into setting-up an internal incubator and a privileged collaboration with Plug and Play, a platform ecosystem and venture capital fund.

4.3   La Poste

While having some common elements with the two above-mentioned strategies, the business model of Le Groupe La Poste appears to have undertaken a further step towards a mix between digitalization of the core business and outright diversification. Under the umbrella of the "La Poste 2020: Conquering the future" (Le Groupe La Poste, 2017, p. 14) strategy, the group is now organized as five business units: Services-Mail-Parcels, GeoPost, La Banque Postale, Digital Services and La Poste Network. The first two units count for 73.6% of the consolidated operating revenue, which means that the traditional business (letters and parcels) is still key to the present of the group.

A major diversification came in 2005 with the creation of La Banque Postale, which today accounts for 24% of the consolidated operating revenue. It is structured around three divisions: retail banking (the core business), insurance and asset management. La Poste is also active in mobile communication via La Poste Telecom, a mobile virtual network operator (MVNO). Other digital services currently account for only 2.1% of the consolidated operating revenue of the group, but they are growing the space for digital identities, secure information exchange platforms,

and hybrid products such as archiving and supporting personal and administrative services.

Finally, La Poste is also seeking a role in the new sharing economy/smart society evolution. It aspires to provide services such as collecting and recycling paper, co-mobility, delivering health products, and being present in smart homes. Particularly interesting is its presence in the so-called silver economy, assisting old people, especially in helping them to make the digital transition.

4.4   Poste Italiane

Poste Italiane is a clear and brave example of a postal operator in which diversification was pushed further. Today its four operating segments are Postal and Business, Finance, Insurance Services and Asset Management, and Other Services (including Poste Mobile). In particular, its customer distribution network is built around three main pillars: mail and parcel; mobile and digital payments; and financial and insurance. The Postal and Business division, which includes logistics, represents in 2016 only 11.5% of total revenue of the group. This surprisingly small number is clear evidence of the radical change in business strategy by Poste Italiane in the past few years.

What appears to be the new core for Poste Italiane today is its Insurance Services and Assets Management business (71.8% of turnover), where the group successfully operates in life insurance (i.e. long-term investments), non-life insurance and health insurance. Financial Services also contributes 16% of total revenue. Finally, Poste Italiane diversified also toward telecom services, where Poste Mobile is the first mobile virtual network operator in Italy with about 50% of the market share for MVNOs.

Within its specific digital strategy, Poste Italiane was accredited as a Digital Identity Manager by the Agency for Digital Italy. It is developing a new service "Ritiro Digitale" that provides hybrid mail. Through SPID (Sistema Pubblico di Identità Digitale) Poste Italiane offers access to government digital services (with a 90% market share); with pagoPA operates as the leading payment service provider for payments to the government. It also has an agreement with the Ministry of Education to provide a card platform for students. Poste Italiane is also a partner of a Talent Garden point in Rome, which is an incubator for digital developers.

4.5   Correos Group

Correos Group is probably the company most difficult to classify in this strategic assessment. In the words of its Annual Report: "The purpose of Correos Group is to become the best global provider in physical and digital communications and parcel services" (Grupo Correos, 2016, p. 5). Letter and parcel delivery are still its core

business, but its effort is to collaborate and partner with the online world appears extremely relevant. The Correos Group comprises Correos y Telégrafos and its subsidiaries, Correos Express Paquetería Urgente, Nexea Gestión Documental, and Correos Telecom.

Correos y Telégrafos is the provider of physical and digital communications and parcels solutions, which are still by far the main activity of the Group, providing more than 90% of the revenues, while Correos Express delivers parcels within 24 h. Nexea Gestión offers integrated management of corporate mass communications and customized technological solutions for document processes. Correos Telecom provides network services in the telecommunications market.

The recent relationship between Correos and the online world is extremely interesting. While delivery remains its core business, Correos established very strong partnerships with important e-commerce operators such as Alibaba, and it is acting as an enabler of different e-commerce online platforms. This development is advanced though the Comandia platform created by the group. Comandia provides both the expertise in marketing and designing and the logistics network for delivering products to small and medium enterprises (SMEs) that decide to create their e-commerce platform. Only the future will tell if this effort of creating strategic partnerships with the online world will affect significantly the sources of revenue of the Group.

In Table 3 we summarize the present strategic positioning of these five EU POs along some of the dimension we explored.

In conclusion, following primarily one of the two lines of reaction we summarily sketched, and often mixing them, these five major EU POs have become relevant digital players in their countries. However, notwithstanding the differences among countries, no PO has, at least so far, managed, or even only attempted, to completely shift toward an "online only" or "online mainly" business model.

Table 3 Strategic positioning of five major EU postal operators

	Letters parcels business	Diversification-product expansion	Digital services presence	Smart life presence	Geographic expansion
Royal Mail	High	Low	Medium	Low	High
Deutsche Post DHL Group	High	Low	Medium	High	High
Le Groupe La Poste	Medium-High	Medium	Medium-High	High	Medium
Poste Italiane	Low	High	Medium	Low	Low
Correos Group	High	Low	Medium-High	Low	Low

5 Postal Operators as Ground-Based Online Platforms

The online world is affecting the offline world and changing it, but also the opposite is true. Delivery of goods acquired online still requires a physical location. Most services, notwithstanding the possibility of an important online phase, require a personal contact. E-government, while a significant instrument for improving the relation between citizens and the state, still has a limited reach, because of a frequent lack of adequate levels of digital literacy in the population.

Recalling here the basis of most online platforms' business models can be useful. Primarily, online platforms have built their success on a stable core component plus a set of growing complementary components. These additional components are often the basis for the value creation by the platform. The essential ingredient in platforms is the exploitation of network effects. Indirect effects are essential for the "for free" business model, but direct effects are also decisive factors for acquiring customers and market shares. Moreover, an online business model rarely is developed or fully implemented within a single firm, but is generally part of a larger ecosystem.[6] Most successful platforms are built on agreements, standards and rules that define how the various participants interact in their relations with the customers. These agreements may be limited to interoperability but may also propose higher degrees of integration, normally make large use of common data and often require a strong commitment to openness toward third parties.

The key question we address here is if POs could find a way to continue their evolution toward a more digital business model and at the same time help foster the digital transition of our societies. With regard to complementarity, it is first worth asking whether POs' peculiar physical presence can play any specific significant role. Similar to other traditional network industries, the postal market is characterized by a very strong physical element, but this has a peculiar prevailing human characterization. POs historically offer a delivery service of a product that is tangible, physically consigned by the client to an employee of the PO and then delivered by another employee to the recipient. Moreover, post offices are spread widely and, therefore, are a presence within local communities. Be it in cities or in rural areas, one can take it for granted that he or she can find a nearby post office. Coherently with the mission to deliver the items from one costumer to the other, and because of their ubiquitous physical presence, postal operators have a very large number of employees and vehicles continuously at work. This physical presence, with a prevailing human characterization, could certainly complement other characteristics of online platforms.

The other fundamental complementarity between physical and online presences, is the difficult search for an adequate level of trust for online transactions. The online environment has a structural element of anonymity and a lack of personalization that

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[6]Probably, Apple is the most important example of an originally closed platform/company, but the development of the Apple store shows that global success anyway requires an increasing degree of openness and interaction with other players.

somehow limits the ability of citizens to have full confidence in the good and services provided. Clearly online services have radically changed our habits and simplified our daily life, however, many users still do not fully trust online platforms. There is an overall suspicion of insufficient protection of personal data; on this issue, it will be interesting to see whether the new GDPR regulation in Europe will have a true impact. The easy and often "for free" business model, typical of the online world, hides behaviors contrary to consumers' interests and protection. A specific twist of this argument is that all the current Internet giants emerged in non-EU countries, but they are now facing significant and increasing troubles in becoming truly compliant with EU rules. The issue is important if one thinks to major themes such as workers' rights, taxation, privacy, and data protection.

Carefully considering all these elements, important for the success but also the limitations of online platforms, suggests that none of them appears alien or opposite to POs' characteristics. Where the physical element plays a role, POs have the advantage of their strong reputation built on their direct personal contact with customers, often ending up in playing a social role within communities.

Do some of their peculiarities impede to POs to evolve and become themselves typical online platforms? Probably yes. Compared to examples likes Google or Uber, a PO is very different. The physical element and differences in turnover per employee and working conditions signal a permanent and structural diversity between postal operators and any normal online platforms. But these same differences could also constitute the specific advantage and opportunity for postal operators. Can online platforms productively use of these type of assets? Which of them would represent a true added value?

There is little doubt that physical presence and consumers' trust could be key added values for many online activities. Postal operators could become "ground-based" platforms, an anchor for online platforms for a host of activities. These include government services, digital identities, insurance-finance-banking, telecommunication products, and ticket selling for events. Less familiar examples include pollution measurement and assistance to old people.

Online postal platforms could become a sort of "Google Home" but for the outside. They could become a "personal life assistant" for citizens impacted by the digital transformation. Especially, considering their local presence, POs can be of extreme help in the digital transition phase. Some initiatives of EU POs, which we mentioned in previous sections, are clear examples that this evolution is not only possible but has already started.

In a nutshell, a strategy for POs would be to identify the key elements that can lead to the creation of a successful online/offline postal platform. This opportunity could be pursued in partnerships with native digital companies, a route probably easier than having POs reinventing themselves as global competitors in the digital ecosystem. This strategy would require exploiting all the possible advantages of opening a postal digital platform, seeking to become part of an ecosystem, and developing it in collaboration with many partners. This would also require a search for third parties that carry innovation and ideas that POs have not considered, and especially to be open to all kinds of potentially successful projects then can increase

the size and value of their businesses. This would entail risk sharing with private companies and, especially, local start-ups dedicated to immediate citizens' needs.

This potential new business model will have to be consistent with the current EU regulatory framework, both specific postal sector regulation and regulation in other relevant sectors, for example, data protection. The relation between this enhanced role of POs and the traditional Universal Service Obligations still would need to be explored, but it is most likely that the USO role and the new role of POs would not conflict but could easily integrate.

6   Conclusion

In the past 10–15 years, the Internet has severely impacted the postal and delivery market. The volume of letters (advertising and bills included) dropped, demand for parcel delivery increased, and costumers' needs changed. As highlighted in the latest editions of the Conference on Postal and Delivery Economics, POs have updated and readdressed their offers and their quality of service as delivery companies and have started diversifying their businesses toward adjacent markets.

When connectivity, technological development and digitalization started to impact consumers' habits, the postal sector proved able to react and showed a surprising resilience when facing the digital transformation. This rapid response might be related to the fact that, as mentioned above, e-substitution of mails was one of the first services users profited from on a large scale. However, the cause of the resilience rests in the quite wise business approach of the postal sector, which understood the disruption and non-reversibility of digitalization and opted for an immediate and general effort to adapt. The response of the postal sector has been to employ different, but not necessarily conflicting, strategies: improvement of existing products, introduction of new postal services, acquisition of strategic companies and assets and business diversification.

Probably today, it is possible to open a new phase. In this chapter, we ask if the time is ripe for a further step ahead for POs. The specific characteristic of widespread physical presence and consumers' trust of the POs, i.e. once again building on their legacy assets, can lead to a new strategy that fully integrates them in the digital world. POs could become new, sophisticated but ground-based digital players. In front of the advancing digital revolution, POs could redefine themselves as a new type of online-offline platforms that can accompany the change. This may facilitate the digital transition for consumers and citizens, contributing to the realization of a more human digital ecosystem.

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Inducing Optimal Quality Under Price Caps: Why, How, and Whether

Timothy J. Brennan

1 Introduction and Overview

A well-known result is that while a monopoly sets price above the socially optimal level, it might also set quality above its optimal level (Spence, 1975). In the postal context, quality refers to non-price aspects of service such as frequency of delivery (3-day, 5-day, 6-day) and speed (next day delivery, delivery in 2 days, etc.). Because increasing quality increases the price at which a monopoly can sell its product, it could obtain more in profit from increasing quality than consumers gain in surplus. It follows that the level of quality chosen by a monopolist under price cap regulation (PCR) could also be greater than the overall social optimum, when price is set at marginal cost (at that level of quality) as well.

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However, the quality level chosen by a PCR monopolist is too low at a regulatory price cap, which will typically be set above marginal cost. A firm under PCR will set quality to maximize profits from increased demand for its product, but will not take into account the increase in surplus to inframarginal buyers (Sappington, 2005 at 131, n. 18). This result also applies to an unregulated monopolist, in that it will set quality too low relative to what would be optimal at the monopoly price, even if that quality level may still exceed what is optimal when price equals marginal cost.

Intuitively, increasing a price cap should increase quality, because with higher margins the PCR firm can capture more of the benefits from increasing quality (Weisman, 2005). This suggests a possible trade-off between price and quality, where the gains from higher quality could outweigh the welfare losses from the higher price. If a regulator cannot observe quality directly, it may be able to increase consumer welfare by raising the price cap. Unfortunately, a positive association between the price cap and service quality does not hold in general. Moreover, there appears to be no effective means for a regulator to give the firm the appropriate incentives to optimize quality without requiring enough cost information that it could just set the optimal price without relying on PCR to induce efficient production (Brennan, 1989).

This chapter sets out these theoretical principles and investigates whether it is possible to increase welfare by increasing the price cap and, if so, what conditions are necessary for that to occur and what information the regulator would need to see if they are satisfied. Section 2 of this chapter presents postal policy motivations for searching for regulatory solutions to the problem of suboptimal quality. Section 3 reviews the theory relating to the incentives of price-capped firms to set quality and the reasoning behind the claim that a monopoly might provide a higher level of quality than would be optimal. Both of these serve as background for the findings in Sect. 4 that a price-capped firm, and a monopoly, will provide too little quality relative to the quality that would be optimal at the prices they charge.

Section 5 briefly examines why increasing a price cap need not lead to higher quality. The intuition is that if those with low willingness to pay are particularly sensitive to quality, it may be worth it to attract them by increasing quality under a low price cap, but not if the firm can charge higher prices. Section 6 finds that if the regulator knows the value of quality, it can provide incentives to the firm to produce optimal quality—but only if the firm captures the entire consumer surplus from quality improvements. Other legal and political considerations suggest that having the price-cap regulated firm and its regulator negotiate quality standards and penalties for non-compliance may lead to a reasonable agreement and be the best we can expect to do. Section 7 summarizes and concludes.

2 Postal Policy Motivations

In 2006, the United States enacted the Postal Accountability and Enhancement Act (PAEA).[1] Among other things, PAEA bifurcated U.S. Postal Service (USPS) offerings into "market dominant" and "competitive" categories, and mandated that the Postal Regulatory Commission (PRC), USPS's regulator, use a "modern system for regulating rates" to set prices for the former.[2] This "modern system," essentially PCR, fixed rates for market dominant services in 2006, adjusted upward by the percentage increase in the U.S. "Consumer Price Index for All Urban Customers," abbreviated as CPI-U.

This is essentially a form of price-cap regulation (PCR), which typically includes a generally upward adjustment following some price index and a downward adjustment allowing for expected increases in productivity (Littlechild, 1983; Brennan, 1989). This expected productivity follows from the motivation for price caps—if a regulated firm believes that it will retain cost reductions the regulator will not force it to adjust prices to match those reductions, it will have an incentive to produce efficiently rather than wastefully. PCR leads the regulated firm to act as a price taker, giving it the same incentive to minimize costs as do competitive firms, and the X factor reflects an aspiration to share expected cost savings with buyers of the regulated service.[3] For this reason, PCR is often referred to as CPI–X; for USPS, PAEA did not include an X factor, effectively setting it equal to zero.

In late 2016, the PRC instituted a review, mandated by PAEA, of how well this "modern system", that is, PCR for market-dominant services, is working.[4] One of the criteria for such review was "to maintain high quality service standards established under section 3691."[5] In its solicitation of comments, the PRC proposed a preliminary criterion for service quality as when a "system [of "modern regulation", that is, PCR] . . . is designed for the Postal Service to consistently achieve, for each class of mail, stated days to delivery at a desired target rate."[6] In the order it

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[1]Pub. L. 109-435 (2006).

[2]39 U.S. Code §3622(d)(1)(A).

[3]If demand increases, the regulated firm's profits will typically increase, as price for regulated firms generally exceeds marginal cost. If increases in demand are expected, the X adjustment could be a way to share those profits with buyers. Brennan and Crew (2016) explored how a regulator could increase a price cap to prevent declining demand from reducing profits; the same adjustment would reduce prices when demand increases, sharing accompanying higher profits with customers.

[4]39 U.S. Code §3622(d)(3).

[5]39 U.S. Code §3622(b)(3). The §3691 reference is to a part of the statute requiring USPS, with PRC consultation, to institute service standards that "enhance value," "preserve access," and "reasonably assure Postal Service customers delivery reliability, speed and frequency." 39 U.S. Code §3691(b)(1)(A)-(C).

[6]Postal Regulatory Commission, *Advance Notice of Proposed Rulemaking on the Statutory Review of the System for Regulating Rates and Classes for Market Dominant Products*, Order No. 3673, Docket No. RM2017-3 (Dec. 20, 2016) at 5. This is the proceeding in which I filed declarations for the PRC Public Representative on adjusting prices when demand declines, mentioned in the above

issued following its review of public comments on its PAEA review, the PRC stated that "that the current system does not effectively encourage the maintenance of high quality service standards."[7] It also added as a component of quality "how often the Postal Service meets its stated service standards."[8] In response to its concerns, the PRC proposed a 0.25% increase in price if USPS "adhered to" its service quality standards.[9]

The PRC's assessment and recommendation raises a number of theoretical questions. The first is in what sense does PCR imply too little quality if, after all, monopoly may set quality above the optimal level. If quality is a problem, what should be done? Pearsall (2018) suggested the possibility of an adjustment to price based on quality, but his suggestion was not based on the value of quality but what a price cap would be had it been based on the initial cost of providing lower quality service rather than what had been provided when PAEA mandated PCR. This reinforces the potential value in examining whether adjustments to PCR could provide appropriate incentives to set service quality levels.

3   Quality, Monopoly, and Price Caps

An intuition frequently brought to bear on the issue of price caps and product quality is that the former precludes the latter. Under price caps, the firm retains profits from cutting costs. Since better quality costs more, PCR implies that the firm will minimize quality. This claim is not correct. Cutting quality reduces demand, and thus the quantity that the firm will sell under PCR. If, as one would expect because it is regulated, the price cap exceeds marginal cost, a reduction in demand will reduce the firm's profits. The firm will reduce quality only to the extent that the savings in reduced quality make up for the lost profits from reduced demand.

To see this, let p be price, q be quality and $x(p, q)$ be the quantity of the regulated service demanded at p and q.[10] For simplicity, let the variable cost of producing x units at quality level q be given by $h(q)x$, that is, with constant marginal cost $h(q)$

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disclaimer. Prof. John Kwoka of Northeastern University filed declarations for the PRC Public Representative that discussed service quality.

[7] Postal Regulatory Commission, *Order on the Findings and Determination of the 39 U.S.C. § 3622 Review*, Order No. 4257, Docket No. RM2017-3 (Dec. 1, 2017) at 250.

[8] *Id.*

[9] Postal Regulatory Commission, *Notice of Proposed Rulemaking for the System for Regulating Rates and Classes for Market Dominant Services*, Order No. 4258, Docket No. RM2017-3 (Dec. 1, 2017) at 53-56. The PRC did not say how it would ascertain "adherence".

[10] This model presumes that each PCR service has only one quality level. There may be a menu of PCR services each with a different quality level, e.g., first-class mail and second-class or standard mail.

that depends on the level of quality.[11] With p fixed at $p°$ under PCR, the firm chooses q to maximizes profit

$$\Pi(p°, q) = p°x(p°, q) - h(q)x(p°, q),$$

implying that the level of quality that maximizes profits satisfies

$$\Pi_q(p°, q) = [p° - h]x_q - h'x = 0 => [p° - h]x_q = h'x.$$

The right hand side is the added profit from the increased demand from increasing quality; the left hand side is the marginal cost of increasing quality for the amount of x produced. For this to imply that quality is minimized, the marginal cost of more quality always would have to exceed the added profit, and this need not be true in general.

That quality need not be at a minimum is less surprising when we recall the familiar result that an unregulated monopoly need not imply that quality is below the socially optimal level. Change the notation a bit to optimize over x and q, and let $d(x, q)$, where d is the willingness to pay for the xth unit of output at quality level q, be the demand curve for x given q. The socially optimal level of x and q is given by maximizing total gross surplus less cost,[12]

$$\int_0^x d(z, q)dz - h(q)x.$$

The conditions for an optimal x^* and q^* are given by

$$x^* : d(x^*, q^*) = h(q^*)$$

$$q^* : \int_0^{x^*} d_q(z, q^*)dz = h'(q^*)x^*.$$

The condition for x^* is simply that price equals marginal cost. The condition for q^* is that the marginal cost of increasing quality equals the aggregate increase in willingness to pay for quality over all purchasers. A perhaps clearer interpretation can come

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[11]Fixed costs, having no effect on decisions, are ignored to simplify the notation. Assume fixed costs are large enough to generate significant natural monopoly conditions to warrant monopoly regulation, but not so high to make provision under PCR unprofitable. A potentially more restrictive assumption is that fixed costs are independent of quality, but I assume that to minimize notation and do not think it materially affects the results.

[12]Calculating optimal levels of quality neglects receiver welfare, other than to the extent it would be captured by the sender who pays the postage. I also do not discuss changes in optimal quality over time as demand changes because of the overall economy or continuing diversion to Internet-based communication. For more on this, see Okholm, Basalisco, Boivie, and Gårdebrink (2018).

from dividing both sides of that condition by x^*, which gives that the average increase in willingness to pay for quality of the inframarginal consumes just equals the per unit marginal cost of increasing quality:

$$\frac{\int_0^{x^*} d_q(z, q^*)dz}{x^*} = h'(q^*).$$

The familiar "Monopoly 101" quality result comes about by having the monopolist choose x and q to maximize its profit Π:

$$\Pi(x, q) = d(x, q)x - h(q)x.$$

The first-order conditions that define the profit-maximizing x^M and q^M are

$$x^M : d_x(x^M, q^M)x^M + d(x^M, q^M) = h(q^M);$$
$$q^M : d_q(x^M, q^M) = h'(q^M) \text{ [dividing both sides by } x^M].$$

The first-order condition for output is the familiar equating of marginal revenue to marginal cost, here at the monopolist's quality choice q^M. The first-order condition for quality is that the increase in the willingness of the *marginal* buyer to pay for a good when quality goes up has to equal the marginal per unit increase in cost from that higher level of quality. This contrasts with the condition for the social optimum, where that marginal per unit increase in cost from increasing quality equals the increase in willingness to pay of the *average* buyer. Because the former could exceed the latter, a monopoly could set quality above the optimal level.

Or so the story goes. It turns out to be not so simple. The calculation of the social optimum implies that price equals marginal cost at the optimal quality. The above example of the PCR firm shows that with price equal to marginal cost, a firm would gain no profit at the margin from increasing quality, and would lose nothing by decreasing it. Consequently, these optimality conditions are not market conditions. In practice, confidence that competition leads to optimal quality requires an assumption that there are multiple providers at any quality level, leading to marginal cost pricing for each quality level; different quality automobiles being an example. If as a practical matter there is but one quality level, quality itself becomes uninteresting as a matter of both industrial organization economics and regulatory policy.

4 Which Brings Us to "Footnote 18"

The right question for quality under PCR, however, is not whether the quality level chosen is bigger or smaller than the social optimum. Rather the question is: for a price set under PCR, is the level of quality too high or too low? It turns out that given

that price in general it is too low.[13] The intuition is straightforward and the derivation sufficiently simple that it was covered in just a footnote in Sappington (2005 at 131, n. 18).

An even simpler derivation follows. Given the capped price $p°$, aggregate economic welfare as a function of quality q will be the sum of consumer surplus and profits. Let consumer surplus be given by $CS(p°, q)$ and profit by $\Pi(p°, q)$. The PCR firm will choose q^R (R for "regulated firm") to maximize $\Pi(p°, q)$, that is, $\Pi_q(p°, q^R)$ equals zero. But if $CS_q(p°, q^R)$ is positive, in other words, if higher quality would make consumers better off, as we would expect, then the derivative of social welfare with respect to quality at q^R will be

$$CS_q(p°, q^R) + \Pi_q(p°, q^R) > 0.$$

At $p°$, economic welfare would be greater with quality above q^R, that is, q^R is too low. This is because increasing quality increases demand for the firm's service under PCR but the firm does not fully internalize the inframarginal benefit to consumers from increasing quality. Consequently, there is a theoretical justification for a regulator using PCR to intervene to increase quality above the level the monopolist would choose. The problem is how to design a way for the regulated firm to internalize those gains under PCR, which is predicated on the regulator not needing to know anything about the regulated firm's costs.

To reinforce the view that this is a problem, return to the unregulated monopoly setting. It turns out this argument also implies that an unregulated monopoly will also choose too little quality, given the monopoly price. Let p^M be the monopolist's price and q^M be the monopolist's quality. The monopolist chooses p^M and q^M to maximize its profit $\Pi(p^M, q^M)$. The first-order condition for price will just be the familiar "marginal revenue equals marginal cost", at the levels of demand and cost obtained with quality q^M. The monopolist's first-order condition for quality will be

$$\Pi_q(p^M, q^M) = 0.$$

The above argument for too little quality under price caps, relative to the price, holds here. Given p^M, the condition for the level of quality q^* that maximizes welfare will be

$$CS_q(p^M, q^*) + \Pi_q(p^M, q^*) = 0$$

If holding price constant increasing quality would make consumers better off, $CS_q(p^M, q^*)$ is positive at the overall optimum, implying that $\Pi_q(p^M, q^*)$ is negative. The monopolist would increase profits were it to reduce quality below the overall optimum level at the monopoly price, implying that its quality choice q^M would be

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[13]This is not an optimum for quality either globally or subject to a profit or revenue constraint, but optimally only given a price that is set by a regulator.

less than $q*$, that is, it sets quality too low given p^M. The monopolist may still set quality above the level that would be optimal at the *lower overall optimal price* but it will be less than optimal quality at the *higher monopoly price*.

The similarity of this result with that for a firm under PCR arises because for both, the first-order condition for profit-maximizing quality holds price constant. With constant prices, the firm sets the level of quality that maximizes profit but not consumer surplus. This common feature in the result for price caps and for unregulated monopolies suggests that perhaps too little quality holds in general for firms that set price. The argument above says that a firm in practice setting price at the optimal level has no incentive to adjust quality, since by setting price equal to marginal cost, increasing demand by increasing quality produces no increase in profit.

While I do not have a proof here, there is an intuition suggesting why a "too little quality" result would not hold in general when firms choose prices. Suppose that instead of having a monopolist, either unregulated or price-capped, one has multiple firms. Then, the profits to any one firm from increasing quality will come in part from business it captures from its rivals. Those redistributed profits will not constitute a contribution to overall net economic welfare. This effect need not only turn the result into a "not so little quality" outcome; it could turn it into a "too much quality" result. The intuition is akin to that for Mankiw and Whinston's (1986) result that there can be too much entry into oligopoly markets because the marginal entrant's profits come largely from other firms and not from increasing overall consumer benefit.

5   Could Adjusting Price Solve the Problem?

The finding of too little quality under price caps suggests the possibility of a welfare-increasing trade-off, increasing the cap in order to incentivize the regulated firm to increase quality. Whether this is a sensible policy requires first that increasing the price cap would lead the firm to supply higher quality service. Intuition appears to support such a relationship. At higher prices, the profits from increasing demand go up, and since increasing quality increases demand, the incentive to increase quality should increase with price.

It turns out to be not that simple, or general. Weisman (2005) concluded that it held with a particular assumption; that assumption is refined below. For a price-capped firm, the relationship $q(p)$ between the quality q that it chooses given the p the regulator sets (these were q^R and p° above) is implicitly defined by the profit-maximizing condition (dropping superscripts for clarity):

$$\Pi_q(p, q) = 0.$$

From this, we have that

$$q'(p) = -\frac{\Pi_{qp}}{\Pi_{qq}}.$$

If the regulated firm is choosing quality to maximize profits, Π_{qq} is negative, implying that q increases with p (the above left hand side is positive) if Π_{qp} is positive. To determine Π_{qp}, recall from above that

$$\Pi_q(p,q) = [p - h(q)]x_q(p,q) - h'(q)x(p,q).$$

It follows that

$$\Pi_{qp}(p,q) = [p - h(q)]x_{qp}(p,q) + x_q(p,q) - h'(q)x_p(p,q).$$

This will be positive, and a higher price cap will lead to more quality, if (again suppressing some notation),

$$x_{qp} > -\frac{x_q - h'x_p}{p - h}.$$

Both the numerator and denominator of the fraction on the right hand side are positive. The first term in the numerator is positive because demand increases with quality ($x_q > 0$). The second term that is subtracted is negative because cost increases with quality ($h' > 0$) and the demand curve slopes downward ($x_p < 0$). Together, these imply the numerator is positive. The denominator is also positive because price typically exceeds marginal cost, that is, $p > h$, for regulated firms. Therefore, the expression on the right hand side is negative.

Weisman (2005) found that quality will increase with the cap if the absolute value of x_{qp} is small, but it is useful to be more specific. Π_{qp} will be positive, and increasing price will increase quality, if x_{qp} is positive (or zero); that is, the higher the price, the greater is the willingness to pay for the service, the more quality demanded. In this case, the intuitive result holds.

However, if those with a lower willingness to pay would sufficiently increase purchases with higher quality, it could pay to increase quality with a lower cap. With a lower cap, the only way to make profits is to attract more customers could be by increasing quality, but this might not be worthwhile if one can charge high prices to those customers less sensitive to a cap. If customers with a low willingness to pay and happen to be those most responsive to quality improvements are not in the market at a higher cap, that incentive to increase quality would disappear.

This is not an unreasonable finding, especially in the postal context. A monopolist can find it profitable to lower price when demand increases, if the increase in demand is disproportionately greater for buyers with relatively low willingness to pay. On the one hand, one normally expects that those who value something more also value quality more. But in mail, those with low willingness to pay for traditional non-electronic services because of a preference for email might be sensitive to

higher quality in the sense of faster delivery. This was the core intuition behind the identification of this possibility in Brennan and Crew (2014).

There is a more fundamental problem. Suppose that a regulator would set a price cap to exploit a relationship $q(p)$ to increase welfare. As shown below, this would require that the regulator know the firm's costs. If the regulator had that knowledge, it could set price directly using cost-of-service methods rather than leave information on costs and how to minimize them with the regulated firm. To see this, suppose the regulator were to choose to maximize welfare as defined above, but now letting $c(x, q)$ be a more general cost function of output and quality.

$$\int_0^{x(p,q(p))} d(z, q(p))dz - c(x(p, q(p)), q(p)).$$

Taking the derivative of this with respect to p to maximize welfare gives (again suppressing notation)

$$\int_0^x d_q(z, q(p))q'dz - [p - c_x][x_p + x_q q'] - c_q q' = 0.$$

The first term in this expression is the change in consumer surplus of present buyers from the change in quality induced by the change in price; this goes up if increasing price increases quality. The second term is the net surplus from the change in customers when price goes up, with a negative component because price went up and a positive component because of the increase in quality. The last term is the change in cost because of the change in quality; as with consumer surplus, this cost goes up if increasing price increases quality.

The crucial point here is that for a regulator to get this right, it has to know costs, specifically, how costs change with quantity (c_x) and quality (c_q).[14] If the regulator knew these, as well as fixed costs, it could cut to the chase and simply prescribe the optimal price and quality. Doing so, however, would be contrary to the argument for price caps. That argument is that PCR creates an incentive or regulated firms to control costs. But that's important only because the regulator does not know costs and cannot determine or verify that the regulated firm is minimizing cost. A quality policy that fits within the rationale for PCR should not presuppose regulator knowledge of the costs of providing quality. Instead, a mechanism should exploit the regulated firm's private knowledge of the costs of providing quality.[15]

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[14]In the simplified models above, this would entail knowing $h(q)$ ($=c_x$) and $h'(q)x$ ($=c_q$).

[15]These costs would include time-varying costs, e.g., weather effects on meeting delivery speed targets.

6 Regulation to Internalize the Externality?

The reason that a price-capped firm would choose too little quality, relative to the price cap, is that it does not internalize the benefits buyers get from higher quality apart from profits from added sales that the higher quality would stimulate. The firm does not capture the value that higher quality brings to buyers of inframarginal purchases. Using $p°$ again to refer to the capped price, the regulated firm chooses quality q to maximize profits $\Pi_q(p°, q)$, when we want it to maximize total economic welfare

$$CS_q(p°, q) + \Pi_q(p°, q)$$

In this sense, $CS_q(p°, q)$ may be regarded as a positive externality resulting from the regulated firm's quality choice. This suggests applying the approach used for positive externalities generally—subsidize choices that generate them.

To provide an appropriate subsidy to increase quality, the regulator would have to have some idea, even if informal, of $CS_q(p°, q)$, that is, how much buyers in the aggregate would be willing to pay for better service. This added informational requirement does go beyond the information needed to set prices under a cap, but adding the objective of optimal quality to minimizing cost of service requires an additional regulatory policy instrument. If such a subsidy scheme were to work, the regulator would still not need to know the regulated firm's cost. The firm will balance its cost against the quality incentive provided by the subsidy, thus leading to the optimum.

Granting that the regulator knows (more or less) the willingness of buyers to pay for incremental increases in quality, the problems arise in considering who pays for the subsidy and how they do it. A first possibility is from general taxation. Doing so increases tax distortions elsewhere, which should be recognized and limit the degree to which a subsidy would correct this regulatory quality externality. Moreover, a taxpayer-funded subsidy to increase the quality of service would likely not be politically feasible, although postal services have and in some cases arguably continue to receive explicit or implicit subsidies, for example, to cover costs of meeting universal service obligations.

This leaves the regulated firm's customers as the source of the subsidy. This too is problematic on numerous grounds. As just shown, the optimal subsidy involves transferring the full increase in consumer surplus from increasing quality to the regulated firm. This could lead to optimal quality, but in doing so, the customers are no better off—all of their incremental benefits go to the firm. This has precedents in regulatory economics; it is akin to the mechanisms in Loeb and Magat (1979) and Sappington and Sibley (1988) that involve transferring incremental welfare gains from increased output to from customers to the regulated firm.

This conclusion holds whether the transfer from the customers is a fixed payment or an increase in the cap. Covering the cost from an increase in the cap creates additional difficulties. To a first approximation, the increase in the cap has to equal

the average willingness of customers to pay for the increase in quality, leaving customers with no net welfare gain, as before. With an increase in the cap, buyers would lose despite the quality improvement because the regulated service is now more expensive at the margin.

In addition, at a different price, the magnitude of this "positive quality externality", the increase in consumer surplus, also will change. This would lead to a different subsidy, entailing a different price, and on and on. To internalize quality externality at price cap p°, one would increase the cap to p^1. But at p^1, the quality level for p° is not optimal. At p^1 the firm would set quality too low again, necessitating a further increase in the cap to p^2 to cover the cost of the incentive to increase quality to the optimal level for p^1. Unfortunately, this iterative process does not to converge at a desirable point because, as shown above, even at the monopoly price, quality too low for that price.

A different approach could be more appealing. Suppose, contrary to expectation, that the regulator sets what it believes the optimal level of quality q° at the price cap p°. The regulator could impose $CS(p^\circ, q^\circ) - CS(p^\circ, q)$ as a penalty for the firm setting q below q°. A lower q might be optimal if the regulated firm finds that costs of improving quality exceed the regulator's (implicit) cost estimates. The question then is who pays this penalty. Assigning it to the firm might threaten its economic viability and, in the US, violate legal requirements that a regulated firm be given a fair opportunity to earn a just and reasonable return.[16] On the other hand, allowing the firm to pass the penalty cost to the ratepayers through higher prices perversely penalizes them for the firm's lower quality service.

This suggests a plausible compromise. The firm and its regulator could negotiate a baseline level of quality, with penalties for failing to meet that baseline.[17] One might expect that in such a negotiation the regulated firm would exaggerate the costs of providing better quality, and the regulator perhaps would exaggerate benefits, so perhaps a negotiation would come out close the to the right quality level. Such an approach would probably mitigate political, legal, and economic costs of payments to or transfers from the regulated firm.[18]

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[16]"[T]he return to the equity owner should be commensurate with returns on investments in other enterprises having corresponding risks. That return, moreover, should be sufficient to assure confidence in the financial integrity of the enterprise, so as to maintain its credit and to attract capital." FPC v. Hope Nat. Gas Co., 320 U.S. 591, 603 (1944).

[17]The US approach to postal service quality has this flavor, where USPS proposes standards subject to PRC approval, and with USPS getting a small reward in terms of a higher price if it meets those standards—or, conversely, a penalty for failing to meet those standards. See n. 8 and 9 *supra* and accompanying text. Ovaere (2017) provides a theoretical examination of such mechanisms.

[18]The PRC's reward of 0.25% of revenues on USPS for meeting its quality standard seems unlikely to equal the consumer surplus at stake. If the negotiated quality level is reasonably close to optimal and if this small penalty succeeds in getting USPS to reach that level, however, the PRC's policy may be reasonable.

7 Concluding Observations

Concerns that price-capped firms will minimize quality are likely exaggerated. Monopolies and price-capped firms may set quality levels above what would be the optimum level if the price of the regulated service is also at the optimum, that is, marginal cost. However, this result is not relevant to the optimal level of quality for a monopoly or a firm under PCR, since the monopoly or regulated price will be above marginal cost. Adapting a result in Sappington (2005), we find that a PCR firm or monopoly will set a quality level too low relative to the price it charges.

Hence, a regulator may want to adapt PCR to provide incentives to increase quality. Because PCR is appropriate to contexts in which the regulator does not know the regulated firm's costs, prescribing optimal quality, which requires knowledge of costs, is not a likely option. Increasing the price cap would seem to increase quality, but this result need not hold and still required too much information on the part of the regulator.

Consistent with the rationale for PCR, we would like a way to give the regulated firm the incentive to set quality where it knows its cost of increasing quality, but not have the regulator prescribe quality, as that entails the regulator knowing those costs. In principle, this can be done by transferring to the regulated firm the full surplus created by increasing quality. Although this result is consistent with prior results in regulatory economics, as with those results it is unlikely to be adopted because it leaves customers no better off. Moreover, if ratepayers cover the cost of these subsidies through an increase in the price cap, they are worse off, and the system would have to be redesigned to provide incentives to increase consumer surplus at the new price, with no likely point of convergence.

The likely best policy, then, will be less formal: The PCR firm and its regulator negotiate a quality target, with penalties if that target is not met. One can only hope that this will be near the optimal quality level with a price cap, and not simply pulling a number out of a hat.

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Challenges of Regulating Quality of Service in the Postal Industry

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1 Background

Quality of service (QoS) is one of several regulatory objectives that authorities oversee. The EU Postal Directive, on the issue states: "Member States shall ensure that quality of service standards are set and published in relation to universal service in order to guarantee a postal service of good quality". Subsidiarity is key, since the specification of domestic QoS regulation is left to individual countries.

The economic literature on whether it is appropriate to regulate QoS is extensive.[1] This paper does not ask whether QoS should be regulated or not, but takes this as settled investigating the challenges of regulating QoS in the contemporary postal industry. In particular, we look for the potential influence of current market dynamics on the effect of QoS regulation. In addition, we map out the practical difficulties of QoS regulation. Further, we identify key changes in QoS regulation in the postal market.

Although QoS is inherently multidimensional (quality can be interpreted in many ways), the postal directive makes clear that one key dimension of quality is routing time, others are the regularity and reliability of services. In practice, most of the focus in Europe has been on delivery speed and transit time. An incumbent operator's "expected quality" is often regulated as an obligation to offer mail services with a particular delivery speed (i.e. included in the product scope of the USO). Sometimes, additional regulations ensure how well these expectations are met, i.e. "reliability of quality". Thus, it is common in the postal sector that QoS is thought of as reliability of delivery speed, often referred to as transit time.

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[1]See for example Valletti (2000) and Cremer, De Rycke, and Grimaud (1997).

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Different dimensions of quality—different features of the postal product—are interlinked. For example, the frequency of delivery is inherently linked with delivery speed. This is because in order to fulfill a certain delivery speed, a certain level of deliver frequency is needed and vice versa. Arguably, neither the sender nor the recipient may value a higher frequency per se, but it may be necessary in order to ensure that a letter is delivered within a given time, regardless of which day it is sent. Moreover, regulation that provides incentive to supply one quality dimension can limit or even contrast incentives to supply other quality dimensions.

Another complication is that the experienced quality in the postal sector and the utility derived from it is shared by two entities, the sender and recipient. The sender typically pays for the service and is therefore the agent whose willingness to pay drives demand in the market. Of course, it may be that the sender response to the preferences of the recipient, but it is not a given. Authorities may however be interested in the recognizing both senders' and recipients' preferences when designing market regulation.

Furthermore, QoS, e.g. delivery speed, is not observed before the purchase has been made, but only after the service is completed. Thus, higher quality of experienced service does not affect directly willingness to pay (WTP), but only indirectly in the form of a higher reputation for repeated purchases.

The postal industry has been characterized during past decades by a drastic and fundamental changes. Letter volumes have been declining due to substitution of electronic communication. At the same time, parcels have been increasing in volume as a result of the rapid growth in e-commerce. This product mix shift has fundamental implications for the postal industry as a whole and thus, unavoidably, also on QoS regulation.

First, lower letter volumes reduce the economies of scale which makes it more expensive to deliver mail. The delivery speed, and the operational requirements that are needed to uphold a certain standard are linked to the "drop density" of the delivery process (i.e. the level of saturation of the local delivery network). Thus, volume decline, by decreasing the drop density in local delivery (even as networks may get readjusted, i.e. scaled down), makes it more costly per mail unit to provide a given level of QoS.

Second, related to the shift in demand from letters to electronic communication, is a potentially lower demand for high QoS. However, this is an area which is not fully covered by the empirical literature in postal economics.[2] In particular, there is room for more comprehensive empirical research on the relationship between the demand for delivery speed (i.e. expected quality) and the demand for predictability (a key component of QoS). Further, there is a difference between understanding demand for QoS, including as a "nice to have" vs. the "need" for QoS. In the context of regulatory objectives, the discussion is often surrounding users' need for different service features and less about the willingness to pay. This is because the regulatory

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[2]For an overview of recent literature on market preferences and needs see e.g. Zurel (2016) and ERGP (2016a).

concern is to secure a certain minimum acceptable level of quality and ensuring a cohesive, uniform treatment among users.

These dynamics (shifting cost and demand) have two main implications for QoS regulation: First, QoS regulation may become obsolete because market conditions change while the regulation stay the same. Second, the appropriate level of quality the regulator should aim for is changing from year to year, i.e. the target is moving. In addition, there may be more regulatory objectives that come into conflict. Examples include objectives related to competition, affordability or a financially sustainable USO.

The analysis proceeds as follows. Section 2 considers the theoretical underpinning of QoS regulation and its inherent trade-offs. Section 3 reports on practical challenges emerged in the experience of regulating QoS and Sect. 4 on recent evolutions in member states. Section 5 concludes.

2 Economic Theory of QoS Regulation

From the firm's perspective, its objective is to set a level of quality that maximize profits. The level of quality affects the firm's profit via both costs and revenues. Mathematically, the objective function can be written as:

$$Profit = [p - c(x, q)] \times (p, q)$$

where p is price of the product, $c(x, q)$ is the unit cost, c depends on the quantity of units sold x and the quality of the product q, and $x(p, q)$ is the quantity of units sold, which depends on the price p and the quality of the product. When deciding on the level of quality, a firm thus considers the impact on cost in relation to the impact on revenues.

From the perspective of a social planner, the optimal level of quality is the level that maximizes total social welfare. That is, it maximizes producer surplus (the profits in the market) and the consumer surplus (the benefit to the consumers in the market). The socially optimal level of quality occurs when the marginal benefit (i.e. the marginal increase in consumers' willingness to pay) is equal to the marginal cost of providing one additional unit of quality,[3] see Fig. 1.

When market conditions change, the socially optimal level of quality changes with them. Declining letter volumes increase the cost of providing a given level of QoS due to reduced economies of scale. This will shift the marginal cost curve upwards, see Fig. 2.

A parallel, equally important factor is the evolution of demand for quality. A key question is then the effect of substitution with electronic communication. Insofar as it is users with a more marked preference for faster communication that are

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[3]See e.g. Spence (1975).
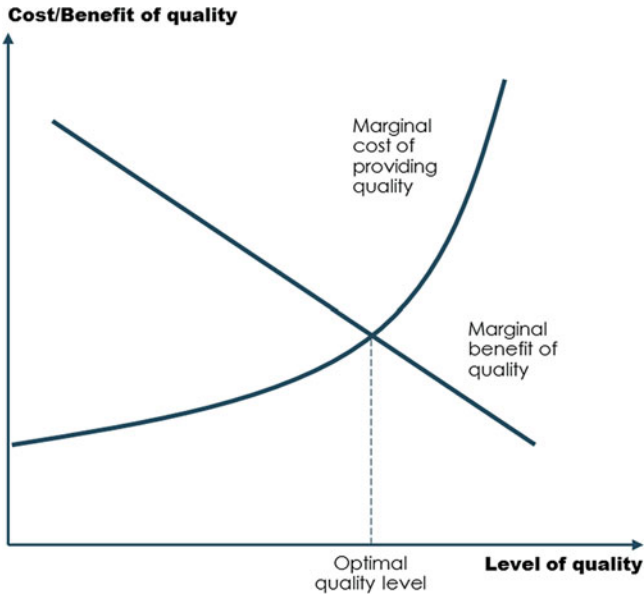
Fig. 1 Social optimal level of quality. Source: Copenhagen Economics
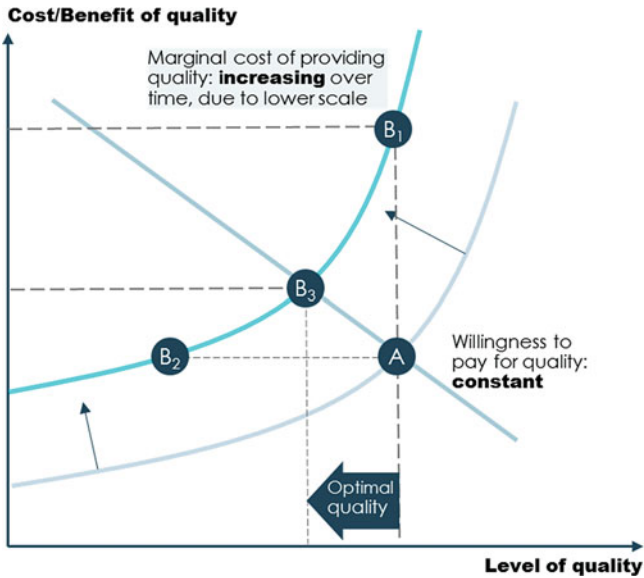
Fig. 2 Shift of optimal quality of service level. Source: Copenhagen Economics

abandoning the postal market to turn to electronic communication, then it may be that the residual postal users would have a lower willingness to pay for the speed attribute. If so, this would lead to lower demand for QoS. If, on the contrary, the shift

to electronic communication leaves on the postal market buyers who are on average more willing to pay for speed (and reliability) then this would lead to a higher demand for QoS. This composition effect is thus an important consideration.

This means that a drop in quality levels in an unregulated market may not necessarily have to reflect a deviation from the socially optimal level (given that quality was optimal at the outset). It may instead reflect that the socially optimal quality level has shifted to a lower level. If the market is not responsive to adapt to these shifts, the provided quality level will be inefficient. Consider the case where the marginal cost of providing quality of service is increased (for example due to lower scale of economies).

If the level of quality is kept constant, the marginal cost of supplying quality will be high, see point B_1 in Fig. 2. In this case, the firm(s) would opt for setting a high price for the product, due to the increase in cost of providing quality. The economic literature shows that a regulation that implements a minimum level of quality that is higher than the socially optimal level can raise industry prices and reduce aggregate consumption disproportionately.[4] Alternatively, if quality is kept at a high level at the same time as price is restricted from adjusting to additional cost, it can instead have an impact on the financial sustainability of the regulated firm(s), see section below.

If instead the cost of providing quality should remain constant, the level of quality would have to be reduced to a low level, see point B_2 in Fig. 2. This would result in undersupply of quality of Service. This could for example be the case if price regulation limits the ability raise price when cost is increasing, see section below.

In order to converge to a new optimal equilibrium level of quality, the marginal cost and demand for quality should equal again, see point B_3 in Fig. 2.

2.1 Price and Quality: Two Sides of the Same Coin?

Quality, and the regulation of it, has a direct link to prices. Thus, changes in market equilibrium for quality also affect regulatory objectives related to price. On the one hand, there is the objective of affordability. If quality is kept at a high level, prices may be set such that it becomes too expensive for some users. On the other hand, there is the objective of maintaining a financially sustainable postal service (or USO). While the objectives of high quality and affordability may point towards regulation of both quality and prices simultaneously, this may put financial pressure on the regulated firm(s).

While quality regulation has implications for the price, conversely, price regulation also has implications for quality. A price cap regulation may incentivize the regulated firm to reduce quality levels or refrain from increasing quality in two ways. *First*, by incentivizing the firm to reduce its costs in order to increase its profit given

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[4]See e.g. Leland (1979), Besanko, Donnenfeld, and White (1987, 1988), and Kluger (1989).

the pricing constraint, the price cap may incentivize the firm to *reduce quality in order to reduce costs*. Since costs depend on the level of quality, when the firm has a strong incentive to reduce costs, it also has an incentive to reduce quality, insofar as the cost savings are greater than any lost demand that may be caused by the quality reduction.[5]

Second, the price cap reduces the marginal benefit of supplying a higher quality of service compared to a situation without the regulation. If the price cap has any effect, the capped price has to be lower than the price that the firm would otherwise set. For each new customer that the firm can attract with higher quality it will therefore receive a lower price under the price cap regulation than it would without the cap. While the firm still has to bear the full cost of providing additional quality, it will not be able to reap the full benefit of the increased quality, to the extent that the increase in demand is associated with a lower margin. This reduces the firm's incentives to provide a high level of quality under a price cap regulation.[6]

This highlights the need for a comprehensive regulatory strategy that takes spillover effects into account. Which regulatory objective that needs to be prioritized will depend on the particular circumstances in the given market. A comprehensive strategy will require further empirical work to determine the connection between quality and profits, and therefore, the connection between demands and costs.

Both the cost of providing quality and the demand for quality may differ between customers (product segments or regions). A regulation that constrains the operator from differentiating between segments may leave some users left unserved (if quality is set too high and price becomes unaffordable to some users) or cause cross-subsidies, which may distort market outcomes.

2.2 Impact of QoS on Competition

It is well understood that the cost of providing high quality postal service to some groups are more costly than to others. The most obvious example is the difference between providing fast and reliable delivery speed in densely populated urban areas compared to sparsely populated rural areas. From a regulatory perspective, it may be an objective in itself to ensure a uniform quality level among geographical areas. However, enforcing the same quality level in areas with different cost of providing quality has implications on the postal service's profitability and thus on the market outcome.

Similarly, there may be groups of postal users with different preferences. As an example, bulk mailers may have a preference for lower quality (slower) service, while private consumers may have a stronger preference for high quality (faster)

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[5]Laffont and Tirole (1993, p. 213).
[6]Laffont and Tirole (2001, p. 88) and Laffont and Tirole (1993, pp. 210–231).

service. While different products, bulk mail and consumer mail often share the same network.

Thus, a competitive question arises from the fact that QoS regulation in the postal industry is typically asymmetric, i.e. only the incumbent's QoS is regulated, while competitors can provide their services at any quality level. This asymmetry in regulation gives a corresponding asymmetry in the competitive dynamics.

In practice, this means that competitors may be able to make use of differences between customer groups (e.g. geographic region or product segments) to gain a competitive advantage. The competitor can provide lower quality to some customers (e.g. non time-sensitive transactional mail); or no service to costly customers; or a higher quality product for those who demand it.

This may become especially important given current market developments for two reasons. First, if quality is kept at a too high level because of obsolete regulation, the competitive advantage from being able to supply lower quality than the mandated QoS level becomes more important. Second, there may be spill-over effects to competition in highly contested segments such as parcels.

Furthermore, there can be a strategic link between quality of service and coverage. Consider a situation where an incumbent firm is covered by a universal service obligation that restricts its capacity to choose the quality level, coverage and price. The entrant (or competitors) can strategically choose to differentiate its quality of service level in order to attract mail volumes from the incumbent. In turn, if the incumbent cannot adapt its QoS, its corresponding cost base and ultimately its price, it will be a softer competitor. Thus in this situation QoS can be seen to weaken competition.

It has been shown by Valletti, Hoernig, and Barros (2002)[7] that when the incumbent is subject to a constraint of a uniform price, equilibrium coverage of both incumbent and entrant may be lower than without regulation, and firms may even (non-cooperatively) leave each others' markets to lessen competitive pressure in their remaining markets. In a similar fashion, it has been shown by Calzada[8] that when the entrant can choose both coverage and quality level (a means of product differentiation) it can achieve the same price increase in the incumbent's price with a smaller reduction in its coverage. One implication, as highlighted by Calzada, is that in a liberalized market, imposing a minimum quality requirement on the entrant and the incumbent can have different effects.[9] However, the same paper also shows that if the incumbent sets its coverage, quality and prices in order to maximize total welfare (we can think of this as a perfectly regulated firm), quality by both the incumbent and the entrant are optimally allocated.

An important take-away from this literature on QoS regulation is that if the incumbent firm is considered to be a commercial entity (i.e. it choses its prices and

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[7]Valletti et al. (2002).

[8]Calzada (2008).

[9]Calzada (2008) notes that because the entrant is more likely to undersupply quality, it is only welfare enhancing to impose a minimum quality regulation on the entrant.

quality on commercial grounds), there may be incentives for competing firms to under supply quality in order to limit competition. By reducing their quality (or enter at a low quality) competitors may be able to benefit from serving only part of the market and at a lower quality than the optimal allocation. At the same time, it is the very limitation in geographic coverage (and higher drop density in densely populated areas) that may enable the competitor to offer a sufficient delivery quality level. To put this into context, we observe that reliable next day delivery service in the letter market has historically been a product unique to the postal incumbent, while mail competitors historically have typically competed with lower quality, i.e. lower speed products (the noticeable exception being the express networks, where available).[10]

3   How Is Postal Quality of Service Regulated in Practice?

QoS can be regulated in different ways. Our review of quality regulation in the postal sector and other network industries have identified four main approaches that regulators can use[11]:

(a) Monitor quality levels and publish performance results;
(b) Define regulatory standards, review performance and impose agency penalties or rewards;
(c) Require customer compensation if quality is too low;
(d) Incorporate a quality parameter into a price cap.

Monitoring and publishing quality performance can be considered a soft regulatory approach where the regulator collects information about quality performance from the regulated operator and makes the findings available to customers and other stake-holders. In this way, reactions from customers and other stakeholders can provide the operator with incentives not to lower excessively the quality of service.

Defining regulatory standards and taking action when the regulated operator deviates from the predefined level of quality means that the regulator can decide to make further review and possibly impose measures depending on how the operator's performance relate to the standard. Figure 3 show QoS standards for single piece priority mail in 2015—showing the percentage of items to be delivered by the next day.

Requirements for customer compensation imply that customers are reimbursed if they suffer from a too low quality of service. Although the direct reimbursement may have some desirable features, such as the direct link between low quality and financial compensation, the approach also entails challenges. One such challenge is the difficulty associated with capturing quality dimensions shared by many users,

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[10]WIK (2013, p. 211).
[11]Swindand and Scully (2006).
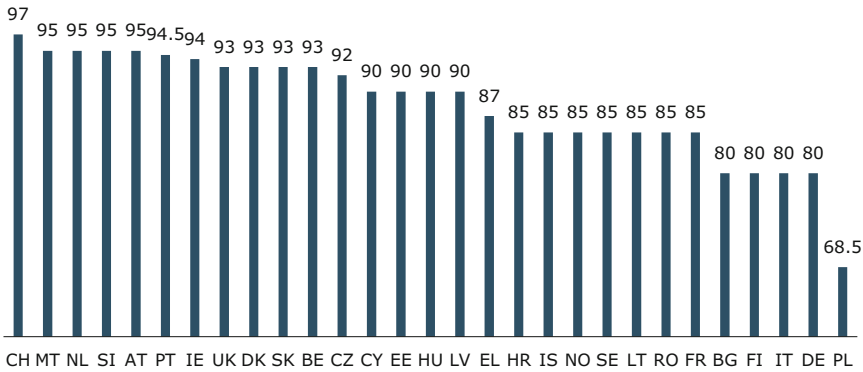
Fig. 3 QoS standards for single piece priority mail, 2015. Note: In 2015, Portugal had both a minimum requirement (93.5%) and a target (94.5%). Source: ERGP (2016b)

i.e. where the harm of low quality is shared by many users without a clear link to a specific transaction with the operator. The impact may be different on different users (some of which may have not noticed or not found the impact material) When this is the case, establishing a system that guarantees incentives for customers to seek compensation when quality is too low may become a complex task.

The last instrument, *the incorporation of quality parameters into a price cap* mechanism implies that the level of quality provided by the regulated operator is directly linked to the price (or revenue) allowed under a price cap. More specifically, changes in the quality of service will lead to changes in the allowed price changes under the price cap. While this mechanism can be very good at aligning the incentives of quality provision to financial incentives, there may be many considerations to take into account in order to get the most out of this regulatory solution. A key challenge is: how does the regulator quantify the value of quality? In theory, one would need a measure to add a quality parameter to the price cap formula. This could be based on the demand-side valuation for the quality (a difficult exercise) and/or on the supply-side consideration of the postal operator's cost impact of providing different quality levels (equally complex to establish in a continuum).

The most common approach to design a good QoS regulation is to define an appropriate level and attach relevant incentive devices. The process may consist of the following steps. First, take a comprehensive approach by considering which are the overall objectives and which are other regulations consistent with other market performance needs or government obligations. For example, an appropriate QoS regulation may strictly depend on the scope of the USO. Second, given market conditions and regulatory environment, what features should be included in a QoS regulation? This may be transit time, but could also include other features such as the share of items delivered correctly or waiting time at the post office. The choice of QoS dimensions needs to reflect market preferences and needs both now and in the foreseeable future. It needs also to be measurable and simple in order to avoid unnecessary regulatory burden.

Third, once the quality dimension(s) have been chosen, one needs to consider how to measure it. This brings attention to several trade-offs. For example, the regulator may consider whether quality should be measured at (1) product level or at an aggregate level, and (2) at national or regional level. Finally, once quality has been measured, often it will need to be weighted into one index in order to make it more useful for regulatory purposes. The regulator may therefore need to prioritize (setting relevant weights) among quality dimensions related to different products or different geographic regions.

3.1   The Role of Clear Incentives

In order to provide incentives, the regulator may wish to attach a sanctioning mechanism to the quality performance of the operator. The regulator then has to choose whether to punish failure to meet a minimum standard or to reward for meeting or beating a target. There are several considerations when choosing the level of the standard. Primarily, the regulation needs to be clear and transparent. For example, the standard needs to be achievable, such that the operator has sufficient incentives to provide quality in relation to the regulation. In addition, there needs to be clearly defined rules for exemption. This could be the setup of a force majeure clause in the event of unexpectedly weather conditions.

Furthermore, the regulation may need to take into account the maximum quality level, above which the marginal benefit to users of additional quality becomes too low. For example, if the regulation gives the operator a reward for going above a certain target, there may be a point where further increases should not be rewarded because they provides little additional benefit. Taking this into account avoids gold-plating and a mismatch with users' willingness to pay for quality. *Finally,* when setting QoS standard, the regulator needs to account for the volatility in the delivery process. When QoS is defined as transit time, there is an uncertainty for the operator in the quality that it provides. In order to aim for a certain quality level, the operator must then account for a certain volatility. At the same time, the regulator can consider the cost of meeting a QoS level; this could include the costs of mitigating the inherent volatility, which could enable "insurance" measures that aim to prevent as far as possible quality shortfalls due to volatility.

4   Recent Regulatory Changes Across Postal Markets

The trade-offs identified in the analysis above point to inherent pressures on QoS regulation in the face of changes in postal market, especially lower mail's volumes. One would expect that policymakers—realizing the pressure these place on established QoS rules—have considered and implemented changes to QoS regulation.

A review focused on European markets shows that this is indeed the case for several market. This section presents short case studies highlighting the drivers and outcome of recent changes in QoS across the following three markets: Italy, Portugal and UK.

Box 1 Italy
Old system

- Italy had an inflation-based price cap regulation, between 1996 and 2015, that included a Q-factor.
- The formula had a combination of penalty (for not reaching the target) and reward (for going above the target).
- The QoS targets were measured based on a weighted average of transit time → Similar to Portugal, since it had a high number of separate indicators (9).
- Unlike the Portuguese model, the Italian model took into account differences in zonal variances in quality.

New system:

- The system was abolished in 2015 in favor of a simpler enforcement model.
- The new system gives the regulator the power to impose fines if quality is not met, but a review is made each year (i.e. it is not automatic).
- According to the regulator, the change in regulation was a logic adaptation to the development in the Italian postal market. It reflects two main developments:

  1. The quality performance had risen to a higher level, and additional increases in quality performance would be less valuable.
  2. With falling mail volumes, providing high quality is more costly and ensuring financial sustainability of the USP is also a major objective of the regulator.

- Additionally, the ministry approved a segmented delivery model (Mon, Wed, Fri, Tue, Thu), for up to 25% of the population. Changes in the products' *speed* and *quality targets* (in most cases: 1 more day for delivery and lower quality target requirement).

Source: Dieke, Junk, and Zauner (2012), Gazzetta Ufficiale (2010), and Delibera (n.d.).

Box 2 Portugal

Old system:

Quality of service is regulated via 11 different parameters, most of which imply routing time for different products. Each parameter are attached to a minimum standard and an objective standard. A score for each parameter is calculated based on the actual performance of the operator, measured by the regulatory authority. The score for each parameter is proportional between zero (below the minimum) and one hundred (at the target). Failure to perform high quality of service render in a penalty of 1% reduction in the annual allowed price increase.

The operator is then evaluated first by a weighted average of the product specific indicators, which gives an overall performance score. If the overall score is below 90, the firm gets the minimum requirement. If the overall score is above 100 there is no penalty for this. If the overall score is between 90 and 100 there is a proportional deduction in the price.

In addition, if the overall score is above 90, the operator is evaluated on each individual indicator separately. The amount of price reduction is then relative to the weight of each indicator.

New system:

The new proposed system decouples the outcome of each indicator from the total (weighted average) outcome. The QoS outcome is simply the weighted sum of each individual part. Moreover, the number of indicators is raised to 24. Further, the minimum standard is removed and only the target standard is kept—in other words, the former target standard becoming the new minimum. Moreover, standards for several indicators are raised, seeking a higher percentage of reliability. Finally, bulk mail products are included in the scope for QoS regulation, albeit with a less demanding standard.

Source: ANACOM (2018).

Box 3 UK

Old system:

- Between 2003 and 2012, Royal Mail's quality of service performance was incorporated into a price cap (for separate baskets).
- The quality performance was consisting of eight quality indicators within two categories: *transit time* and *completion*.
- The system only imposed a penalty when performance fell *materially* below the required target (for #1–6: de minimis threshold of 1% below standard, 7–8: 0.1% below standard in 2006–2010)

Box 3 (continued)
- The quality factor also takes into account Royal Mail's varying performance in different postcode areas through a postcode area floor (House of Commons, 2006, pp. 5, 12).

  New system:

- The system was abolished in 2012.
- When Ofcom took over responsibility from its predecessor Postcomm, in 2011, it decided to reform the price regulation altogether, thereby also abandoning the quality factor in the price cap.
- Reasons for this were the weaknesses of the price cap regime: lack of pricing flexibility for RM in a declining market, lack of sufficient efficiency incentives, threats to the sustainability of the universal service.
- To ensure a sufficiently high quality of service, Ofcom continues monitoring the same types of performance indicators that fed into the formation of the C-factor. If Royal Mail fails to meet the set standards, Ofcom may issue a fine.

  Source: Swinand and Scully (2006, p. 13); based on Postcomm (2006, 2004).

From these parallel cases, we draw the following reflections.

First, we observe that, while national market and policy circumstances differ to a notable extent, similar forces seem to be at play. In most cases, policymakers recognize the urgency and need for a reduction in QoS standards in order to compensate for reduction in mail volumes. Thus, policy makers recognize that adjusting QoS is a cost-efficient way to foster the sustainability of the USO, provided that quality remains sufficiently safeguarded. However, an exception to this trend is the Portuguese proposal which seeks to tighten QoS regulation and extend the scope of QoS rules—irrespective of the common trend towards volume decline experienced also in Portugal.

Second, simplification efforts are common. In practice, irrespective of the approach to regulatory oversight of QoS, this means that solutions are chosen with lower interdependency between indicators and more direct link between QoS result and outcomes.

Third, policymakers strive to link their decisions and the need for change to the viewpoint of postal users. Here a question remains open, as to whether sufficient (and sufficiently up to date) information has been gathered in postal markets that captures the users' views and valuation for specific QoS attributes. Thus a key consideration and challenge for policy makers remains predicting and monitoring the postal users' view of evolution in QoS standards.

5   Conclusion

The ongoing changes in the postal markets across the world is affecting both the cost of providing QoS and the demand for it. This paper has revisited the concept of QoS regulation in the postal industry. Specifically, we bring attention to the impact that the current market dynamics have on the design of QoS regulation.

First, we have reviewed the literature on QoS regulation and brought attention to two specific issues. One is the important interplay between price and quality and the potential trade-off between regulatory objectives. When letter volumes decline, the marginal cost of providing QoS becomes higher. If QoS is restricted at a certain level (an optimal level) and kept so when cost increase, the regulator faces new challenges. If price is fully flexible, the price will increase because the increased cost, which bring into question if the new rate will be affordable. If price is not flexible, this brings into question whether the financial stress put on the operator will cause the risk of an unsustainable universal service.

The other issue is the potential of competitive distortions if QoS function as a strategic tool in terms of product differentiation. In the postal sector, the QoS regulation is often asymmetric, i.e. only the incumbent faces QoS obligations. The economic literature have illustrated the concerns for undersupplying quality may not lie with the incumbent, but in fact with the entrant firm(s). An entrant may be able to make use of customers' differences in preferences (or differences in cost) and better optimize their drop density by supplying lower QoS when it is beneficial. This may imply a competitive advantage if the QoS level for the incumbent firm is set at a too high level.

In addition, we investigate the practical details of QoS regulation and note that while economic theory provides us a simple logic to follow, implementing QoS regulation is not as straightforward. It is recognized that while QoS in the postal industry is commonly referred to as transit time, the quality that users value includes both delivery speed and transit time (reliability of expected delivery speed). In addition, measuring QoS, converting it into a useful index, setting appropriate standards and associated mechanisms is a complicated task. The changes in the market makes this task even more complicated because so many factors are dynamic.

An informed view on sustainability of universal service and appropriate QoS rules can benefit from market-based empirical evidence framed in a conceptually correct way. This would include: Further research on the cost of providing QoS, what elements, at what cost—based on what volume of mail and more empirical evidence on user preferences and willingness to pay for both speed of delivery and reliability—as well as on the dispersion/distribution of user preferences.

In conclusion, we expect QoS regulation to become a debated topic in the coming years as changing market conditions contribute to shape future QoS regulation. Furthermore, we expect this debate to be closely linked to the sustainability of the universal postal service.

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Creating Last-Mile Incentives from Inside-Out. A Template Drawn from Rural Telecom

Victor Glass

1 Introduction

On December 1, 2017, the Postal Regulatory Commission (PRC) issued a Notice of Proposed Rulemaking to adjust rates and incentives for market dominant Postal Service products.[1] This was the second step in an ongoing review of the incentive regulatory system defined in December 2006 by the Postal Accountability Enforcement Act (PAEA).[2] The first step in this 10-year review was to assess whether the incentive plan had met three key objectives related to (1) the structure of the rate-making system; (2) the financial health of the Postal Service; and (3) service.[3] The conclusion was that the rate-making system had not maintained the financial health of the Postal Service and that service quality had deteriorated.[4]

As a result, the Commission took the second step to modify the current ratemaking system.[5] The proposed rate-restructuring has five objectives: (1) to produce positive annual expected net income; (2) to build up accumulated retained earnings; (3) to raise service class prices above unit costs, particularly for periodicals; (4) to move workshare discounts towards 100% of avoided costs; and (5) to provide price incentives that will incentivize the Postal Service to reduce costs and increase service quality.[6] The plan retains price caps based on the urban Consumer

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[1] United States Postal Regulatory Commission (2017b).

[2] H.R. 6407 (109th) Postal Accountability and Enhancement Act (2006).

[3] United States Postal Regulatory Commission (2017a).

[4] PRC Order 4257 p. 4.

[5] PRC Order 4258, p. 4.

[6] PRC Order 4258, pp. 26–27.

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Price Index (CPI-U) but allows prices to rise above the CPI-U during a 5-year window by an additional 2% rate authority per year for 5 years to restore the Postal Service to financial health; an additional 1% rate increase is also authorized of which 0.75% will be awarded for meeting cost reduction targets and 0.25% for meeting service quality standards.[7]

This paper uses the PRC's plan as a template to explore strategies for reform, taking no position on the PRC's plan, except to point out three serious problems with its price cap proposal. First, the ceiling on price increases is based on a projection of per-unit cost increases, assuming that incentive regulation was not in effect. Any projection that lasts more than a few months typically deteriorates badly. In the Postal Service's case, the sector was hit by an unexpected recession,[8] the take-off of email and other on-line communications, and a new legislatively imposed pre-funding of employee retirement funds.[9] Second, incentives must remain in place for a credible length of time to reward the regulated company for reducing unit costs, which presents a problem if market conditions take an unexpected turn. Third, the dominant company must be a profit maximizer or profit pursuer for it to respond to the profit opportunity, which the Postal Service is not because it lacks a residual claimant on earnings. Crew and Kleindorfer (2003) recommended privatizing the Postal Service. Stockholders as residual claimants would serve as an external pressure source and management stock options an internal incentive program that would both promote efficiency.

The aim of this article is to offer a novel supplement to the PRC's incentive program that grew out of the author's experiences in the telecommunications industry. The title of the paper, *Creating Last-Mile Incentives from Inside Out*, summarizes the objective and basic approach. The *Last Mile* refers to the delivery routes that are often assumed to be a natural monopoly because of economies of scale. The intuition is that a postal carrier incurs little extra cost if he or she delivers an additional letter or small parcel to a particular location. Bradley, Colvin, and Perkins (2006) tested this intuition empirically and found it to be realistic. Another barrier to full-scale entry into the last-mile market is the universal service obligation. Sparsely populated postal routes would be unlikely candidates for private investment (Crew & Brennan, 2017).

The *Inside Out* descriptor suggests that, in the absence of external pressure, internal incentives are an important starting point for developing a framework to attract private capital and management at reasonable prices. The basic strategy offered here is to organize competing service territories within the Postal Service into subsidiaries and award management bonuses tied to quantitative metrics for superior performance that go beyond service delivery standards now in place. Proposed benchmarks are anchored to the PRC's cost and service quality targets but could anchored to other metrics if adopted.

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[7]PRC Order 4258, p. 26.

[8]PRC Order 4257 p. 111.

[9]PRC Order 4257, p. 261.

A further recommendation is to develop a "best practices" simulation model that can be used as the basis both for fine-tuning internal benchmarks and for setting minimum bid prices for operating service territories in case the Postal Service decides to subcontract with the private sector or spin off service territories to the private sector.

The rest of the articled expands on these ideas. Section 2 briefly motivates the organizational value of forming internal subsidiaries by comparing Postal Service territories to rural telecom service territories and discusses methods and challenges for setting subsidiary performance benchmarks and employee bonuses. Section 3 reviews the simulation cost model used in the telecom industry to quantify the value of best practices for efficient network operations, and its use for privatizing service territories via reverse auctions, discussing a possible application to postal markets. Section 4 concludes.

2   Organize Competing Service Territories

The Postal Service is organized geographically into areas and districts[10] that serve as performance centers. There are also specialized performance centers organized geographically for minimizing inventory.[11] The performance standards themselves are limited mainly to percentage of deliveries on time; cost of delivery is not part of the performance metric.[12] The proposal explored in this chapter is to widen the performance standard by treating service territories as subsidiaries with targets fit for a stand-alone firm. As with a firm, a subsidiary would have to balance service improvements with potential cost increases.

Treating a pool of service providers as subsidiaries is similar to a strategy used by the National Exchange Carrier Association (NECA) in the telecommunications industry (Glass, Stefanova, & Sysuyev, 2013). NECA set wholesale rates for more than 1100 rural telephone companies that were under rate-of-return regulation. These rates covered a variety of services from traditional voice to high-capacity broadband services. NECA had a choice: it could set one rate for all companies or at the other extreme set rates for each member. It chose a strategy that resembled treating each company as a subsidiary. If the company lowered its unit cost, its rates would be reduced. In effect, NECA, itself, acted like a corporate headquarters that set average benchmarks for rates and other performance measures that tied to individual company performance.

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[10]United States Postal Service Office of Inspector General (OIG) (2010).

[11]The United States Postal Service (USPS), has already adopted a regional management approach for some purposes. For example, where appropriate, the Postal Service uses "Centralized, regional, Districts, or stockrooms" for managing inventory. Retrieved from http://about.usps.com/manuals/spp123108/html/pp_ps5_004.html.

[12]See for example, United States Postal Service.

In a similar fashion, the Postal Service's headquarters already sets performance delivery benchmarks for its areas and districts and compares them to actual results. However, it does not treat them as subsidiaries with their own decision-making power over unit costs. Instead, geographic organization is used as a tool to minimize overall costs. Continued centralized control may be a missed opportunity for setting up internal competition within the Postal Service.

The PRC proposes a 1% price increase per year for 5 years above the price cap if the Postal Service meets or exceeds historical productivity and service benchmarks. The measure selected as a benchmark for operational efficiency is the Postal Service's Total Factor Productivity (TFP)[13] growth averaged over the most recent 5 years of the Postal Accountability and Enhancement Act (PAEA) period, which was 0.606% per year.[14] If the Postal Service meets or exceeds this standard, the price ceiling increases by 0.75% during the 5-year catch-up period. Service standard performance will be determined yearly from data submitted by the Postal Service in an Annual Compliance Report (ACR). In it the Postal Service must describe reasons for any changes in service standards during the year. If the Postal Service maintains current service standards by each class of mail, the Postal Service will gain a further 0.25% increase above its price cap during the catchup period.[15]

The PRC's productivity and service targets are for the Postal Service's entire operation. Under the competing territories plan here, the PRC's targets would have to be disaggregated because the average TFP productivity gain or other metric used may not be uniform across service territories. Certain service territories may be the cause of overall service declines because they have experienced the most losses in mail per premises passed. Once the benchmarks are calibrated to service territories, the Postal Service headquarters can evaluate relative performance of service areas.

To strengthen the incentives, and concretely advance the plan, managers' bonuses may be conceived as a substitute for having an equity interest in the firm. The Postal Service has a group incentive bonus plan aimed at driving down costs and improving performance.[16] However, the bonus plan gets mixed reviews for not targeting top performers.[17] An effective bonus plan has to be large enough and individualized enough to be meaningful but so large as to make Postal Service employment a risky proposition. The most reasonable approach is to imitate salary structures in private non-profit industries. This is the strategy used by NECA. Even so, there is a wide disparity in the split between base salaries and bonuses in nonprofit industries, suggesting that finding an appropriate bonus structure for the Postal Service will require research and testing (Ballou & Weisbrod, 2003).[18]

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[13]TFP is used here for illustrative purposes only. Other metrics may be adopted. TFP is defined in PRC Order 4257, p. 206.

[14]PRC Order 4258, p. 62.

[15]PRC Order 4258, p. 71.

[16]United States Office of Personnel Management (OPM).

[17]Federal Manager's Daily Report (2017).

[18]Ballou and Weisbrod (2003, pp. 1895–1920).

It is likely that subjective measures of performance such as being a team player will remain part of the bonus evaluation. Team player bonuses, for example, have distinct dangers associated with them because they are difficult to quantify. However, in the Postal Service's case, the PRC can anchor its overall bonus plans to hard targets, 0.75% and 0.25% pricing flexibility above the price ceiling. Other metrics could be instituted based on demand and cost forecast accuracy as examples.

3   Best Practices Simulation Model and Reverse Auctions

The Postal Service relies on an econometric cost model to estimate changes in costs due to changes in demand levels and demand mix (Bozzo, 2000). The problem with this approach is that it assumes stable historical relationships, which may not be true as the mix of mail shifts rapidly to packages.

In the telecommunications industry, the Federal Communications Commission (FCC) developed a national simulation model based on engineering principles to estimate the cost of broadband service by Census Block in the United States.[19] This model was developed to transition universal service support from a historically cost-based method to one based on forward-looking costs. The simulated cost is the FCC's estimate of how much it should cost for an efficient company to serve a particular territory. Ultimately, the model would serve to develop minimum price service territory benchmarks for a reverse auction in service areas where the incumbent carrier refuses the support offered by the government in exchange for meeting service commitments.[20]

Shaley and Asbjornsen (2010) explained the FCC's rationale for giving incumbent broadband providers first chance at providing service before auctioning off unclaimed service territories. A potential weakness of an auction is its effect on long-term suppliers of service: auctions ignore customer/supplier relationships built over time. As a result, auctions damage supplier loyalty.[21] Further, the transition from a long-term supplier to a new one may create switching costs,[22] which is likely because incumbent broadband providers will have deployed infrastructure even in unserved broadband territories. The authors also noted that suppliers often complain that auctions ignore innovation and quality.[23] Use of the simulation model to set a minimum bid also suggests that the FCC is wary that there will be few bidders. As a result, the bidders may inflate the cost of operating a service territory.

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[19] Federal Communications Commission, "Connect America Fund Phase II Models." Retrieved from https://www.fcc.gov/general/connect-america-fund-phase-ii-models.

[20] Federal Communications Commission (2011).

[21] Ibid, p. 431.

[22] Ibid, p. 438.

[23] Ibid, p. 429.

As the FCC learned, developing a realistic network simulation model is very difficult. A review of the first to the latest vintage is instructive. Major decisions had to be made: Network sizing and design depended on the scope of services being offered. In early models, the service was voice only, later to be superseded by voice/data services with video being excluded. The model also depended on the growth of demand and likely technological changes. Early simulation models used technologies that have been superseded by packet technology in its latest simulation model. Then there was the problem of how to build "best practices" into network design. Should the network be designed from scratch or more realistically assume certain switching centers would remain? Other issues were routes through different types of terrain and climates, and even holy grounds. The definition of costs was also controversial. Forward-looking costs do not account for past mistakes, which are inevitable in any business. Allocation of joint and common costs is an ongoing issue. The time horizon of the model needs to account for investment recovery. These and other issues were discussed in a series of FCC presentations and evaluations.[24]

A similar strategy to estimate costs and define service levels is possible for the Postal Service. Arguably, the challenges of building a simulation model may be less complex for the PRC because the Postal Service is mainly labor intensive, with few technological changes in the offing. Perhaps new approaches to combining on-line and physical mail may revolutionize postal services, but for now progress has been slow.[25]

In any case, developing the simulation model may surface new business opportunities. An immediate benefit of a simulation model is that it would isolate opportunities to improve cost and service performance without assuming dramatic technological changes. Delivery times and routing strategies could be assessed by simulating network designs at different mail volume and mail mix levels.

The simulation model could also be a first step in privatizing Postal Service operations. The Postal Service could subcontract service territories to postal employees, now treated in this scenario as potentially spun off entities, or to other private firms. A more sweeping strategy is to privatize permanently service territories by spinning them off from the Postal Service.

Instead of giving postal subsidiaries the right of first refusal, the Postal Service could jump directly to reverse auctions. This strategy has its complexities. Using a telecom analogy, bidder eligibility becomes an issue. In telecom, bidding is open to companies with having a track record serving customers that could become Eligible Telecom Carriers within a specified time.[26] Electric utilities, for example, are a target group for the auction. In the postal industry, the bidding could be open to companies that already deliver parcels or have the capability to provide service. UPS would be an example of an eligible bidder.

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[24]CAF2 Model Overview, Hogendorn (2012 and 2013).

[25]Informed Delivery may be a first step towards combining the benefits of physical and virtual mail. https://informeddelivery.usps.com/box/pages/intro/start.action.

[26]Federal Communications Commission (2017).

The FCC's bidding process notices and order addresses also had to address challenges associated with setting reserve prices for managing service territories,[27] establishing a budget, weighting the tradeoff between reaching as many unserved consumers versus consumers in very high-cost serving areas, standards for use of different service technologies, value of potential future service upgrades, eligibility to bid, and non-compliance rules.[28]

The PRC would face similar challenges. For example, the PRC's current weighting of general objectives and factors is unclear because they vary across particular services and service classes. For example, the PRC uses four general objectives and ten factors to evaluate the structure of the ratemaking system.[29] The PRC ties the effectiveness of the ratemaking system to incentives for cost reduction.[30] Setting up the bidding process would force the PRC to weight the nine performance objectives and the fourteen factors as they apply to achieving those objectives to attract bidders that will meet the social objectives defined in Rule 3622.[31]

The reverse auction will likely require government funding because the cost of service is high in rural areas. The funding requirement is the equivalent of defining an explicit Universal Service Obligation (USO). The USO will depend on the size and diversity of the service territories. For example, a territory that has a large urban center could cross-subsidize a rural area. This cross-subsidy will lower the explicit USO amount.

The reverse auctions process will also reveal geographic considerations in achieving cost and service targets. Should the Postal Service devote the bulk of its resources to improving service in high-density areas or consider the importance of sparse territories where service is well below urban standards? Should one geographic region of the United States receive most of the government funding or will political considerations require a more even distribution across states?

The reverse auction strategy used in the telecom industry may require radical reconsiderations before it is applicable to the Postal Service. The most glaring difference between the two industries is that the Postal Service is a public enterprise; telecommunications companies are already privately owned. Before the auction occurred, telecommunications companies had the right to accept the FCC's reserve price support funding calculated from the forward-looking cost model. It was only when they refused the offer that triggered the reverse auction. Being profit driven, the telecommunications companies would base their decisions on the present value

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[27]The reserve prices were the cost levels calculated using the FCC's forward-looking cost model.

[28]Federal Communications Commission (2017).

[29]There are two general objectives for the structure of the ratemaking: with respect to the ratemaking process, objectives 2 and 4 (PRC Order 4257, p. 46); administrative process, objective 6, (Id., p. 47); with respect to pricing, objective 4, (Id., p. 46); with respect to just rates, objective 8 (Id., p. 46), and the relevant factors are 1, 2, 3, 4, 5, 6, 7, 10, 11, and 14 (Id., p. 48).

[30]PRC Order 4257, p. 130.

[31]Postal Accountability and Enhancement Act (PAEA). Retrieved from https://www.gpo.gov/fdsys/pkg/BILLS-109hr6407enr/pdf/BILLS-109hr6407enr.pdf.

of accepting the FCC's support and future cash flows from operations. In the Postal Service's case, the right of first refusal may not be effective if Postal Service management or its unions assume they will be bailed out by the government if they fail to meet forward-looking cost targets.

Working with unions will be critical to the success of reverse auctions or even developing a forward-looking cost model for USPS service territories. Commenters in the Postal Docket have claimed that union wage scales are high compared to like workers in private industry.[32] If the claims are true, should a forward-looking cost model embed union wage scales? If it does, the explicit support fund size and reserve prices for service territories must be higher than market-determined costs. Outside bidders may see profit opportunities by replacing union workers in the service territories they bid to operate. If unions lose power, there may be a push to reduce their retirement benefits.

Another glaring issue is the separation of parcel from mail delivery. In the telecommunications industry, a reverse auction allows a service provider to offer any bundle other services together with the basic broadband service required by a winning bidder. In the Postal Service's case, dominant services exclude package delivery, which is, overall, a profitable enterprise in its own right, although it may lose money in high-cost delivery areas. It may be useful to broaden the service territory concept to include all types of delivery to tap into economies of scope from delivering both mail and parcels. Allowing service providers to offer bundles of services, perhaps including new types of deliveries, raises the issue of how to factor in innovative bundles into the bidding process. Are there delivery technologies that warrant more potential support?

Finally, this proposal focuses on the last mile, assuming that central staff would manage upstream services efficiently. It may turn out that reverse auctions are most easily accomplished for these supply chain activities because they may be competitive. Sorting mail is an example. If this occurs, how will it affect distribution of mail and packages to service territories? These types of questions suggest an incremental strategy for privatizing postal operations.

4   Conclusion

Economists have mainly focused on incentive regulation to improve the Postal Service's performance. To date, this approach has failed for a variety of reasons. Instead of continuing to rely solely on external incentives associated with price caps to meet public interest objectives, this paper focuses instead on developing a set of internal incentives based on defining competing service territories and a management bonus plan. Paradoxically, internal incentives may show the way towards subcontracting or spinning off last mile delivery to the private sector.

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[32]See for example, Before the Postal Regulatory Commission Washington, D.C. (2018).

Following the FCC's lead, the PRC would need to develop a delivery simulation model with the goal of using reverse auctions to attract private sector interest in last mile delivery. This process would require an explicit value placed on the universal service obligation. It would also clarify which public interest objectives are most important to the PRC.

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Crowdsourcing the Last Mile

Michael D. Bradley, Jeff Colvin, and Mary K. Perkins

> *UPS can put a driver on every block every day, Uber can put a driver on every block every minute*

—Ryan Peterson

> *. . . delivery systems are more likely to succeed with top-down optimization, no matter how badly a sharing economy corporation tries to screw its non-employee employees*

—Michael Byrne

1 Introduction

Recently, crowdsourced ridesharing companies have made moves to expand into last-mile package delivery. This sets up a potential competitive struggle between the national hub-and-spoke companies (NHS) and such crowdsourced delivery companies over the last mile delivery market. This is an issue hotly debated on the Internet,[1] but one that has thus far received relatively little academic attention. There has been keen interest in the economics of the 'sharing economy' generally,

[1]See Petersen (2015) and Byrne (2015).

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and also in analysis of crowdsourced grocery delivery, but so far not much on ridesharing companies wishing to expand into adjacent markets (see Kung & Zhong, 2017).

The delivery market is dominated by the NHS companies, primarily UPS, DHL, FedEx, and posts, whose optimized networks enjoy scale and scope economies. Fully private delivery companies employ very different business models from national posts, but they both thrive on density, including multiple pieces per stop and/or a large number of stops per geographic area. Such companies also maintain significant physical assets, such as delivery fleets and staging centers.

Crowdsourced ridesharing platforms, such as Uber and Lyft, have achieved significant penetration of the passenger service industry. They have done so through constructing a two-sided platform linking consumers seeking rides with independent drivers and have avoided directly investing in a large physical network. Such companies have been quite successful at attracting capital, and these companies are now moving into the same-day delivery (SDD) market (Jinks, 2016).

The question this chapter addresses is whether such crowdsourcing companies can take enough volume from the NHS companies to grow their own networks profitably. It seems clear that, at least initially, it would be difficult for crowdsourced delivery platforms to compete on a national scale, given the vast NHS network of air and truck package delivery capacity. Moreover, NHS companies earn much of their profit on long-haul package transportation.

The potential for competition may be different for the last mile, delivery to the end user. The last mile is important to NHS companies, perhaps more so in the future if the demand for SDD displaces some of the demand for Next-Day or Two-Day delivery service. Uber, like other ridesharing companies, lacks an inter-city infrastructure, but it does have an intra-city infrastructure in some cities with potential scope economies between passenger service and parcel delivery that might be capable of competing successfully for B2C parcel delivery (about 45% of US domestic package volume), especially if a significant portion of B2C demand is sliced off into SDD. In effect, the crowdsourced platform provides consumers with a fleet of on-demand delivery services, setting the stage for a contest between instant delivery and NHS local, next-day residential shipments.

This chapter investigates the conditions under which a crowdsourcing, two-sided platform could successfully enter the same day package delivery market. We model the pricing decisions of the platform under which it both sets prices to consumers receiving package delivery and rates paid to independent drivers delivering the packages. Cross-side network effects are explicitly included in the model, and such effects turn out to have substantial impact on whether ridesharing platforms can successfully complete with NHS companies. Section 2 reviews literature on the topic, Sect. 3 summarizes lessons learned from existing attempts to establish crowdsourced delivery networks. Section 4 brings up some issues in Integrating ride-sharing and goods delivery. The model is introduced and analyzed in Sects. 5 and 6 concludes.

2   Literature Review

There is a growing literature on the general topic of two-sided markets, per se and the role of two-sided platforms in the economy. Armstrong (2006), Rochet and Tyrol (2003), and Eisenmann, Parker, and van Alstyne (2006) are some of the classic works on the subject. What distinguishes a market with two 'sides' is fundamentally the external effect of actions of one set of consumers, those on one side of the market, upon another set, those on the other side, or other sides in the case of multiple-sided markets. This characteristic of such markets, dubbed "cross-side network effects," highlights the increase in the value to consumers on one side of a market as the number of participants increases on the other side.

Of particular interest to economists are the implications for pricing brought on by the presence of cross-side effects. Pricing on one side of the market depends not only on the demand sensitivity and marginal cost of that side, but also on the impact of changes in participation on the value of the market on the other side. Hence, the elasticity of response of one side to changes in participation, and therefore on prices, on the other, figures importantly in determining the profit-maximizing price.[2] Since the same is true on the other side of the market, prices on either side depend upon elasticities and marginal costs on both sides.

A related issue is the so-called chicken-and-egg problem, sometimes encapsulated in the phrase 'no side will join while the other side is missing.' A critical mass of participants on one side is needed to attract participants on the other. Once the network is mature, it may stay in business owing to its significant entry barrier, but how to get started? One way sometimes chosen is to subsidize one side or the other, especially in the early phases of the growth of the network. For example, a delivery platform, that will ultimately earn its profit from the difference between the delivery charge to the consumer and the payment to the driver, might delay taking profits, essentially allowing drivers to keep the entire delivery fee, until a sufficient number of drivers join the market to attract consumers to using the service. On the other hand, if the concern is to grow the number of consumers, the platform may offer free delivery, effectively subsidizing the ordering consumers.[3]

Hagiu (2014) highlights complex pricing challenges that multi-sided markets present. It will generally be more profitable to charge a higher price to the side with less price sensitivity. However, the appropriate price needs to recognize not only sensitivity of demand of a side with respect to price but as well sensitivity with respect to the number of participants on the other side.

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[2]See Rysman (2009).

[3]"Penetration pricing" and similar strategies are discussed in Eisenmann et al. (2006).

3   Strategic Considerations in Crowdsourcing Goods Delivery

The home delivery market is mainly served by the NHS companies, who have benefitted significantly from its rapid growth. However, last-mile delivery is not always profitable. Distances between stops, variation in pieces/stop (cross sectional and longitudinal), varying demand for delivery times, make optimization challenging. All the usual difficulties in optimization of the last mile are made more critical with the growth in on-demand (2 h, 1 h, same day, etc.) delivery.

Crowdsourcing offers a different approach to the delivery optimization problem, one that involves opening the driver side of the market. The design of their delivery platforms rests on engaging their drivers to make deliveries, expanding the capacity of the network without incurring much of the 'fixed cost' borne by NHS companies.[4] In contrast, NHS companies keep closed the driver side of their market and fight for the volume of packages to defray the cost of maintaining permanent employees and fleets of trucks.

Kontio (2016), who conducted a survey of crowd-shared goods delivery platforms, discussed cases of platforms growing by opening an additional side. A grocery delivery company, for example, may begin with just two sides: drivers and consumers. But once the company has enough consumers, it can sometimes open a third side by getting a retail grocer to offer groceries at a discount, essentially paying to participate in the delivery platform, and then either take profits, pay drivers more or charge consumers less. The retail grocer not only gets more consumers but pays a reduced cost of last-mile delivery as scale economies make it less costly to offer delivery from a grocery delivery business that serves many retail grocers.

Alternatively, there are cases where delivery platforms have closed a side by hiring their drivers as full-time employees. The purpose is typically to increase reliability and service to consumers. This has occurred where the flexibility of crowdsourced driver supply allowed a platform to make a profit even at low volume, but also resulted in infrequent and unreliable deliveries. In some cases, drivers were hired full-time to operate in the busiest areas.

The flexibility of crowdsourcing is what distinguishes a delivery platform from traditional shipping companies. Closing a side (hiring deliverers) would trade off the flexibility that allows them to expand into the market without high upfront cost. Further, flexibility helps to avoid risk: platforms can operate profitably even in uncertain environments prone to demand fluctuations.

> "Some of our (noncrowdsourcing) competitors are very slow to expand. It just shows how expensive it is to expand when you've got a fleet of drivers to pay and have to make sure you give them constant work" – YellowGrocer, quoted in Kontio (2016)

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[4]Such a development is highly dependent on technology, especially mobile technology. On the mobile technologies enabling the expansion of crowdsourcing into goods delivery, see Rouges and Montreuil (2014).

4 Integrating Ride Sharing and Goods Delivery

Amazon has made initial efforts to utilize crowdsourcing for delivery of packages. The company advertises Amazon Flex to those wanting to earn $18–$25 per hour while setting their own schedule.[5] As reported in 2015, the company's plan is to sign up retailers to store packages. Then drivers would use an app to learn pickup and delivery points, required delivery time, etc.[6] At the same time, Uber, Postmates and Instacart are all seeking to develop their own logistical networks for package delivery.[7]

Like any platform, a delivery platform that expands ride-sharing operations into package delivery faces the problem of realizing sufficient network effects to attract a crowd, though in this case the crowd is already assembled, it just needs expansion into the new activity. And again, the complications of managing a platform arise as soon as it engages entities on both sides. In the case of integrating ridesharing with goods delivery, a platform would put together drivers with senders (the other side of the platform), where the value of the platform increases for consumers increases as more drivers are available to go more places at more times. At some point the platform may subsequently need to alter its strategy to improve delivery quality by partially closing its driver side.

5 The Model

This model is designed to identify the characteristics of a same-day delivery market that would permit a ride-sharing platform to enter and compete with a traditional large-scale delivery enterprise. The market we describe is local, same-day delivery of packages from retail stores to consumers.

Prior to the entry of the ride-sharing platform, same-day service is provided by a NHS company. The NHS company has built its network to serve the multi-day delivery market (1- or 2-day delivery), by comparison to which the same-day market is small. For that reason, we assume that the quality of the delivery, essentially the delivery time, provided by the NHS company is low relative to the willingness of consumers to pay for more rapid delivery. This leaves room for entry by crowdsourced package delivery enterprises that can deliver more quickly than an NHS.

Consider entry by a two-sided delivery platform, connecting ride-sharing drivers with consumers seeking delivery of packages. The driver goes to the retail store, picks up the package and delivers it to the consumer. For this service, the platform charges the consumer a fee, ρ, and the driver is paid a fee denoted by δ. To study this

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[5]See Amazon (2017).

[6]See Benzinger (2015).

[7]*Ibid.*

market development, we apply the general framework proposed by Kung and Zhong (2017) for understanding the economic structure of a two-sided platform delivery firm in a sharing economy. In this framework, consumers gain by participating in the two-sided delivery platform if the time for delivery is less than that of the NHS company.

Following Kung and Zhong, we treat the perceived quality, q, of package delivery as a function of delivery time, in which quality increases as delivery time decreases. Since delivery time falls as the number of drivers, n_d, increases, and quality is a function of delivery time, we specify that quality is a positive but decreasing function of the number of drivers, specifically

$$q = n_d^{\propto}, 0 <\propto< 1.$$

Consumers are heterogeneous with regard to their willingness to pay for rapid same day delivery, uniformly distributed and indexed by θ between $(0, 1)$. $N > 0$ is a scaling factor that reflects the notional number of orders per consumer would make in the time period without reference to delivery speed. For example, this could be the number of grocery orders a consumer expects to make in a month. The utility a consumer enjoys from participation in the platform is given by

$$U(\theta) = N\left(\theta\left(q - \underline{q}\right) - \rho\right),$$

where $\underline{q}$ is the quality provided by the NHS delivery company. The consumer will join the platform coalition if $U(\theta) > 0$.

We next model drivers. The driver incurs a cost c_d to pick up and deliver a parcel and experiences disutility from labor, indexed by λ.[8] Drivers earn net income of $\delta - c_d$ and their utility is found by comparing net income to their disutility. Hence, since

$$V(\lambda) = N(\delta - c_d - \lambda)\left(\frac{n_c}{n_d}\right)$$

drivers will join if $V(\lambda) > 0$. Since N is the expected orders per consumer per time period, $N\frac{n_c}{n_d}$ is the expected number of packages per driver.

There exists a critical value $\theta*$ such that a consumer joins if and only if $\theta > \theta*$ and a critical value $\lambda*$ such that a driver joins if and only if $\lambda < \lambda*$. This means that

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[8]We include such items as wear and tear on their vehicles in the drivers' cost. In terms of the disutility of labor for delivery packages, this includes not only the additional time required for package delivery but also other costs such as dealing with unfriendly dogs, difficulties in getting the package to the proper location at the customer's address and potential liability issues associated with package damage. These kinds of effects are indexed by lambda and help determine how many drivers enter.

$$n_c = 1 - \theta* \text{ and } n_d = \lambda*.$$

The platform's profit function is given by

$$\Pi_{\rho,\delta} = Nn_c(\rho - \delta)$$

We can gain some insight into the solution by examining the utility functions for a given ρ and δ. Recall that consumers join the market when $\theta > \theta*$, so that $U(\theta*)=0$.[9]

$$U(\theta*) = N(\theta* n_d^\alpha - \underline{\theta} - \rho) = 0$$

Solving yields

$$\theta* = \frac{\rho + \theta}{n_d^\alpha} = \frac{\rho + \theta}{\lambda^\alpha}.$$

We use $\underline{\theta}$ to capture the level of utility associated with use of the NHS network for delivery. This is associated with q, the quality provided by the NSA delivery company. As $\theta*$ declines there are more orders for delivery coming from consumers. And as ρ increases or $\theta*$ increases, there are fewer consumer orders. But as n_d rises, more drivers and more consumers enter the market.

Drivers will join so long as their disutility is less than their net income, or $\lambda < \lambda*$, $V(\lambda*)$ will equal zero for the marginal driver. Hence,

$$V(\lambda*) = N\left(\frac{1 - \theta*}{\lambda*}\right)(\delta - c_d - \lambda*) = 0.$$

Solving this yields:

$$\lambda* = \delta - c_d$$

As δ rises or c_d falls, more drivers enter. And this also means more consumers join the market, as an increase in n_d implies an increase in q.

Inserting this value for $\lambda*$ into the equation for $\theta*$, we can now express the platform's profit maximizing problem as:

$$\Pi* = \max_{\rho,\delta} \left[1 - \frac{\theta + \rho}{(\delta - c_d)^\alpha}\right](N(\rho - \delta))$$

for which the first order conditions are

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[9] Note that $\underline{\theta}$ represents the utility the consumer receives from having the package delivered by the NHS company.

$$\frac{\partial \pi^*}{\partial \rho} = \frac{-1}{(\delta - c_d)^\alpha}\left(N(\rho - \delta)\right) + N\left[1 - \frac{\theta + \rho}{\delta - c_d}\right] = 0$$

and

$$\frac{\partial \pi^*}{\partial \delta} = \frac{\alpha(\delta - c_d)^{\alpha-1}(\theta + \rho)}{[(\delta - c_d)^\alpha]^2}\left(N(\rho - \delta)\right) - N\left[1 - \frac{\theta + \rho}{\delta - c_d}\right] = 0$$

These conditions can be solved for the profit maximizing values of ρ and δ. However, because of the complexity of the first order conditions, it is not feasible to solve for the profit maximizing charge to consumers and payment to drivers analytically.

6 Solving the Model Numerically

To gain insight into the factors influencing those rates, the resulting profits and the numbers of drivers and consumers that participate in the platform we solve the model numerically. To facilitate the investigation, we choose values for the parameters and exogenous variables that support an interior solution in which the platform exists and both drivers and consumers participate.

Recall that the model assumes a continuum of consumers and a continuum of drivers, both defined by the uniform distribution in [0, 1]. Thus, the number of participating consumers and drivers will fall between zero and one. We set the expected number of packages sent per unit time at 10, although because we assume the volume of packages is independent of shipping price or delivery speed, this value plays no role in the first order conditions or the profit maximizing values for ρ or δ. We initially set α at a value of 0.25, and we set $\underline{\theta}$ to a value of 0.05. A low value for this parameter is required for an interior solution. If consumers get relatively high utility from the NHS company, then it will not be possible for the platform to find a positive set of prices that will yield a positive profit. In other words, the platform would not be able to enter the market.[10] Finally, we set the driver's cost of making the delivery to 0.10.

Table 1 presents the profit maximizing rates along with the values for θ^*, λ^*, profits and the proportions of consumers and drivers participating. The values themselves have no particular meaning but can be used as the basis for calculating numerical comparative statics and comparing relative values of the solutions. For example, the model provides a value for the charge to consumers that is above what the platform pays drivers, allowing the platform to make positive profits.

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[10]This means that as the value for $\underline{\theta}$ changes this will influence whether entry by crowdsourcing is likely. If consumers are getting sufficient utility from the NHS company, crowdsourcing will not arise.

Table 1 Baseline solution

ρ	0.3588
δ	0.2022
θ*	0.7230
λ*	0.1022
π	0.4338
Nc	0.2770
Nd	0.1022
Nc over Nd	2.7101

Table 2 Increasing Cd

ρ	0.3941
δ	0.2610
θ*	0.7694
λ*	0.1110
Π	0.3069
Nc	0.2306
Nd	0.1110
Nc over Nd	2.0767

Our first comparative statics exercise is to increase the cost to the driver for making the delivery. The driver's cost is increased by 50% from 0.10 to 0.15 and the results are shown in Table 2. As one would expect, this leads to a large (29%) increase in the payment to drivers. Table 2 shows that a higher payment is needed to entice drivers to participate in the platform. It also leads to a higher charge to consumers as the platform is attempting to preserve profit. However, the consumer charge increase is just 10%, as the platform must avoid driving too many consumers out of the platform. The number of participating consumers does fall and this, combined with a smaller profit margin per delivery causes profits to fall. In contrast to the decline in participating consumers, the number of participating drivers increases. The increase in the value of the network to consumers, from the external cross effect, is swamped by the increase in the delivery charge. As shown above, a profit-maximizing platform will be forced to raise the driver payment and the delivery charge to consumers. A platform more concerned about growth over time might forego the profit, temporarily, to grow the network.

Our next experiment is to assume a higher level for $\underline{\theta}$, (increasing it by 50%) the utility associated with provision of delivery by the hub and spoke company. The results are shown in Table 3. A higher value for this parameter means the crowdsourcing platform is facing a more challenging environment in which consumers are getting a higher level of satisfaction from the NHS provider.

In this environment, the platform charges a lower price to consumers in order to overcome their resistance to participating in the platform. The charge to drivers is slightly higher as is the number of drivers who participate, which provides a higher level of utility for consumers at a given price. Not surprisingly, the number of consumers participating in the platform is smaller, leading to a reduction in profit.

Table 3 Increasing θ bar

ρ	0.3515
δ	0.2066
θ*	0.7464
λ*	0.1066
π	0.3674
Nc	0.2536
Nd	0.1066
Nc over Nd	2.3780

Table 4 Increasing α

ρ	0.3422
δ	0.2471
θ*	0.8048
λ*	0.1471
π	0.1857
Nc	0.1952
Nd	0.1471
Nc over Nd	1.3272

Table 4 contains the results of the last experiment, which is to increase α, which lowers the rate at which increases in the number of drivers increase quality as perceived by consumers. We increase α by 50%.

A lower value of quality per number of drivers produces a need for additional drivers to entice a sufficient number of quality consumers to participate in the network. This requires the platform to pay drivers more. At the same time, the platform must lower the price to consumers in order to encourage their participation. Thus, Table 4 shows that profits are sharply reduced because the platform is faced with higher driver costs and lower prices to consumers. This result emphasizes the importance of quality (timely delivery) for the platform to be profitable.

Finally, the fall in the number of consumers reduces the packages transported. The model helps to illustrate the tradeoffs facing the platform. An increase in δ, given ρ, will result in more drivers *and* consumers, because of the positive cross-side external effect, but reduce profits. That these lower profits may make the increase in driver payment unsustainable, as the model shows. In fact, the platform will have to raise ρ to avoid losing profit. However, as we have seen, some crowdsource delivery companies have chosen a path to a larger network in the longer term that sacrifices short term profits.

An important aspect of integrating a ride-sharing platform with delivery could be the cost complementarity experienced by drivers. Drivers that are already close by, as a result of the passenger business, will experience little of no added disutility or cost from the package delivery. This will shift λ* or c_d, so that the number of drivers below the critical disutility value will increase, and n_d will rise. On the other hand, if drivers experience diseconomies of scope in the expansion, disutility will increase relative to net income and there will be fewer drivers. Similar effects will be present for changes in driver cost, regardless of the cause.

The model shows that successful entry by the platform depends crucially on beating the hub and spoke company in perceived quality. As the gap between the service quality of the platform and the hub and spoke company narrows, the number of consumers interested in the platform falls. In addition, the power of the cross effect is evident in the model. As expected, fees and market participants grow as the cross effect gets larger. However, the increase in the driver fee is greater, proportionately, than the increase in the delivery charge. The platform in unable to raise the delivery charge and still keep enough consumers in the market, and so loses profits.

The strategic decisions before the platform is whether to take profits initially or let the network grow by allowing drivers to keep all or nearly all of the delivery charge, i.e., by setting $\rho = \delta$. At a later stage of development the question of openness will emerge; the platform may consider hiring its own drivers as full-time employees, though in that case the new platform would resemble a local version of the NHS company it has replaced. Such a solution might not be stable.

7 Conclusions

In this paper, we have developed a model of equilibrium delivery charges and driver remuneration rates for an 'uberized' delivery operation. Naturally, much of the action in the two-sided markets is dynamic, and incorporates issues of short term losses, subsidies and expected future growth through network effects. However, most two-sided platforms fail, so it is of value to investigate the conditions for one to succeed in last mile delivery. Future research on the time path of such strategic decisions through time would be interesting, as would empirical research on the parameters identified. This latter will have to wait, of course, for further market experimentation.

Apart from purely economic considerations, this business model faces an array of challenges. Who is responsible for lost or damaged packages? How willing are customers to welcome a new set of deliverers onto their porch? An important part of the model is the 'nonworker' status of drivers, to which there are substantial legal challenges in many countries.

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Lessons from Other Network Industries: Should Posts Seek to Collaborate More in the Last Mile?

Adam Houck and Bernhard Bukovc

1 Introduction

The race for retailers to build and acquire last mile delivery capabilities continues to reshape not only the e-commerce landscape, but the way citizens engage with the digital world. Re-urbanization, changing demographics, evolving customer expectations, and growing infrastructures are concentrating markets. In response, emerging delivery technologies such as new e-commerce fulfillment models, the growth of intermediaries, drone delivery, Uber parcel delivery, infrastructure sharing, and strategic partnerships are forming to meet growing parcel delivery demands in densely populated areas. Set against the backdrop of a sharing economy and a postal industry that has experienced significant letter volume declines that threaten its viability, significant questions need to be faced. Should asset heavy incumbents like postal operators (POs) partner to increase delivery volume density in the last mile? Are POs positioned to capitalize on opportunities in the last mile ecosystem? Do other delivery companies, often more agile and flexible without the legacy burdens carried by POs, have a competitive advantage too strong to overcome? Do new intermediaries innovate too quickly for POs to be good partners?

One interesting approach to answering these questions is to ask whether any lessons can be applied from cooperative models in other network industries to better

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understand whether POs have an opportunity to collaborate within the last mile with the understanding that the competitive environments and other networks themselves are quite different from postal networks.

This paper examines the drivers behind cooperative models in other network industries and offers approaches that POs and regulators might consider for such arrangements to succeed. The next section examines the differences between letter networks and parcel networks that help to explain why lessons from cooperative models in other network industries cannot be simply applied to the last mile. Section 4 explores the importance of considering viable collaborative models as well as scenarios under two regulatory frameworks that address whether posts possess or could acquire the needed capabilities to be the one who facilitates the collaboration in the last mile for parcel delivery networks. Conclusions are presented in Sect. 4.

2 Parcel Versus Letter Network Differences and Other Factors for Consideration

While traditional letter markets exhibit the classic attributes of network industries, parcel networks are different. These differences and the elements parcel networks lack compared to traditional network industries are crucial and illuminate why different strategies are required for each network structure. In other network industries such as energy, cables and pipes create fixed network costs, which create economies of scale and barriers to entry. Coupled with vast mail processing and transportation infrastructures, monopoly protection and a USO, postal letter markets behave in a similar fashion.

For parcels the story is different, especially in the last mile. In many countries, no USO exists. The competition for parcel delivery is fierce, unlike the monopolies that protect firms in the energy, telecommunications, and airline industries. New competitors and intermediaries frequently arise, and the very notion of what constitutes a delivery agent is evolving, as anyone with a vehicle and a smartphone can deliver a parcel. Therefore, while parcel supply chains might resemble letter networks for long-haul transportation, the first and last miles differ significantly. Network duplication is not as great a concern when a parcel delivery firm only chooses to compete in a few metropolitan markets. There are fewer, if any, access restrictions or USO. Therefore, the decision to collaborate or cooperate with a postal and logistics provider will not be driven by the argument that there is a network which a firm cannot duplicate. Instead, a firm will decide to serve a specific geography itself or seek to partner with another provider based on other factors.

In addition to the differences between letter and parcel networks, a variety of forces are shaping the future landscape including urbanization, parcel volume growth, customer expectations, brand and trust, and other environmental factors such as traffic and vehicle congestion. These forces inform the discussion on whether

collaboration and cooperative models in the last mile are viable solutions to growing challenges.

Urbanization is fueling the growth of parcel volumes in the last mile. A 2016 McKinsey report showed the share of the global population living in urban centers reaching 60% by 2030, up from 50% in 2015 (Bouton, Knupfer, Mihov, & Swartz, 2015). As stated in Houck (2018), "this density can benefit POs while generating additional threats. The increasing density amplifies advantageous economies of scale and scope and given the ubiquitous networks of POs, positions them to capitalize in the first and last mile. It does, however, create significant opportunity for entrants to compete for hyper-local population centers, especially those with higher amounts of wealth and purchasing power. In these small population centers, scale is less important when attempting to cream skim profitable segments." (Houck, 2018, pp. 162–163). It is important to build density in the last mile to help contain delivery costs and the composition of that density is perhaps equally important, as it could limit the ability to bundle deliveries. Alternatively, this density creates additional opportunity to offer higher value services, such as late evening delivery or same hour delivery. It is plausible that customers at some point could start to see these elements as standard services and expect them. If delivery providers, however, begin to offer these higher value services, density and quantity considerations will reappear as prices will likely need to decrease as competition increases.

Exacerbating the urbanization effects, parcel volumes are growing and show no sign of slowing. A 2017 Pitney Bowes study forecast global parcel volumes growing at 17–28% each year between 2017 and 2021 (BusinessWire, 2017). This does not include the growing challenges presented by parcel returns, which are significant, as "57 percent of shoppers say they would be likely or very likely to use a try-before-you-buy service," which could only exacerbate return volumes in the years ahead (MetaPack, 2018, p. 4). Combining the effects from urbanization and growing volumes presents significant opportunity for entrants to compete for delivery in hyper-local markets, lessening the need to compete in wider areas or nationally with an incumbent PO. For example, in the U.S., 40% of the population is concentrated in 21 metropolitan locations (U.S. Census Bureau, 2015). Such markets create both opportunity and challenges for POs to seek ways to compete with asset-light entrants, possibly through collaboration, which is explored in Sect. 4.

Customer expectations cannot be overlooked, and it is too simplistic to assert customers demand speed, flexibility, and free shipping. A 2018 MetaPack report showed that 50% of shoppers had abandoned online shopping carts because available delivery options did not meet their expectations (MetaPack, 2018, p. 2). Further, 35% of shoppers were willing to pay to get items delivered "when and where they want" (MetaPack, 2018, p. 4). These evolving expectations, combined with the implications resulting from poor delivery performance, suggest "delivery has the power to make or break the online shopping experience" (MetaPack, 2018, p. 2).

Combining the effects of changing expectations with the evolution of the trusted brand image POs enjoyed for many years, the results can be significant. Monopoly privilege and trust assisted POs in maintaining parcel delivery volumes even faced with new entry in the last mile. This was important when POs were the only

delivery firm customers would see each day. However, given the extensive entry in the last mile for parcel delivery, people now see many delivery agents each week. Unfortunately for POs, the establishment and growth of these last mile firms such as Uber, Lyft, and Lasership demonstrate that POs no longer hold the monopoly on trust.

A complicating factor may be the distinction, or lack thereof, between the brand of the retailer and the brand of the delivery agent. Along the value chain, brand exerts an influence across all components which becomes a significant B2C issue when delivery issues arise. Retailers must make the strategic choice with whom to partner as the consumer's choice of delivery agent is not always transparent. As with the Parcel Select product in the U.S., a consumer does not make the explicit choice for USPS to deliver the last mile when purchasing a UPS parcel. The implications of this lacking transparency are significant, especially given how quickly trust can be earned, lost, and transferred to new market entrants in the digital economy. If this trust can be quickly created by new entrants, the growth seen in B2C and B2B startups will likely accelerate.

Lastly, other environmental factors must be considered when evaluating whether POs should seek greater collaboration in the last mile because of urban congestion. In the U.S., delivery trucks "represent up to 7 percent of urban traffic and 17 percent of congestion costs due to wasted hours and petrol" (WEF, 2018, p. 7). Considering the forecast growth in parcels, this is not likely to abate and some cities are already acting. "Metropolitan leaders like London's Mayor Sadiq Khan are looking to reduce freight traffic in a bid to lower congestion and carbon emissions in cities, introducing 'micro-distribution' centers and demand shipment consolidation" (MetaPack, 2018, p. 8). London and Singapore already require steep fees to enter the city center by car. Other cities in Germany and France require stickers that indicate the type of car and whether the vehicle can enter the city.[1] It is likely to assume regulators and legislators will soon consider applying limitations to parcel delivery vehicles, perhaps through specific regulation in the postal and logistics sector. The critical questions to answer are under alternative scenarios where restrictive regulation exists or does not, are POs the best choice as the facilitator of collaborative logistics and delivery in such urban centers? (Panzar, 2015) argue that it is indeed in the USPS's best interest to cooperate with other last mile firms, but who is best positioned to serve as the facilitator in the last mile remains unanswered.

A simple case can be made for POs to seek postal-specific regulation in the last mile. Such a conclusion, however, ignores the critical factors discussed in this Section. Upon closer examination, it becomes clear that such regulation could harm POs and customers. If postal-specific regulation were to proceed, POs would be well positioned to win a tender or respond to new requirements given network coverage and trust. However, traditional PO networks are fixed. If POs are unable to repurpose assets to meet the flexibility demands of new delivery models, their networks would no longer function to their benefit and instead drive up the cost of

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[1]At present it appears electric vehicles are the only transportation mode without restriction.

delivery. This could have significant effects on delivery cost containment and the need to preserve low shipping costs for customers.

The differences in network structures between letters and parcels are exacerbated by the factors discussed in this Section and confirm the difficulty in using lessons from other network industries to solve the issue of last mile collaboration. Instead of seeking explicit collaboration or partnering arrangements, several firms have gone the route of acquisition to obtain needed capabilities in the last mile. Target acquired Shipt, a grocery marketplace and same-day delivery platform for $550M USD. Walmart recently acquired New York-based delivery service Parcel for $10M USD and Jet.com for $3B USD, a U.S. e-commerce company, to drive innovation and access to millennial customers. Amazon purchased Whole Foods for $13.7B USD to likely acquire forward warehousing locations that enhance the ability to serve population-dense markets with innovative same-day delivery models.

Acquisitions can be interpreted as de-facto collaboration in the last mile and cooperation is certainly not isolated to these three firms. New membership programs such as LiveUp between Uber, Netflix, and Lazada in Singapore offer combined services that consumers view favorably. "Almost three-quarters (71 percent) of respondents. . .indicated that the idea of joining a scheme involving multiple retailers and brands working together to offer premium delivery services held a strong appeal for them" (MetaPack, 2018, p. 13). While this partnering is already occurring and some delivery network duplication exists, it fails to address the underlying challenges posed in this paper. Specifically, as parcel delivery volumes grow, what capabilities must exist to deliver all volumes most efficiently that meet customer expectations, lessen the impact on traffic and neighborhood infrastructures, and deliver the security and trust needed? Perhaps most importantly, what will the role of POs be in this new landscape, and what rules, regulations, and competencies are required for the PO, or any facilitator in the last mile, to succeed?

3 Exploring Collaboration and Determining Potential for Posts

The case for exploring greater collaboration as a solution to the factors explored in Sect. 2 is rooted in a firm's ability to meet many, if not all, of the requirements that will determine success. As it is not likely a single provider possesses all the capabilities such as network design, the ability to scale delivery agents in near real-time, and the intra-day network flexibility to deliver a ship-from-store arrangement, partnering and collaboration emerge as a viable means to meet these demands. If parcel volumes, traffic, congestion, and delivery costs continue to increase and no greater collaboration occurs, it is likely customer experience will suffer, and that can translate to increased pressures up the fulfillment chain.

For collaboration to be viable, the right incentives must exist. In traditional network industries, participants seek to partner to avoid duplicating the large processing and transportation network infrastructures. The case for parcels and

logistics is quite different, however. While it may be beneficial to outsource part of the fulfillment process such as delivery to selected areas or last mile, the reasons are not likely rooted in network duplication. A delivery company might cooperate with another provider because they do not service a specific area or because the other provider has a superior service level. It could also simply be too expensive to deliver an equal level of service to every location. In each case, the decisions made in these situations will likely be business-driven arguments, not network-driven ones, as network infrastructure elements do not really preclude firms from overcoming barriers to entry.

In any case, the ability to scale delivery networks and offer the flexibility required to meet demanding customer expectations can be addressed by increased collaboration, especially as populations continue to move back to cities. As greater amounts of wealth and purchasing power return to urban centers, the size of a delivery network can be less important, but the ability of a delivery network to meet the intra-day flexibility required from evolving online shopping habits becomes critical. Just as POs and delivery companies shifted transportation volumes from surface to air decades ago to contain costs and increase speed, collaboration in the last mile can control costs and allow participating firms to focus on their core competencies and team with others to address shortcomings. Identifying these efficiencies is critical, as "70 percent of online shoppers say they still expect home delivery to be free and are prepared to wait longer for a delivery if shipping is free" (MetaPack, 2018, p. 5).

There are clearly incentives to increase delivery density for asset heavy incumbents like POs. There can also be economies of scale in delivery production costs for firms, like Uber, who own no assets. However, unlike POs that have fixed fleets of vehicles available for package pickup, crowdsourced delivery platforms significantly reduce the fixed cost, as explored by Bradley, Colvin, and Perkins (2018). As Uber's delivery agents are independent contractors, each agent indeed has incentives to increase volume and density for a given delivery route due to decreasing costs to scale. These costs, in turn, could have an impact on the prices Uber charges for each delivery, regardless of whether operating under a traditional or reverse auction paradigm. Therefore, even different types of agents could have similar incentives to increase density as volumes increase. Whether regulation requires a single delivery provider to service a given location, increasing density per agent has a significant and positive effect on local communities. Most importantly, by increasing the delivery volume per agent, total delivery vehicle traffic can be reduced.

As discussed in the previous Section, parcel deliveries significantly contribute to overall vehicle traffic and congestion costs in city centers. With the recent focus on smarter city models where local authorities are seeking to reduce overall vehicle traffic, it is likely to assume incentives or explicit vehicle regulation will force greater collaboration among delivery agents in the last mile. WEF (2018) argues global parcel volume growth, among other factors, will continue to create strain on urban infrastructures which will result in increased negative externalities for many participants from traffic safety, transportation cost, e-commerce customer experience, and vehicle emissions. Therefore, the need for increased collaboration in

the last mile is clear, as many factors, as those addressed in Sect. 2, show no signs of abating.

The critical question for consideration is in a world of greater cooperation and collaboration in the last mile, what role should the PO play? POs are already the asset-heavy incumbents with infrastructures and can immediately contribute to solving the scale challenge without likely building out greater delivery capacity. However, one must take a closer look at the characteristics of their delivery capacity. While total capacity is important, the ability for the infrastructure to offer the intra-day flexibility to enable new innovative delivery models such as ship-from-store is equally important. Same-day delivery and ship-from-store models require the network to flex to handle peak load delivery volumes in real-time; furthermore, these are not flows characterized by static routes. As many POs still do not operate separate parcel and letter delivery networks, this flexibility does not currently exist. Hence, network duplication is less of a concern when exploring partnering models since the required network attributes do not already exist. Indeed, it is likely POs will have to partner to acquire this flexibility to meet the high demands of these new delivery models.

Delivery capacity is only one of several important considerations that must be evaluated including the ability to partner, trust and brand, and interoperability. If one cannot directly apply lessons from other network industries, we consider the differences between two scenarios to determine the options for POs and their resulting effects: one where regulation requires a single last mile delivery provider to operate in an urban area, and one without such strict regulation.

3.1 Scenario 1: Regulation of the Last Mile

If one considers the emerging smart city models where local authorities, such as London and Singapore, are working to reduce total vehicle traffic in urban locations, it is likely only a matter of time before severe rules are applied to the postal and logistics sector for parcel delivery. Absent a USO for parcel delivery which reduces the likelihood of market failures through exorbitant delivery prices or failure to service certain geographical markets due to profitability concerns, it is likely that environmental considerations will shape the regulatory landscape for delivery vehicles in the years ahead. Other considerations such as cost control and customer expectations will probably not be compelling enough to force regulators to act.

Significant concerns arise in this scenario including the provisions granted in the regulation itself, customer expectations, and the ability to partner. If regulators were to monopolize parcel delivery in the last mile and grant exclusive rights to a single carrier, clear rules are required to ensure the market functions. If only one company could deliver, some controlled network access for other firms would be required considering that, as discussed in Sect. 2, no single provider possesses the assets and capabilities to service a given metropolitan segment. Partnering models are likely to

be the only means for offering all available delivery models to a given market, but this does not solve the underlying challenges of traffic and congestion.

A key challenge for regulators lies in defining what customers need or want, now and in the future. Delivery market needs are developing quickly. In city centers many business customers demand high quality, individualized service and pick-ups and deliveries within given time windows with varying service features. Given the myriad expectations both for individuals and businesses in the last mile, it is difficult to see how regulation could address or foresee all market demands.

If such innovative demands are not within the regulated delivery provisions, one must consider if and how smaller competitors would still be allowed to perform same-day and 1-h deliveries. For example, if regulators believe only standard delivery service plus an additional element is required such as evening deliveries or specific time windows, much of the innovation in delivery models would be eliminated. As lack of partnering will not lead to the desired reductions in traffic and congestion, strict regulation could both detrimentally affect delivery quality and stifle innovation. Regulators should evaluate whether actions are required, and they must do so carefully. They must ensure that any public tenders or provisions allow such flexibility to exist for innovation to continue to benefit all members of the ecosystem including citizens, retailers, established POs, and new entrants. If regulators would issue a public tender for such last mile arrangements, it is important to consider how POs could contribute to the solution. POs do possess the facilities to consolidate shipments and sizeable vehicle fleets to service deliveries within typical workday hours. It is unclear, however, whether POs could offer cheaper prices relative to other firms. Competitors might have more flexible labor contracts and cheaper labor compared to POs, especially given the significant amount of delivery labor that is collectively bargained. Having POs perform higher value services such as flexible, late evening deliveries could quickly become cost prohibitive. Therefore, regulators must carefully consider partnering arrangements to offer all innovative delivery services. There is likely no scenario where a single PO can provide or add new services in any regulatory regime that would both reduce traffic and be responsive to customer needs.

3.2   Scenario 2: No Regulation of the Last Mile

Evaluating the case against explicit regulation for monopolizing the last mile is interesting given the underlying challenges and speed at which the landscape is changing. Efforts to regulate the quality of customer experience citizens must receive is a substantial challenge, especially when considering the heterogeneity of parcel delivery models and number of firms that already exist in the last mile. Not only are the current expectations diverse, the speed at which expectations evolve is significant, which greatly limits the ability to predict the types of models in the future. As an example, over just the last 5 years, parcel delivery models have grown to include new asset-light intermediaries such as Lasership, Deliv, Zipments, Uber,

and Lyft that are all driving innovation today. The growth of these firms and the variety of delivery models offered have increased overall customer value and has occurred without explicit regulation. The success of these firms demonstrates how trust can be quickly created in the digital economy, it is transferrable to parcel delivery, and POs no longer hold the monopoly on this trust.

Given the heterogeneity of market forces, explicit postal or logistics regulation may not be required to create incentives for cooperation and collaboration. Once there is cost pressure, regardless of its origin, cooperative models will develop. This also creates competitive pressure such as we see in parcel lockers. Currently, DHL has a significant number of lockers in Germany, but it does not share these lockers with other companies. One can imagine if UPS, DPD, FedEx, and Amazon each had its own locker system, not only could confusion develop, but this solution would not be in the best interest of customers. Instead, if all delivery companies except DHL used the same system, it could create convenience for customer and thus a competitive advantage over DHL. Here, collaboration is occurring outside explicit postal regulation due to these cost pressures and illustrates how someone, DHL in this case, can be left out and harmed from an inferior strategy.

This cost pressure, specifically in fuel, has already forced POs to act to improve their net financial position. Most POs have adopted strict environmental goals of reducing greenhouse gas emissions (GHG), as GHG is a proportional measure to the cost of operations and delivery. Between 2016 and 2017, USPS reduced postal fleet petroleum use by 2.1%, "focusing on initiatives that use new technologies that will accommodate a diversifying mail mix, improve safety and service, reduce emissions and produce operational savings" (USPS, 2017, p. 14).

This cost pressure might also be an indirect one, as it might be free or much easier to enter city centers with non-polluting vehicles. In a similar manner, new delivery models would develop outside postal-specific regulation. For standard delivery services, fixed routes with no added value can serve the market need. Cooperation among partners can make sense, in that efficiency gains can be realized and innovation can also happen, mainly to speed up service through better routing. However, if one firm can address all the market need, partnering might not be required.

For all other services, flexibility is needed to build the services demanded by the market, not postal-specific regulation. If there are restrictions, such as electric-only vehicles in a city center, companies must seek innovation and come up with new solutions such as drones and crowd-sourced bicycle delivery. The market will adapt to these general rules, but sector-specific regulations might attempt to force companies to bundle their delivery activities and have the inverse effect, undermining innovation in delivery methods and service levels.

Regarding non-postal-specific regulation, evidence has shown that cooperative models can develop once local governments enact city restrictions, such as total vehicle traffic or emissions. When governments introduce special vehicle fees, this puts upward pressures on delivery costs as companies attempt to pass portions of these increased fees onto end consumers. This is particularly challenging given consumers' demand for free shipping. Faced with such pressures, it is likely that

delivery companies will autonomously try to reduce the number of vehicles entering the city to reduce costs. It is also likely POs, who are strong in more traditional parcel delivery, will have an opportunity to obtain additional volumes from other delivery companies for standard deliveries between 9 AM and 5 PM. In addition, it would be possible for POs to hand over volumes for late evening delivery to a private express company, as they could have more flexible labor contracts and thus greater capabilities to deliver outside regular work hours. For same-day and ship-from-store models it might be a third company who delivers, perhaps working with delivery robots, drones, and crowdsourced models to meet these specific market needs.

The challenge facing policy makers is how to solve the negative externalities question posed by the evolving consumption habits from citizens in urban locations. Even if politicians are willing to impose taxes on both businesses and private drivers to resolve traffic congestion, one must evaluate whether voters are also willing to accept the implications of their bloated shopping behaviors in the form of higher prices. Higher taxes and fees might solve the externality issue and can also create a barrier to entry. It is unclear whether such actions would suppress future delivery model innovation, but they could lead to an increase in innovations in adjacent areas such as urban consolidation centers as explored by Borsenberger (2018).

Pricing is another element that warrants consideration if different firms with largely heterogeneous underlying production costs are serving different delivery segments choose to collaborate. Asset heavy POs handling delivery volumes during regular business hours could likely charge prices as they do today. However, if a portion of the delivery volume must now be expedited for same-day delivery and the PO cannot meet that expectation, the PO can choose to give the delivery to a collaboration partner. However, the underlying economics in the crowd sourced delivery space are quite different. New intermediaries such as Lyft are likely willing to accept lower compensation for delivery because their comparative marginal costs are lower with no significant legacy infrastructures. Therefore, an interesting question that arises is whether the facilitating PO should pursue a reverse auction model for these volumes to decrease overall PO delivery cost yet maintain quality of delivery service? As Houck mentioned concerning these crowdsourced delivery volumes, "one can imagine a reverse auction paradigm will emerge, fueled by online platforms that allow any agent to bid on a given delivery, where the highest quality delivery service could well be the cheapest" (Houck, 2018, p. 167).

The implications of pricing regimes cannot be understated and will fuel the success of collaborative logistics in the last mile. Each firm has an incentive to control costs while maintaining delivery quality and meeting customer expectations. Further research is required to explore the resulting effects for different pricing structures and the incentives such structures create for the partnering firms in the last mile ecosystem.

Regardless of the regulatory regime, trust and security are important considerations for widespread collaboration to work. As stated in MetaPack (2018), "technology investments to ensure networks are agile and fast will be a priority for handling growing volumes and combating new market entrants" (p. 19). Such collaboration will require technology to build and ensure the trusted brand status

POs enjoy in letter and parcel delivery can be merged with the trust gained from new market entrants such as Uber and Zipments. Moreover, the collaboration must be seamless to consumers as the underlying infrastructures, service models, and delivery cost structures will determine the number of hand-offs among partners and the associated charges incurred to perform such a delivery.

To make this collaboration and trust transparent to consumers, POs should build platforms utilizing technologies such as blockchain to meet the growing needs of last mile customers. As many studies have confirmed, most notably by USPS OIG RARC, security, trust, transparency, and track-and-trace capabilities will become increasingly critical in the years ahead for parcel delivery. Whether the PO plays the role of buyer, auctioneer, coordinator, facilitator, or provider of last resort, failure to meet these expectations will likely result in the failure or underutilization of such a collaboration platform, marginalizing the potential benefits.

4 Conclusion

Lessons from other network industries cannot be directly applied to last mile parcel delivery. The incentives that shape partnering in the telecommunications, electricity, and airline industries such as network sharing of costly infrastructure, while applicable in letter networks, are quite different for parcels. As a result, the incentives that shape the actions of firms in the last mile will be driven by other factors including service levels and profitability rather than network driven factors.

POs that have high quality and flexibility in parcel delivery and the respective infrastructure and facilities are in a good position to partner with other firms in the last mile for a variety of services. This is important, as evidence suggests that no single provider has all the capabilities required to meet current expectations and confirms how critical collaboration will be in the last mile. It is indeed possible select POs will have to build and acquire additional capabilities or contract with other delivery companies to even meet the immediate needs of consumers.

In any case, it is almost certain that increased environmental and political pressure will drive governments to push for greater collaboration and consolidation in the last mile to reduce traffic and congestion. Regulators must be careful to ensure any such regulation does not stifle the continuing innovation in last mile delivery models from POs, established delivery companies, and new business startups. If regulators seek to reduce traffic and congestion, regulation should not choose single service providers with monopoly protections for last mile delivery. Clear rules and flexibility is required to ensure the market functions and the network can be accessed by ecosystem partners. Efforts to resolve the negative externality issues through taxes and fees should carefully weigh any potential barriers to entry they may create that can curb innovation and collaboration.

POs themselves will be called to make a choice concerning last mile collaborative logistics. They can lead from the front, play the role of the silent partner, simply contribute excess infrastructure capacity in vehicles and warehouses, or lend

their trusted status to technology platforms created by business partners. Given the factors presented in this paper, POs should lead from the front and seek greater collaboration. They still possess key competitive advantages that can be utilized to play the role of primary facilitators in the first and last mile in nearly every densely populated geography. However, it is not going to be easy. POs must seek this increased collaboration not because of the mortal danger of losing significant parcel volume density. Rather, they must act because in an increasingly digital world, the opportunity for increasing the role they can play not only in the last mile but in citizen lives overall is too great a prospect to overlook.

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Consolidation in Urban Logistics: What Could We Learn from Past Experiences and Economy Theory?

Claire Borsenberger

1 Introduction

Every day, both businesses and private households use and consume goods that for the most part are produced outside their living space. They also produce goods and waste that must be transported out of their living area. All their movements of freight or goods in urban areas are known under the terms "urban" or "city logistics".

Issues related to sustainable urban or city logistics, i.e., the movement of goods within cities, are not new. Already in ancient Rome, measures had to be taken to regulate the traffic of vehicles (Quak, 2008). Today, the growth of population, the urbanization phenomenon and the development of new ways to consume goods are fragmenting freight flows, increasing the number of deliveries, and consequently, creating larger and widespread negative externalities associated to the transportation activities (congestion, pollution, noise, and so on).

Therefore, attention on last mile delivery inside cities is growing and all different types of stakeholders are seeking solutions to optimize it. Supporting the development of e-commerce and the growing number of parcels delivered in the city center, while limiting negative externalities of freight transport and safeguarding inner-city livability is the complex equation to solve in order to build a more fluid and breathable city. Many authorities do not know yet how to efficiently regulate freight transport. Some have gambled on cooperation or collaboration between supply chain actors on the last-mile delivery segment. In particular, Urban Consolidation Centers

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(UCC) were identified in the literature as one of the most effective approaches to improve freight transport efficiency and sustainability. In response, many municipalities founded their own UCC. However, the majority failed to succeed. In order to try to understand why, the economic theory of co-opetition is mustered, straying from traditional approaches. The ambition of this work is not to fix the problem but to put on the table the main issues at stake.

Section 2 deals with the issues faced by public authorities, lists the expected benefits of urban consolidation centers and their effective results. Section 3 draws lessons from co-opetition theory and its application in air transport and lists some success (or failure) factors which could be applied to urban logistics in order to make UCC sustainable in the long term. Section 4 concludes.

2   Urban Logistics Challenges: Are Urban Consolidation Centers an Efficient Solution?

2.1   Challenges Faced by Stakeholders

Transporting goods plays an essential role in economic growth (Allen, Browne, & Cherrett, 2012), but also generates negative externalities: CO2 emissions, noise, road accidents, damages to historical buildings and congestion in urban areas (Piecyk & McKinnon, 2010). On average, 40% of the pollution within European cities is caused by freight even though it represents only 10–15% of the total kilometers driven in the urban area (Lindohlm, 2013).

Under the combined effects of urbanization, the development of e-commerce and "on-demand" consumption habits, these figures are expected to grow. Indeed, the development of e-commerce combined with the desire for delivery speed increases the frequency of shipments. More and more "empty" trucks are on the roads: according to a Eurostat study (2012), approximately 24% of all road freight kilometers driven in the European Union (27 countries) are by empty vehicles. The average utilization of the available load capacity of trucks for delivery or distribution purposes was calculated at a low 54% (European Environmental Agency, 2010). The cost of this inefficiency has been estimated at about €160 billion in the year 2010 (Cruijssen, 2012).

Despite its prominence for city livability, mobility of goods has been an issue surprisingly neglected by public authorities. Traditionally, freight transport was seen by local authorities as a "business problem" (Dablanc, 2007), which more or less ought to be left to itself since transport operators and their stakeholders have an interest to perform it as efficiently as possible.

This is not quite correct. The presence of significant (negative) externalities justifies public authorities' intervention since markets fail to correctly allocate resources. As Macario, Galelo, and Martins (2008) argued "logistics companies

have no incentive in engaging for sustainable solutions, because the costs they are responsible for are partly supported by the whole society, as externalities" (p. 79).

Fortunately, opinions are evolving. In the past few years, public authorities have become more involved in logistics issues (Van Druin, 2012). But many authorities do not know yet how to efficiently regulate freight transport. Already in 2003, the OECD emphasized that there is a lack of awareness and understanding of long-term perspectives by the public authorities, a lack of data, a lack of dissemination of knowledge from past experiments, too little communication and co-operation between private and public stakeholders. Moreover, a successful urban freight layout is a complex issue due to the variety of stakeholders involved and the specificities of each urban area. Marcucci and Danielis (2008) and Munuzuri, Cortés, Guadix, and Onieva (2012) among others have proved that geographic, economic, social, politic and cultural characteristics affect city logistics and people's perception of critical issues related to this field. While a measure can be successful in a particular context or at a given time, in other context or time, the same measure may fail.

2.2 Mutualization of Infrastructures or Resources: A Relevant Solution for Last-Mile in Theory that Fails to Succeed in Practice

Among the various solutions for sustainable urban transport identified in the literature, horizontal cooperation or collaboration schemes between supply chain actors has been recognized as one of the most effective approaches to improve freight transport efficiency and sustainability. On the last-mile segment, consolidation has commonly taken the form of proposing the creation of an Urban Consolidation Center (UCC), "one of the most studied solution" according to Allen et al. (2012).

UCCs are facilities that are situated in relatively close proximity to the geographical area that they serve, "in which flows from outside the city are consolidated with the objective to bundle inner-city transportation activities" (Van Rooijen & Quak, 2010).

The key purpose of UCCs is to reduce the total distance travelled, especially by avoiding that poorly-loaded goods vehicles make deliveries in urban areas. The technical solution is transshipping and consolidating goods at the UCC onto vehicles with high load factors for final delivery in the urban area. Thompson and Hassall (2012) estimated to 70% the savings in travel distance and between 25 and 50% the savings in the number of vehicles required to transport goods that can be achieved by using a collaborative distribution network.

The mutualization of infrastructures or other resources in order to pool flows, in theory, allows for both improving the quality of services provided to customers (Cruijssen, Cools, & Dullaert, 2007) and reducing operational costs. Roca-Riu and Estrada (2012) estimated at 12–14% the reduction in operational costs (in terms of

line-haul and local distance savings and time savings) thanks to the use of an urban consolidation center.

UCCs also offer the opportunity to operate electric and alternatively-powered goods vehicles for final urban delivery work, thus helpfully reducing the environmental footprint of urban logistics. According to Belien et al. (2017), horizontal collaboration in the freight transport leads to (1) a 20–25% diminution in CO_2 emissions; (2) a 10% improvement in transport reliability; and (3) a 10–15% reduction in transportation cost.

Based on the promising benefits obtained from experimentations, numerous UCCs have been established worldwide: in Italy, Ecologistics in Parma, Cityporto in Padua, the Center for Eco-Friendly City Freight Distribution (CEDM) in Lucca; in France, Elcidis in La Rochelle, Distripolis UCC in Paris; in the UK, the LaMiLO consolidation center serving the boroughs of Camden, Waltham Forest and Enfield in London, the Bristol and Bath UCC; the Motomachi UCC in Yokohama, Japan; SpediThun UCC in Thun, Switzerland; the San Sebastian UCC in Spain; Binnenstadservice in several Dutch cities; the Gothenburg UCC in Sweden; etc.

However, many of these experimentations or business attempts had short lifespans. For instance, amongst the 83 projects of urban distribution centers listed by Lagorio, Pinto, and Golini (2016), only 26% were for sure still active at the time of the study (50% were unsuccessful cases, while for the remaining 24% authors faced difficulties to find information beyond the initial stages of implementation of the projects).

The main identified reason for failure is the lack of participation by carriers. As a result, distribution centers do not cover their operating costs. In other words, the economic sustainability of UCCs remains a real challenge. In practice, many projects are abandoned when initial (public) funding stops (European Commission, 2017). Indeed, private actors seem not to perceive the added value of the UCC and therefore often opt out as soon as they are expected to pay for the service. Last but not least, according to Marcucci and Danielis (2008), some UCC trials have been based on "intuition" rather than on quantified assessments. In those cases, failure is linked to the establishment of an UCC ordained by public authorities without real ex ante impact assessment study. Moreover, public authorities have sometimes introduced in parallel tax or restrictive regulations on vehicles, delivery time-windows which have probably undesired adverse effects also on the sustainability of UCCs. As frankly recognized by the European Commission (2017), "awareness of the concept of an UCC and its different potential applications needs to be increased, as there is considerable lack of knowledge and misunderstanding in both the private and public sectors at present" (p. 27).

3 Would the Promotion of Co-opetition Be a Better Alternative?

3.1 Co-opetition, Its Benefits and Drawbacks

From an economist point of view, an UCC can be explained as a form of "co-opetition".

Co-opetition theory reconciles the competitive and cooperative perspectives: co-opetition illustrates the fact that two or more competitors develop cooperation in certain areas while at the same time maintaining competition in others, with the aim of acquiring mutual benefits. The concept was generalized by Brandenburger and Nalebuff (1996). Co-opetition is supposed to be a way to work together that creates better outcomes for all. In other words, co-opetition is assumed to generate a "win-win" situation. According to Cobena, Gallego, and Casanueva (2017), alliances play a critical role in firm survival, providing access to critical resources that allow gaining and maintaining competitive advantages in current turbulent economic environment.

Over the past decades, the importance of strategic alliances has substantially increased: they have been seen as a response to the challenges of market globalization. For example, Samsung and Sony's successful collaboration in 2006 to jointly produce LCD screens, the AIM alliance between Apple, IBM, and Motorola to create new wave of microprocessors, Renault and Daimler's "strategic cooperation" in 2010, alliance between Ford and Toyota in 2013 to design a new hybrid vehicle, collaboration between Peugeot-Citroën and Toyota.

Key benefits of co-opetition include creation of synergy and acquisition of knowledge, enlargement of the economies of scale, increase in productivity, access to and pooling of scarce resources or knowledge, reduction of waste, cost and risk, development of new products and improvement of services by learning and working together.

But co-opetition also has drawbacks, which may make competitors reluctant to cooperate. Managing an alliance with ones rivals (designing the agreement in the good way) is a real challenge. Such a strategy generates risks (and costs) related to potential opportunistic behavior of partners, to technology failure, to loss of customers and market shares (who may go to the competitors), to loss of know-how and control over the image. Due to their complex nature, collaborative practices offer high potential for conflicts or disagreements.

Moreover, the risks to fall in illegal concerted practices (cartel) could deter competitors from cooperating. European competition policy rules allow entrepreneurs, including competitors, to cooperate in established and acceptable situations. However, the TFEU prohibits agreements that restrict competition. This draws a line not always perfectly clear between accepted co-opetition which is beneficial for the economy and forbidden co-opetition taking the form of anti-competitive practices, notably cartels. To be consider as legal, agreements which reduce competitive intensity, must contribute to efficiency (improving the production or distribution

of goods), promote technical or economic progress. Furthermore, they should not completely cancel any competition and consumers must sizably benefit from these efficiency improvements. In sum, to be considered as legal, co-opetition agreements must lead to a win-win-win situation (both partners and consumers get benefits from them).

3.2   The Airline Case

There is one industry, in particular, that has leveraged co-opetition into a standard business model: the airline industry. Today, the airline industry is shaped by three alliances: Star Alliance, SkyTeam, and OneWorld.

Co-opetition between airline companies is based on code-sharing agreements, allowing two or more airlines to sell the same flight using their own brand. Code-sharing agreements reduce the costs associated with operating under-booked flights while they increase the visibility of an airline that is able to boast multiple routes worldwide despite not actually operating them. Co-opetition among airlines is also a way to manage overbookings by switching travelers from one airline to another.

Note that the U.S. Department of Transportation has granted immunity from the U.S. antitrust law to airlines involved in international air transportation alliances, allowing immunized members in these alliances to collude on prices, schedules, and marketing activities without the risk to be pursued from illegal practices. This decision to grant antitrust immunity to international airline alliances was based on economics studies showing that airline alliances benefit customers, as they allow the partner airlines to market new destinations and offer lower prices (Armantier & Richard, 2006; Bilotkach, 2007). However these decisions are controversial and some recent economic studies tend to show that fares paid by passengers for non-stop transatlantic flights are significantly higher in routes with fewer independent non-stop competitors (Gillespie and Richard, 2011).

3.3   Could the Airline Example Be Extended to Urban Logistics Sector?

Even if airline and urban logistics sectors differ in many aspects, some characteristics of the airline industry making co-opetition a possible relevant strategy are observed in the logistics sector. In particular, fixed costs are high, and there are economies of scale and scope. When demand declines, logisticians cannot remove costs quickly enough or in the same proportion than the decrease in demand. Furthermore, the market is growing under the impulse of e-commerce becoming more and more competitive and regulated, due to the positive and negative externalities.

In this context, would co-opetition be a relevant strategy for urban logistics providers? Panzar and Menk (2015) examined this strategy in the case of the U.S. parcel delivery market. They showed that co-opetition leads to a "win-win-win" situation. The U.S. Postal Service benefits by earning additional revenues through the provision of last mile delivery; the private parcel carrier benefits from having a lower delivery cost; and all of this occurs without the customer having to pay a higher price. In fact, it is even possible that co-opetition leads to an overall price decrease for the final customer. This occurs because through co-opetition the U.S. Postal Service and the private parcel carrier create the most efficient end-to-end parcel delivery service. The private firm provides the most efficient mail processing and transportation, and the U.S. Postal Service provides the most efficient last-mile delivery. If efficiency gains are high enough, co-opetition can reduce the end-to-end prices for parcel customers. How the profits are split between the U.S. Postal Service and the private parcel carrier depends on the relative bargaining power of the two.

In practice, co-opetition examples in the logistics field are already observed. In the USA, both UPS and FedEx use the U.S. Postal Service to provide last mile delivery for a significant portion of their ground parcels. In London, several major parcels businesses (namely Hermes, TNT and DX) participated in the Agile Gnewt Cargo demonstration project about multi-carrier deliveries in central London using micro-consolidation centers and electric vehicles for final delivery between October 2014 and June 2015. In France, Le Groupe La Poste has built innovative logistics spaces such as an Urban Logistics Hotel (ULH) in which several competitors share the same infrastructure at different times (time-sharing mechanism) or mutualization centers in which parcel delivery operators consolidate inward and outward flows in order to optimize vehicles fulfillment[1].

3.4 Critical Factors of Success (or Failure) of Collaborative Strategies

Despite their clear benefits, co-opetition strategies and alliances between competitors exhibit, as UCCs, a very low success rate. The high failure rate highlights the difficulties of building successful alliances, mainly related to the lack of familiarity that firms have with the dynamic nature of co-opetition. Fortunately, economists have identified some general critical factors associated with success (or failure) of collaborative strategies.

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[1]For example, in Grenoble, Le Groupe La Poste is in charge of a mutualization center created in partnership with local stakeholders (EVOL project); in Bordeaux, La Poste built an ULH near from the city-center used in time-sharing way and is also currently managing a temporary "local logistic area" in a collaborative way with a local association Atelier Remuménage, aiming to facilitate the supply of the 166 merchants impacted by the construction works of the future line D of the tramway.

First, the sustainability of a cooperative strategy relies on the choice of partners. At first sight, aligned expectations and proximity in terms of entrepreneurial culture, products, organizational goals, and connections among players seem to be facilitating factors to establish a trustfully environment. This proximity could potentially reduce the risks of conflicts due to lack of cultural, strategic and structural fit among partners. On the contrary, lack of fit could arise conflicts and coordination problems and lead toward alliance failure.

However, there exists a divide among scholars about the relevant degree of similarity between the partners. Ritala (2012) states that similarities among partners help to establish a durable cooperation by "integrat(ing) and bundl(ing) similar resources in order to share risks and decrease the overlap in resource utilization for similar tasks" (p. 309). According to Russo and Cesarani (2017), firms involved in partner selection activity have to consider three fundamental criteria: partner complementarity, congruence and compatibility. Partner complementarity refers to the concept of strategic fit; partner congruence refers to partners' goals and objectives alignment (in order to achieve success, partners have to define clear and compatible goals); and partner compatibility refers to partners' cultural and organizational fit. Stadtler and Van Wassenhove (2016) have a diverging view: they think that managers should select companies with different strategic goals but competitive similarities. By competitive similarities, they mean technological expertise, geographical coverage and product/service range.

Secondly, after a potential partner has been found, the next difficulty is to define a fair distribution of both costs and profits (or net costs) among the partners. Perception of equity leads partners to remain committed for all the duration of the alliance and reduces the risk of opportunistic behavior.

As explained by Schulz and Blecken (2010), finding a fair and a win-win allocation of net gains is complicated since it is difficult to estimate the costs and benefits from the cooperation prior to the actual co-opetition (due to uncertainty). Thus as neither the benefits nor the costs for the operations are well known to partners it becomes difficult to agree on a benefits and costs sharing model beforehand. In this context, contractual provisions are useful to clarify mutual rights and duties, partners' contributions, the way through which exchanges take place and potential conflicts are solved.

Thirdly, cooperation is a relationship based on mutual trust between partners. In this regard, communication and timely, regular and accurate information sharing on the one hand, management commitment/involvement on the other hand are key factors of success to develop and maintain trust. Communication helps to manage potential conflicts, integrates potential differences and promotes coordination between different levels of hierarchy.

Without feelings of trust and commitment, partners could act opportunistically such as holding back important information or gaining unfair advantages on the others. The combination of these two relational factors helps firm to reduce the risk of opportunistic behavior, and leads partners to work together towards common objectives.

In the specific case of urban logistics and UCCs, some additional factors of success (or failure) have been identified, such as the level of demand addressed to the UCC (a sufficient product delivery volume is required to drive down the costs per unit handled), the heterogeneity of products entering into the UCC (different types of products—such as fresh food or drugs—may need different delivery schemes and specific vehicles, hindering consolidation) and its location. As emphasized by Van Rooijen and Quak (2010), a bad selection of the UCC's location (for example too far away from a highway or from the city center) may cause a failure of an UCC project. Moreover, recent experiments seem to prove that activity sector specialized UCCs (like CCC—construction consolidation center) or those offering a wider range of services (like shop storage or IT functionalities) lead to valid business models (see for instance EU projects like NOVELOG, U-TURN, CityLab).

Public sector authorities (national and local government) have a role to play to support UCCs and more generally foster cooperative schemes in urban logistics. First, they have a role to play in raising knowledge and awareness of success and failure factors amongst all stakeholders (including themselves). This may be done by developing appropriate instruments (e.g. UCC planning guidelines or tools) as well as training measures for urban freight planners. Second, they have a role of facilitator or intermediary to facilitate communications and negotiations between the different stakeholders by being involved and giving the right incentives to make UCC a success. Third, they have a business angel and trust-builder role to play: an UCC will gradually build-up as users will sign up. This gradual process reduces its short-term financial viability. During this transition (particularly during the pilot studies), public authorities should financially support the UCC. This may be done by providing temporary subsidies and by acting as a guarantor to raise initial funds and seed capital. Fourth, they have a regulatory role to play: they must coordinate and adapt the various city policies that have an impact on logistics operations such as the regulation of loading and unloading areas, parking, access to inner-city, delivery time windows, vehicles, and so on—all adapted to the needs of the different players involved in the project.

Nevertheless, past experiments prove that publicly-organized UCCs fail to succeed in many cases: public authorities often do not really know how to efficiently arrange freight distribution. In practice, the primary determinants of logistics and transport decisions are the requirements of the receivers rather than those of the public authorities. So, for UCCs to be attractive to companies and to be successful, they should be led and operated by one or several commercial players that have identified the potential benefits of being involved (BESTUFS, 2007). In syntheses, our view is that public authorities should initiate the project by motivating private partners and creating the right regulatory environment and then let private operators and the market carry it to economic success.

4   Conclusion

Citizens, consumers, local public authorities want both to preserve the urban living environment by limiting the circulation of motorized vehicles (and induced pollution), to benefit from the advantages of e-commerce and to develop attractive city centers. Facing their contradictory expectations, last-mile delivery providers are forced to rethink their processes in order to continue providing best services to their customers.

Promoting co-opetition between last-mile service providers and the use of mutualized infrastructures (buildings, vehicles, and so on) could be an efficient solution. To be successful such cooperative schemes must result from voluntary agreements between stakeholders resulting from a "meeting of minds" and not be enforced by public authorities, as a mandatory measure under the excuse of fixing the negative externalities of urban logistics by simply restricting truck movements or other kinds of ad hoc regulations.

According to the literature on co-opetition, the main success factor of UCC is the involvement of stakeholders and the definition of clear new roles for logisticians and local authorities. In particular, the latter have an active role to play: they could put in place a favorable playing field in order to induce private companies to collaborate in an efficient way. This could be done in many ways: granting them antitrust immunity as in airlines industry, thus removing one potential obstacle to success (namely the fear of prosecution for collusion), giving specific rights to operators who collectively manage an UCC (for example regarding delivery time-window or access to inner-cities) or by providing them well-placed premises where flows could be consolidated.

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Design and Enforcement of Compensation Funds After *Confetra*: A Legal and Economic Analysis

Alessandra Fratini and Marc Chovino

1 Introduction

This paper looks at the design and enforcement implications for the compensation fund in the postal sector as a result of the recent ruling of the Court of Justice ("the Court"). In *DHL Express (Austria)*,[1] the Court gave its interpretation of the scope of the obligation to contribute to the compensation fund under Article 9 of the Postal Services Directive.[2] The most recent *Confetra* case[3] confirms along the same line of reasoning that there is, in principle, nothing to prevent a Member State from making the grant of general authorizations conditional on the obligation to contribute to the compensation fund.

Under recital 27 of the Third Postal Services Directive,[4] holders of general authorizations may be requested to contribute to the fund if the services they provide under those authorizations (which '*do not . . . have to cover all the features of the*

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[1]Judgment of 16 November 2016, C-2/15, *DHL Express (Austria)*, EU:C:2016:880.

[2]Directive 97/67/EC of 15 December 1997 on common rules for the development of the internal market of Community postal services and the improvement of quality of service, OJ L 15, 21.1.1998, p. 14, as last amended by Directive 2008/6/EC of 20 February 2008 amending Directive 97/67/EC with regard to the full accomplishment of the internal market of Community postal services, OJ L 52, 27.2.2008, p. 3.

[3]Joined Cases C-259/16 and C-260/16, *Confetra and others*.

[4]Directive 2008/6/EC of the European Parliament and of the Council of 20 February 2008, OJ L 52, 27.2.2008, p. 3.

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universal service') may, from a user's perspective, be regarded as displaying '*interchangeability to a sufficient degree*' with the universal service. For the Advocate General in *Confetra*,[5] the contribution by postal service providers to the financing of universal service is intended to establish some parity between them based on the principle of solidarity. Accordingly, if users can receive the service from another provider as an alternative to that supplied by the universal service provider, the two services may be considered substitutable, which in turn "*is sufficient for it to be acceptable to require the former to contribute to the compensation fund*" (§ 83).

Moving from the above interpretation, this paper considers, from both a legal and an economic perspective, the potential for a wider recourse to the compensation fund as a mechanism for USO (Universal Service Obligations) financing in the future and a number of possible issues that could emerge in relation to State aid rules.[6]

Thus far, in fact, compensation funds have proven to be an ineffective way to compensate the USO, mainly because of the scope of the "contributors" being narrowly defined, with the universal service provider bearing the main share of the distributed USO cost through the fund. A broader notion of "postal service providers" and of the services considered interchangeable could turn the compensation fund into a more appealing financing option for Member States with public budget constraints. The reading given in *Confetra* could ultimately allow Member States to request haulers, freight forwarders, courier and parcel delivery services operators to contribute to the compensation fund, thereby potentially substantially modifying the economics of the postal and delivery sector given the size and the financing capability of these operators.

Compensation funds are particularly distortive State aid measures.[7] They have a stronger potential for competition distortion than other more classic USO compensation measures (e.g. State subsidies), because they not only benefit the incumbent but also proportionally weaken competitors. Compensation funds raise a wide variety of very specific State aid issues, which are quite unusual in a typical State aid assessment: potential discrimination claims, the recourse to market definition techniques, market sustainability considerations. These are all issues that are likely to be controversial and trigger very harsh legal battles should the above interpretation of the *Confetra* judgment be implemented.

After an overview of the obligation to contribute to the fund as interpreted by the Court (Sect. 2), the paper looks at the implications of *Confetra* on the design and

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[5]Opinion of Advocate General Campos Sànchez-Bordona delivered on 28 November 2017, EU: C:2016:880.

[6]Under Article 7(3) b of the Postal Services Directive, a compensation fund is a mechanism for the sharing of the net cost of the universal service obligations between providers of services and/or users.

[7]It follows from the case-law of the Court that Article 107(1) TFEU covers all the financial means by which the public authorities may actually support undertakings, irrespective of whether or not those means are permanent assets of the public sector; indeed, the fact that these means remain constantly under public control, and therefore available to the competent national authorities, is sufficient for them to be categorised as State resources.

enforcement of compensation fund (Sect. 3) and at the State aid assessment of a potential attempt to widen the scope of contributors (Sect. 4). Section 5 concludes.

2 The Obligation to Contribute to the Fund as Interpreted By the Court

Article 7(3) of the Postal Services Directive provides that when the universal service entails a net cost and represents an unfair burden, Member States may introduce: (1) a mechanism to compensate the universal service undertaking from public funds or (2) a compensation fund, which may be funded by service providers and/or users' fees.

According to Article 9(2), third indent of the same Directive,[8] the granting of authorizations may "... where appropriate, be subject to an obligation to make a financial contribution to the sharing mechanisms referred to in Article 7, if the provision of the universal service entails a net cost and represents an unfair burden on the universal service provider(s)". While this condition is contained in Article 9 (2), which, in its first subparagraph, refers to "*services which fall within the scope of the universal service*", it has been acknowledged by the Court in *DHL Express (Austria)* that the wording of the provision, in itself, does not actually make it possible to exclude its application to all service providers.[9]

2.1 DHL Express (Austria)

The reference for a preliminary ruling in DHL Express (Austria) concerned Article 9 (2), second subparagraph, fourth indent, on the obligation to contribute to the financing of the national regulatory authority responsible for the sector. Yet, the Court examined the meaning of the word "authorisation" in relation to all the indents in that provision and concluded that it may be inferred from Article 9(2), second

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[8] Article 9 is divided into three paragraphs: paragraph 1 states that, for services which fall outside the scope of the universal service, Member States may introduce "general authorisations"; paragraph 2, first subparagraph, provides that, for services that fall within the scope of the universal service, Member States may introduce "authorisation procedures including individual licenses" and the second subparagraph of that provision provides that the granting of "authorisations" may be made subject to compliance with various conditions, which are listed in the five separate indents within that subparagraph, including the obligation to finance a compensation fund for the discharging of USO; paragraph 3 provides that Member States shall ensure that authorization procedures be transparent, accessible, non-discriminatory, proportionate, precise and unambiguous, made public in advance and based on objective criteria.

[9] Judgement in *DHL Express (Austria)*, cit., para 19. The Court was asked to rule on the obligation of an express courier and postal undertaking to contribute to the financing of the national regulatory authority responsible for the sector, in the light of Article 9(2) of the Postal Services Directive.

subparagraph that the term 'authorisations' applies to both the "*individual licenses*" referred to in Article 9(2) and the "*general authorisations*" referred to in Article 9(1). Indeed, the provision says in general that "*the granting of authorizations may be subject*" to a set of conditions, without making express reference to Article 9(1) or to Article 9(2), first subparagraph.[10] Besides, such an interpretation seems to be confirmed by Article 9(2), third subparagraph, which states that "*obligations and requirements referred to in the first indent and in Article 3 may only be imposed on designated universal service providers*". Hence, obligations and requirements listed in the indents other than the first may be imposed on undertakings that are not the universal service providers.

When assessing the meaning of the third indent of Article 9(2), which concerns the obligation to make a financial contribution to the compensation fund, the Court argued that, as drafted, that provision "*does not expressly relate to universal service providers*".[11] It recalled that it is clear from Article 7(3) of the Directive that the establishment of such a fund is linked to the Member States' right to introduce a mechanism for the sharing of the net cost of universal service obligations, to the extent those costs represent an unfair financial burden for the actual providers. "*Above all*", it added, recital 27 of the Third Postal Services Directive explains that, in order to determine which undertakings may be required to contribute to that fund, Member States should consider whether the services provided may, from a user's perspective, be regarded as falling within the scope of the universal service.

2.2   Confetra

The Court did not develop the reasoning further because the obligation at stake was going to be interpreted in the context of another preliminary proceeding, *Confetra*.[12] The opinion of AG Campos Sanchez-Bodona builds upon *DHL Express (Austria)* and clarifies the scope of the obligation, in particular as it concerns the operators that may be called to contribute to the fund.

The Regional Administrative Court of Lazio (Italy) had asked: (1) whether the Postal Services Directive applies to the activities of haulers and express couriers and (2) whether, if that is the case, undertakings which carry out those activities have to contribute to the compensation fund (where the national provisions do not define different application modalities according to the specific situation of the operator and of the market).

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[10]Judgement, para 22.

[11]Judgement, para 25.

[12]Judgement of 31 May 2018, Joined Cases C-259/16 and C-260/16, *Confederazione Generale Italiana dei Trasporti e della Logistica (Confetra) and Others v Autorità per le Garanzie nelle Comunicazioni and Ministero dello Sviluppo Economico*, ECLI:EU:C:2018:370.

On the first question, the AG concludes that both haulers (transport undertakings) and express couriers fall within the scope of application of the Postal Services Directive if they carry out the activities of clearance, sorting, transport and distribution of postal items. 'Transport-only' services remain excluded pursuant to the first sentence of recital 17 of the Third Postal Services Directive, which states that transport alone should not be considered as a postal service, to the effect that transport unconnected with other postal activities does not fall within the scope of the Postal Services Directive.

As for 'transport undertakings', the AG moves from acknowledging the evolution of the postal services market, "*motivated primarily by the increase in e-commerce*", where traditional postal operators compete with logistics and transport undertakings, whose customers "*no longer simply demand traditional carriage-of-goods services (from factories to shopping centres) but also the distribution of individual parcels*".[13] According to the AG, while not completely falling within the definition of postal operators, these "*new types of undertaking*" offer similar services to be considered as 'substitutes'.[14] In these circumstances, the ancillary nature of the activities of clearance and distribution of postal items, relied upon by the transport undertakings to exclude their activities from the application of the Directive, is not relevant for the purpose of determining whether the latter is applicable or not: in the AG's opinion. What matters with regard to the Directive is not the proportion of 'ancillary' services *vis-à-vis* transport services—which incidentally would create difficulties of interpretation, as it would require a case-by-case assessment—but the objective "*and easily verifiable*" fact that an operator provides clearance and distribution of postal items in addition to transport in the context of the definition of postal services. That interpretation is also confirmed by the proposed Regulation on cross-border parcel delivery services[15] whose recital 8 clarifies that "*in line with current practice and Directive [97/67], each step in the postal chain, i.e. clearance, sorting and delivery, should be considered parcel delivery services*" and that "*transport alone that is not undertaken in conjunction with one of those steps should fall outside the scope of parcel delivery services as it can in this case be assumed that this activity is part of the transport sector*".

As regards providers of express mail services, the position of the AG is even more clear-cut: he concedes that express mail differs—"*in some instances, significantly*"—from the postal service covering items of correspondence, yet he maintains that "[i]*t is a genuine segment of the postal market, characterised by its premium services which are paid for accordingly by customers*", the core of its activity remaining one of the instruments for communication and information exchange

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[13]Opinion, para 39.

[14]On this point, see Commission Staff Working Document, (SWD(2015) 207 final of 17 November 2015)—accompanying the document—Report from the Commission to the European Parliament and the Council on the application of the Postal Services Directive, COM(2015) 568 final, p. 66.

[15]Regulation (EU) 2018/644 of the European Parliament and of the Council of 18 April 2018 on cross-border parcel delivery services, OJ L 112, 2.5.2018, p. 19.

that characterize postal services.[16] The Court itself has treated these providers as postal service operators "*on at least 'four' occasions*". It has: (1) classified those services as 'specific' services in *Corbeau*[17]; (2) held that the requirement for an external procedure for dealing with complaints as provided for in Article 19 of the Postal Services Directive was applicable to providers of express mail service in *DHL International*[18]; (3) interpreted Article 9(2) as meaning that a national law may impose on such companies the obligation to finance the regulatory authority responsible for the postal sector as other postal operators in *DHL Express (Austria)*[19]; and (4) declared that the provision of such services may be made subject to the issuing of a general authorization, in *Ilves Jakelu*.[20]

On the second question, whether the said undertakings may be called to contribute to the compensation fund, the AG recalls what the Court held in *DHL Express (Austria)* and confirms that "*there is, in principle, nothing to prevent the Member States from making the grant of general authorisations conditional on the obligation to contribute to the compensation fund*".[21] In his view, the contribution into such fund is aimed at establishing some parity between providers, by requiring those "*who do not incur the same costs as operators entrusted with the universal service to pay into that fund and contribute to the financing of certain obligations based on the principle of solidarity*".[22]

Recital 27 of the Third Postal Services Directive, which "*[n]aturally*" includes operators holding general authorizations, explains that to be called to contribute to the fund, "*it suffices*" that the postal services provided under those authorizations—which "*do not . . . have to cover all the features of the universal service*"—may, from a user's perspective, be regarded as displaying inter-changeability to a sufficient degree.[23] The notion of interchangeability is described as follows by the AG: if users can receive a service from a postal undertaking (such as a hauler or an express courier) as an alternative to that supplied by the universal service provider, then it could be inferred that the services concerned are "*substitutable*". That is sufficient for it to be acceptable to require the provider to contribute to the compensation fund.

To conclude, it emerges from current developments of case-law that both transport undertakings (save those that only provide "transport-only" services) and express couriers may be called to contribute to the financing of the compensation fund, this to the extent that they provide services substitutable to the services falling within the universal service.

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[16]Opinion, para 47.

[17]Judgment of 19 May 1993, C-320/91, *Corbeau*, EU:C:1993:198, para 19.

[18]Judgment of 13 October 2011, C-148/10, *DHL International*, EU:C:2011:654, para 30 and 52.

[19]Judgment of 16 November 2016, C-2/15, *DHL Express (Austria)*, cit.

[20]Judgment of 15 June 2017, C-368/15, *Ilves Jakelu*, EU:C:2017:462, para 29.

[21]Opinion, para 80.

[22]*Ibidem*, para 81.

[23]*Ibidem*, para 82.

3 The Implications of *Confetra* on the Design and Enforcement of Compensation Fund

Provided that it is confirmed by the Court, the interpretation of the obligation to contribute to the compensation fund given by AG in *Confetra* could turn the latter into a more appealing financing option for Member States with public budget constraints.

Thus far in fact, while most national postal laws contain provisions for the establishment of the compensation fund, the actual activation of this measure has remained limited to a very few cases, where in any case the fund proved to be a quite ineffective way to compensate the USO, mainly because of the scope of the "contributors" being narrowly defined, with the universal service provider holding the main share of that scope. The reading given in *Confetra* could ultimately allow Member States to request haulers, freight forwarders, courier and parcel delivery services operators to contribute to the compensation fund, thereby potentially modifying the economics of the postal and delivery sector and in particular the economic relevance of the compensation fund mechanism.

For the purposes of the compensation fund in Poland, for example, under Article 3(30) of the Polish Postal Law, "*services comprising universal postal services*" include "*letter items and postal parcels with weight and dimensions defined for universal services and items for the blind, not provided by the operator designated to provide universal services subject to the obligation to provide universal services*".[24] It is made clear, however, that inter-changeable services do not comprise postal services consisting in the clearance, sorting, transport and delivery of courier items. In other words, the interchangeability of postal services concerning courier items is excluded at the outset. In *Confetra* the AG admits instead that, in principle, both transport undertakings and express couriers can provide services substitutable ("*an alternative*") to the universal services. However, he gives no further guidance on determining interchangeability of services for the purpose of the obligation under Article 9(2), forth indent, of the Postal Services Directive. The above mentioned recital 27 makes it clear that, unlike the substitutability notion in the context of market definition in competition law,[25] which requires an assessment of both the demand and the supply side of the market, the interchangeability with the universal service shall be assessed "*from a user's perspective*", i.e. on the demand side alone. Such assessment, recital 27 adds, shall take "*into account the characteristics of the services, including added value features, as well as the intended use and the pricing. These services do not necessarily have to cover all the features of the universal service, such as daily delivery or complete national coverage*".

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[24]Commission decision SA.38869 of 26.11.2015, *Compensation of Poczta Polska for the net cost of USO 2013–2015,* para 10. The decision has been challenged before the General Court (see cases T-282/16, *Inpost Paczkomaty v Commission* and T-283/16, *Inpost v Commission*, still pending).

[25]See Commission notice on the definition of relevant market for the purposes of Community competition law, OJ C 372 of 9.12.1997, p. 5.

The absence of a detailed methodology for the interchangeability exercise in the context of the Postal Services Directive leaves room for diverging interpretations that affect the scope and range of the potential contributors to the fund. That raises specific issues not only for the design, but also for the enforcement under State aid law of the compensation fund.

4 State Aid Assessment of a Potential Attempt to Widen the Scope of Contributors to Compensation Fund

In the hypothetical event that a Member State decided on the basis of an encouraging outcome of the *Confetra* judgment, to request different market operators such as hauliers, freight forwarders, courier, parcel delivery services operators and possibly others (referred in the following as "the new contributors") to contribute to the compensation fund, the measure would probably have to be subject to a State aid assessment in a very litigious context. The purpose in the following is not to try to determine what the conclusion of such potential assessment could be but rather to identify some of the key issues that could emerge.

The typical State aid assessment comprises two steps: (1) the verification of the existence of the aid; and (2) the assessment of compatibility of the aid if aid is present.

4.1 Existence of Aid

As for the first step (existence of aid), in general one has to recognize that USO compensations are State aid. This is notably the case because the conditions established in the so-called *Altmark* jurisprudence[26] and in particular the fourth *Altmark* criterion is generally not fulfilled. Namely, Member States do not generally

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[26]Judgement of 24 July 2003, C-280/00, *Altmark Trans GmbH and Regierungspräsidium Magdeburg v Nahverkehrsgesellschaft Altmark GmbH,* EU:C:2003:415 established the following conditions for a public service compensation to escape an aid qualification:

a. *'(...) First, the recipient undertaking must actually have public service obligations to discharge and those obligations must be clearly defined (...).*

b. *(...) Second, the parameters on the basis of which the compensation is calculated must be established in advance in an objective and transparent manner (...).*

c. *(...) Third, the compensation cannot exceed what is necessary to cover all or part of the costs incurred in the discharge of the public services obligation, taking into account the relevant receipts and a reasonable profit (...).*

d. *(...) Fourth, where the undertaking which is to discharge public service obligations, in a specific case, is not chosen pursuant a public procurement procedure, which would allow for the selection of the tenderer capable of providing those services at the least cost to the community, the level of compensation needed must be determined on the basis of an analysis of the costs, which a*

award the USO through tenders and compensations are generally tailored to the needs of the US provider and not calculated on the basis of efficient costs which would also not be easy to determine.

In a context where it may become possible to have the USO significantly—or possibly totally—financed by market operators (instead of State budget), there could be however a renewed interest from Member States to try to comply with the *Altmark* criteria and thereby avoid a State aid situation. The most natural way to achieve this would be to tender out parts or all of the USO. The context of such tendering would also become more favorable. Given that they would anyway have to contribute to the financing of the USO, the new contributors, which may include very large operators, would have a strong incentive to bid to deliver the USO instead of merely financing it. This would be particularly true if the new contributor would consider being more efficient than its competitors (e.g. the national historic operator): indeed it would then have the possibility to receive an appropriate remuneration for the delivery of the USO instead of paying comparably more for a less efficient delivery of the same service by another operator.

The general idea would be in this context that the USO (or parts of it) would be attributed to the operator which requests the lowest compensation, such compensation being in turn financed in all or in part by contributions from its competitors.

The extension of the scope of contributors could therefore help in adopting a much more market oriented design of the USO, which could possibly be State aid free.

4.2 Compatibility of Aid

As to the second step (compatibility of aid), the most complex situation would arise however if the Member State extends the scope of contributions to new contributors while directly designating the USO provider without a public procurement procedure, as this has been the case in nearly all Member States so far. In such case, the measure would in principle constitute State aid and would be assessed under the SGEI rules (i.e. the 2012 SGEI Decision[27] or 2012 SGEI Framework[28]).

Such assessment comprises parts which are not directly related to the issue at hand. In relation to compensation funds, two steps would be significant: (1) verification of the modalities of determination of the USO net cost and of the maximal

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typical undertaking, well-run and adequately provided within the same sector would incur, taking into account the receipts and a reasonable profit from discharging the obligations.'

[27]Commission Decision of 20 December 2011 on the application of Article 106(2) TFEU on State aid in the form of public service compensation granted to certain undertakings entrusted with the operation of SGEI, OJ L 7, 11.1.2012, p. 3.

[28]Communication from the Commission: European Framework for State aid in the form of public service compensation, OJ C 8 of 11.1.2012, p. 15.

possible amount of compensation; and (2) verification of the modalities of determination of contributions.

The calculation of the net cost of the USO at least in principle is not directly related to the issue of the range of contributors to the compensation fund. The net cost of the USO is to be calculated with the so called Net Avoided Cost ("NAC") methodology, as prescribed by the Postal Services Directive and the SGEI Framework, which consists in a theoretical comparison between the profit of the US provider in a factual scenario where it delivers the USO and a counterfactual scenario where it does not have this obligation.

Such calculation is generally made by the USO provider, subject to the control of the national regulatory authority, and it serves as a basis for the calculation of the amount that can be compensated. It can be expected that the calculation in itself would be subject to much greater transparency requirements, scrutiny and challenges in the presence of a wider range of potential contributors. A specific aspect of the calculation, which would come in particular under great scrutiny, is the potential responses of the market to the counterfactual scenario considered by the USO provider.

Indeed, to the extent that the extension of the scope would be an acknowledgment of a significant degree of inter-substitutability between products and services of the USO provider and of other providers, it would have to be accepted at the same time that such link could potentially influence significantly certain assumptions of the counterfactual scenario, which could in turn impact the profit of the USO provider in such counterfactual scenario and thereby the NAC. The fact that the competitors in question would be much larger in size and possess significant means in general would also allow them to design sophisticated responses to the alternative business strategies that could be announced by the USO provider. The possibility of the USO provider to increase prices could for example be heavily disputed on the ground that competitors could undercut the USO provider in many circumstances. An even more difficult aspect is the possibility that the discontinuation of certain products/services by the USO provider could result in increased revenues for the new contributors, which could capture part of the unserved demand (see discussion on discrimination below).

Regarding the determination of contributions, it can be seen in the decisional practice of the European Commission that obviously non-transparent, discriminatory or disproportionate systems of contributions would not be approved under State aid law.[29]

Each of these criteria (transparency, non-discrimination, proportionality), in the presence of an extension of the scope of contributors to the compensation fund would certainly require a specific assessment.

The criterion of proportionality would probably be easier to fulfill with the presence of more and much larger contributors. Indeed, given that a larger base

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[29]Commission Decision of 1 August 2014 in Case SA.35608 (2014/C) implemented by Greece in favour of Hellenic Post (ELTA), OJ C 348 of 3.10.2014, p. 48.

would be called to finance the USO, it can be expected that the individual contributions would be proportionally smaller, to the extent that it could be potentially envisaged to finance the whole USO without State intervention. The main concern expressed by the Commission in its decisions in this respect was to ensure that the contributions remained sustainable for the market (which for example was considered not to be the case in the Greek case with a 10% contribution on turnover, while it was deemed acceptable a 2% contribution in the Polish case) and would not result *de facto* in a re-monopolization of the extended USO area (composed of USO and all substitutable products/services). That concern would certainly be less of an issue in the presence of an enlarged scope for contribution.

The issue of non-discrimination on the other hand would certainly become central. Discrimination claims could be raised in several respects:

(a) Claims could be made by new contributors that their products/services are wrongly included in the basket of contributing products/services, while they should not;
(b) Claims could be made by new contributors that some products/services that should be included are not, which tend to inflate their own contribution;
(c) Claims could be made by new contributors that the calculation of contributions, even if purely proportional, is discriminatory precisely because it wrongly requests a similar contribution from products/services which should not contribute in a similar fashion;
(d) Alternatively, any system which would entail different contribution rates for different operators would certainly be claimed to be discriminatory by essence.

Trying to address (a) and (b) would call for some sort of market definition assessment. It can be noted in this respect the jurisprudence of the Court shows that market definition is not a necessary pre-requisite for establishing that a given measure constitutes State aid under Article 107(1) TFEU.[30] Nevertheless, when addressing the compatibility of a given State aid, the Commission must put the analysis of the effects in a general EU context.[31]

There is an established practice in the definition of the relevant market for the purposes of EU competition law[32] in the fields of antitrust and merger control. There

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[30]See notably Judgment of 11 July 2002, T-152/99, *Hijos de Andrés Molina, SA (HAMSA) v Commission of the European Communities*, ECLI:EU:T:2002:188, para. 223.

[31]See notably Judgment of 17 September 1980, Case 730/79, *Philip Morris Holland BV v Commission of the European Communities*-, para. 24; Judgment of 28 February 2002, T-155/98, *Société internationale de diffusion et d'édition (SIDE) v Commission of the European Communities,* ECLI:EU:T:2002:53, para. 71: "the Commission should have examined the effects of the contested aid on competition and trade between the other operators carrying on the same activity as that for which the aid was granted, in this case the handling of small orders of French-language books. In selecting the export market for French-language books in general as the reference market, the Commission was unable to assess the true impact of the aid on competition. Accordingly, the Commission committed a manifest error of assessment as regards the definition of the market.{_}".

[32]Commission Notice on the definition of relevant market for the purposes of Community competition law, cit.

are, however, noticeable differences between State aid control and antitrust. The most relevant for our discussion is that the latter focuses primarily on market power and its impact on competition. State aid is instead primarily motivated by the objective to address a market failure or equity concerns: market effects are ancillary to that main concern. State aid analysis thus requires tracing the effects of the aid across Member States, irrespective of whether market power is an issue.

The issue regarding contributions to a compensation fund is, however, very specific in the sense that the rationale of the contribution is that the contributing product/service captures a part of USO revenues (generally the less costly part), while not contributing to the financing of its most costly parts in a context of liberalization of the postal market. The issue there is related neither to the question of market power nor to the effect of aid but merely to the potential cannibalization of USO products/services by other services. This may authorize a specific approach in this case focusing only on the demand side. Nonetheless, it may seem coherent to rely on established qualitative (questionnaires, surveys, etc.) and quantitative (hypothetical monopolist test, price correlations, demand estimations, etc.) techniques to approach that issue.

(c) and (d) above refer instead to the precise system of determination of compensations.

The simplest way to proceed which has been considered by most Member States is to calculate a contribution rate which is the ratio of the net cost of the USO and the turnover of contributors made from USO (only for the USO provider) and substitutable products (for other operators), a cap being often considered to avoid disproportionate contributions which, as explained above, would be less likely to be an issue.

However, this approach could lead to a situation where, although the overlap/substitutability between the USO services and the services of new contributors is rather limited (e.g. mostly limited to parcels), the new contributors would be called to contribute very significantly to the USO because of their very large turnover with these products/services. By putting possibly a disproportionate weight on new contributors in light of the rationale of the contribution, it could be argued that the choice of a proportionate contribution is discriminatory.

At the same time, trying to design a contribution system which caters for the differences in degree of substitutability may not be easy. It may be considered whether a sub area of the USO should be considered covering the products/services which are really substitutable with the products/services of new contributors (e.g. parcel services) and whether the new contributors should be called to finance only this area. Such an approach would probably limit considerably the economic impact of involving new contributors. Indeed, if only parcels are considered for example, contributions would only be necessary if and to the extent they are included in the scope of the USO (which is not systematically the case) and to the extent that there is an associated net cost which again is not obvious as parcel delivery is a profitable business and normally the USO losses rather relate to the distribution of letters.

Another complexity could emerge if, under the counterfactual scenario, new contributors would argue that they would also have greater revenues. This is particularly relevant when the USO provider delivers a product/service under the USO that it would merely discontinue in the counterfactual scenario. Part of the unaddressed demand could then go to other products/services of the USO provider but to competitors as well. The question could then emerge as to whether the theoretical loss in revenues of the new contributors should not also be considered as a form of contribution in kind to the USO and thereby reduce their contribution in cash.

This particular situation can be illustrated by the following example. Let's suppose for the sake of the example that there is only one competitor (C) of the US provider (USP). C has 25% of the relevant market (USO + substitutable products) and the USO net cost is financed by the compensation fund meaning that 75% is financed by USP and 25% by C. Let's then also suppose that USP is delivering a particular service (S) within the USO at a relatively low price in comparison to its cost, which generates a loss of 100 for USP. USP declares that it would discontinue that service absent the USO (and the corresponding compensation) because it cannot provide S in a profitable manner (i.e. its cost for delivering S is too high in comparison of the price consumers are ready to pay for that service).

The NAC of S would then equate the loss that would be saved by USP absent S so 100. This NAC should in turn normally be partially financed by C, which would have to pay 25 to the compensation fund. The difficulty arises if C can credibly argue that because it is more efficient than USP, it could profitably deliver S at a price which, albeit greater than the subsidized USO price, would still be interesting for consumers and that it could make a profit (e.g. of 5) by delivering S if USP stops doing it. In such case, C could argue that it is also suffers a loss with the delivery of S within the USO by USP, namely the 5 profit that it would make if USP stopped delivering S. The competitor could then claim that the request of a contribution of 25, to finance the 100 loss by USP, is unfair and that its own loss should also be taken into account, thus reducing its contribution to 25 − 5 = 20.

This example although very simplified illustrates the type of complex discussions that could arise in this context.

5   Conclusions

The recent case-law of the Court this far paves the way, in principle, for a wider recourse in the future to the compensation fund as a mechanism for USO financing probably involving a much wider range of contributors. This could be an opportunity to reduce the burden on the State budget notably if the choice is accompanied by a virtuous practice to tender out part or all of the USO.

However, an attempt to use such a potential extension to simply increase support to national historic operators from competitors in the usual framework where the USO is directly attributed would certainly raise very significant difficulties and

challenges for Members States, the USO providers and "new contributors" alike. This could also foster complex and unpredictable State aid analysis that could in the end frustrate the push toward a wider use of the compensation fund as a tool.

Is the Compensation Fund an Appropriate Tool for Financing Universal Postal Service Obligations?

Vincenzo Visco-Comandini

1 Introduction

This chapter analyzes pros and cons of the compensation fund (CF) in the postal industry, envisaged in the European directive 6/2008 at whereas clauses 26, 27 and 28, and articles 4 and 5. The CF is an alternative to a state subsidy for financing the net cost of universal service obligations (USO) faced by the Universal Service Provider (USP). While the state subsidy is financed by all taxpayers, a CF is a tax charged only to competitors for sharing USO costs. Being a state aid measure, it requires ex ante scrutiny by the European Commission (Fratini, 2016). Although included in some Member States' legislation, currently a CF has been fully implemented only in Poland.[1]

Section 2 analyzes the CF under normative principles applying to any designated use tax: (1) the benefit principle, requiring taxpayers and beneficiaries to be closely set; (2) solidarity, calling for sharing unfair USO costs among participants of an industry; (3) the value of a competitive playing level field, i.e. the tax structure should not affect provider's relative marginal costs. The discussion of these principles does not question the social merits of the USO, but only the consequences arising when their economic burden is shifted from general taxpayers to the USP's competitors.

The analysis contained in this paper reflects the views of the author only.

[1]In some member States the CF has been partially adopted according to prior legislations, as in Italy where competitors providing USO services are legally charged a 3% tax on their affected revenues. To avoid the tax, competitors labeled their products as non-USO, thus making the Italian CF in practice empty.

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Section 3 discusses the pros and cons of a large versus a restricted CF's tax base and its rates, showing that the chosen range depends on the balancing of these principles, especially with regard to multisided e-commerce parcel markets. Section 4 examines the European Commission's decision authorizing the fund in Poland. Section 5 provides a positive explanation for why governments, regulators and USPs would enact a CF. Section 6 concludes.

2   Principles and Aims of the Compensation Fund

In Europe, the idea of a CF in the postal sector was introduced following prior experiences in telecommunications (TLC), where a CF was used to finance landline connection and public fixed telephone services (Eccles, 2011). In TLC the CF, being small in size, did not significantly affect competitor's profit or behavior.[2] However, in postal services USO net costs are increasing, because of e-substitution, and significant, since they include a broader range of obligations, notably USO deliveries in unprofitable areas, unprofitable post offices (PO), and in some countries as Italy, unprofitable USO priority mail services.[3] Therefore, the potential postal CF is expected to increase as well.

Unlike TLC, an access charge for delivery cannot be used to support the USO, because this sector faces peculiar characteristics as full free delivery for recipients[4] and possible bypass of USP's delivery network. Proposals for its introduction in postal services has proven to be ineffective, since it negatively affects strong network externalities and service ubiquity (Jaag & Trinkner, 2008; Visco-Comandini, Lintell, Gori, Pierleoni, & Tisdahl, 2009).

2.1   The Benefit Principle

The benefit principle was originally defined by Wicksell (1896) and Lindahl (1919), and further developed by Samuelson (1954) and Musgrave & Musgrave (1973). It holds that a tax used to cover a public expenditure should charge as much as possible to their beneficiaries, i.e. the closer taxpayers and users, the better. The reason behind this principle is that charges imposed to beneficiaries may mimic the market price for service provided. Its application to postal services relates to the CF's tax base

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[2]In France, USO cost in TLC represents 0.26% of USP's revenues (Boldron, Borsenberger, et al., 2009).

[3]In some countries as Italy, unprofitable mail delivery already accounts for nearly 24% of total population (Poste Italiane, 2018).

[4]Also, in TLC the calling party pays for the service, but its cost is partially recovered by the access charge imposed on receivers for being connected to the network.

definition, not to its otherwise equally important tax structure (discussed at Sect. 3). Economists have generally not been attracted to the benefit approach to taxation because of the impossibility to identify the breadth of the benefits received by different individuals (Stiglitz, 1999).

However, unlike other public goods, in postal services both USO's beneficiaries and related benefits can be identified: (1) general users accessing ubiquitous services at affordable prices; (2) the USP exploiting both scale and network economies; (3) the government reaching all citizens at their premises and, in some countries, collecting customer's savings for public infrastructure investments; (4) local rural communities, for which PO represents an institution that "binds the nation together"[5]; (5) competitors accessing the USP's postal network for their business. This is why uncovered postal USO net costs are currently mainly financed through a state subsidy. Public funding almost respects the benefit principle, because large areas of beneficiaries and taxpayers can be considered as largely overlapping.

On the other hand, a CF contradicts the benefit principle since USO benefit and taxpayer's areas hardly overlap. In fact under the CF only competitors and their customers pay the tax, while the other beneficiaries (excluding general users) do not pay, and in some cases fully free-ride for the benefits received.[6] Oxera (2007) originally proposed to include into the CF's tax base only competitors using the USP's network for their business. This proposal would match taxpayer and user's areas. Unfortunately, the directive in defining the rules for identifying CF's contributors goes beyond this strict and unambiguous definition, since it includes also non-USO services whose providers don't use the USP's network. In politics, implicit cross-subsidies arising from taxes are common, and the democratic process is asked to balance different interests by minimizing unfair distortions. However, the CF is not only a tax, but also a measure aimed at internalizing both USO's unfair burden and benefits within an industry.

2.2 The Solidarity Principle

A legal justification of the CF was recently stated by ECJ's Advocate General M. Campos Sánchez-Bordona at para. 7 of his conclusions of the unified case *Confetra vs Autorità per le Garanzie nelle Comunicazioni*:

> The contributions by postal service providers to the financing of the universal service is intended to establish some parity between them, by requiring new entrants who do not incur

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[5]All over the world, every time the USP closes some deep loss-making PO, local politicians react negatively. The CF would shift its economic burden to competitors.

[6]The directive by defining the procedure for calculating the net USO cost includes USP's benefits to deduct, but not those enjoyed by third parties. Regulators generally tend to underestimate these benefits.

the same costs as operators entrusted with the universal service to pay into that fund and contribute to the financing of certain obligations based on the principle of solidarity.[7]

It is unclear what exactly this principle means, but we may presume that the stated solidarity character of the CF is considered as equivalent to the notions of fairness and social equity in the economic literature (Fehr & Schmidt, 2006). However, in postal services equity considerations depend on the USO content and extent, and not on its funding mechanism (Oxera, 2007). Calling for solidarity implies the USP and competitors constitute a whole, where both costs and benefits are fairly shared. If this were the case, an appropriate Ramsey tax structure based on a surcharge on each product proportional to the reciprocal of its demand elasticity would make the CF socially efficient.

This implies a definition of a postal industry where products and services provided are slightly homogeneous and USO benefits are equally spread across participants. Unfortunately, this is untrue with respect to either a single postal market or across countries. In countries where chances of a CF's adoption are significant, competitors vigorously fight against it not only because of additional costs, but also because they don't see any benefit arising from it. France, the Netherlands, Sweden, Denmark and Finland all exclude express courier industry from the postal sector, but not the other member States. With regard to parcels, some countries, as Germany, the Netherlands, Sweden, Denmark, Finland, France, include in the USO only items collected at counter, while in others, as Austria, Italy or Slovenia, some business mail and parcel products are included in the USO area. This implies that a same competitor's product may be found as interchangeable with USO products in some countries but not in others regardless of user's perspective, i.e. the only criterion defined by the directive for identifying a CFs' contributors.

Moreover, the evident endogeneity of the interchangeability test with regulation may leave room to strategic behavior by both the USP and competitors. A USP may try enlarge the USO area to have more competitors eligible to contribute to the CF, while competitors would try exclude their products from the CF. For lowering opportunism—the opposite of solidarity—harmonization across Europe aimed at setting USO to an optimal point were single user's benefits are maximized and competition is not distorted would be desirable. As Member States have the exclusive authority to define the USO area, this possibility is very unlikely. In any event, solidarity in practice is not a useful concept, since sharing costs but not benefits is unfair and, for a use tax, efficiency matters, not equity relating to USO content only.

2.3   The Level Competitive Playing Field

In liberalized postal markets, the CF requires balancing two potentially conflicting objectives of fully compensating the USP and ensuring a competitively neutral

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[7]Cases C-259/16 and C-260/16, 28 November 2017.

playing field, in particular by not deterring efficient market entry (Boldron, Borsenberger, Joram, Lécou, & Roy, 2009; Oxera, 2007) or harming competitors already in the market (Gautier & Wauthy, 2012). One problem of the CF relates to the amount of USO costs to compensate, since it includes not only USP's losses due to competitor's cream skimming, but also other components (see Sect. 2.1) contributors have nothing to do with. Were these components absent, applied tax rates would be lower and perhaps affordable with respect to those needed to finance present total USO costs. France has wisely chosen to exclude unprofitable POs from the USO net cost.[8]

A second problem arises when considering tax rates applied to competitor's products, often with different profitability. The Ramsey rule may be difficult to implement correctly in practice, since it requires the availability of data that, in many cases, may be held providers as commercially sensitive. Moreover, regulators adopting a CF may prefer, for sake of simplicity, a uniform tax rate on a competitor's affected revenues.[9] Ideally, a CF should employ a second-best specific tax rate for each affected group of products, but relevant data on cross-elasticities will be unavailable.

If neither Ramsey tax nor its second best applies, market entry and exit may be distorted. A uniform tax rate on competitors' total profits or turnover on a uniform percentage basis may push out of the market competitors supplying services with low margin and uncertain perspectives.[10] This precisely happened in Poland.

A socially efficient CF is hard to implement for two additional reasons. First, it increases competitor's transaction costs by the obligation to set separate cost and revenue accounts for each product. Second, it requires the regulator to perform the nearly impossible task of setting a market neutral threshold excluding small competitors (see Sect. 5). Therefore, a CF is superior to a state subsidy only if social benefits from a cut in public expenditure exceed competitive distortions that may arise within the postal industry.

3 Defining Tax Base and Tax Rate of a Compensation Fund

3.1 Interchangeability

The European directive at whereas 27 states that the tax base of the CF should include both USO and non-USO postal products showing strong evidences of

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[8]La Poste receives a separate state subsidy for its post offices network, financed under the *aménagement du territoire* program.

[9]This is the chosen parameter uniformly adopted across member State's legislation including the CF as an option.

[10]Bring City Mail, the main USP's competitor in Sweden, became slightly profitable after more than 15 years from its market entry. Nexive, Poste Italiane's main competitor in Italy, after getting nearly 15–20% market share in business letter, today faces significant losses.

interchangeability, evaluated from the customers' perspective (Eccles, 2011). This exercise is very hard to perform correctly, since market structure and the effective cost of USOs are endogenous to regulation and funding mechanisms (Armstrong, 2008; Boldron, Borsenberger, et al., 2009; Boldron, Cremer, De Donder, Joram, & Roy, 2009; Gautier & Wauthy, 2012; Jaag, 2013).

Copenhagen Economics (2015) investigated methods for ascertaining these interchangeability conditions. Its study suggested adopting the SSNIP test,[11] observing that interchangeability need not be symmetrical between USO and non-USO products, but only when the increased demand for the latter reduces demand for the former. Copenhagen Economics warned against improper causal relations in evaluating interchangeability between two products, for example, inferring a direct link when they are found to be interchangeable with only a third product.

Another problem of interchangeability arises if the USO area is lately enlarged by a National legislation or regulator's decision.[12] The new authorized USO product may take revenues from non-USO existing services, but not necessarily the reverse. Although new products are always beneficial for customers, enlargement of the USO area combined with a CF can generate a wrong incentive for the USP. It may be tempted to launch new value-added USO products with the aim to make competitor's non-USO products interchangeable, thus subjecting their revenues to the CF.

Price is certainly a key but not exclusive parameter for evaluating interchangeability conditions. As observed by Brennan and Crew (2014) USO and non-USO products may be either gross or marginal substitutes. The former kind of substitution arises when non-USO products directly reduce USO product demand, the latter depends only on relative prices. For marginal substitutes, USO price regulation, in particular upper and lower price floors, will affect interchangeability.

The main challenge for detecting interchangeability conditions arises in the growing market for e-commerce postal products, especially in small packages services weighting up to 31.5 kg (European Commission, 2013). Presently, non-USO providers overwhelmingly supply the delivery of e-commerce products, but USPs increasingly provide some segments (basically for low value items) very closely priced with non-USO deferred B2C shipments. To evaluate interchangeability requires a combination of several characteristics: (1) C2C vs. B2B or B2C; (2) express (next-day) vs. deferred services; (3) International vs. domestic services;

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[11]The Hypothetical Monopolist or Small but Significant Non-transitory Increase in Prices (SSNIP) test usually defines the relevant market by determining whether a given increase in product prices would be profitable for a monopolist in the candidate market. For assessing interchangeability in postal services, it investigates whether a permanent price increase of 5–10% on a given USO product would trigger demand side substitution to a non-USO product sufficient to make the price increase unprofitable (Copenhagen Economics, 2015, Chapter "Inducing Optimal Quality Under Price Caps: Why, How, and Whether").

[12]An example of USO enlargement is the new USO priority mail product Posta 1 PRO (business mail) launched in 2016 by Poste Italiane, provided with a "light" proof of delivery. Before its launch, proof of delivery, a typical value-added feature, was considered by both *ex post* and *ex ante* regulators the yardstick for distinguishing non-USO from USO products (European Commission, 2000).

(4) basic vs. enhanced track and tracing; (5) guarantee of delivery, including reimbursement in case of failure or delays of promised performance; (6) market prices, to be separately assessed whether they are listed or bargained.

In e-commerce postal services, there are doubts that a direct demand analysis based only on publicly available prices will correctly identify interchangeability conditions, since e-commerce is a multisided market (Jaag & Trinkner, 2008; Boldron, Cremer, et al., 2009; Visco-Comandini, 2014). The e-commerce market can be three or four sided.[13] In this market the platform sets prices according to the strength of network externalities flowing between sides. The first problem is to identify users, since they could be either final customers, the platform or the seller. In e-commerce, only in some cases final customers choose their preferred postal delivery options. In most cases the platform makes this choice instead, including free delivery or an annual charge regardless of the number of shipments (as *Amazon's Prime*). Several fallacies arise from using one-sided logic in two-sided markets, the most important being marginal cost pricing that in multisided market rarely applies (Wright, 2004). Therefore, it would be erroneous to measure interchangeability between pair of postal e-commerce products as if the choice about delivery was always up to final customers.

Interchangeability analysis is slightly different from the usual relevant market definition exercise, where supply and technology/innovation also matter. In some cases, the interchangeability test based on consumer's choices without investigating supply becomes meaningless, as for consolidators, whose business model is entirely dependent on USO services. Postal users overwhelmingly ignore even their existence. Here the substitution relates to supply, not to demand, because the same items sent by small SME are consolidated and injected in the postal pipeline for getting quantity discounts.

When drawing the third directive, European legislators had in mind the traditional mail definition of postal services. A postal service arises when an item is created and inserted into a single, clearly defined value chain. Unfortunately, in e-commerce the value chain is more complicated, being logistics often performed by non-postal operators and delivery at final customer's premises only one option, the others being delivery to a shop or to Automated Parcel Lockers and in the near future also by drones or robots. By applying the CF to e-commerce is quite impossible to unambiguously identify the starting point of the postal component for attributing its related revenues to USO, non-USO or non-postal providers. If the destination address is a shop, the service cannot be distinguished from non-USO B2B services. But also in case of delivery to the customer's address the attribution may be uncertain, since nowadays the USP may designate its non-USO subsidiary for delivering USO parcels. The present directive's definition of users is ambiguous and not appropriate for an industry where different segments of the value chain as for

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[13]It is three-sided if the platform directly sells items to customers, four-sided if the platform acts as intermediary between sellers and customers.

many digital markets (Varian, 2010) are continuously combined and recombined. It's update would be desirable for promoting e-commerce.

These circumstances raise an important question for regulators: which of the two options should be implemented, a pure market analysis based on user's preferences (as stated by the directive) or a market analysis affected by present or ongoing USO regulations? The conflict at the moment appears difficult to reconcile.

3.2 The Width of the Tax Base

In defining a non-distortive tax base for the CF, a certain number of questions arise. The directive at whereas 17 excludes from the CF firms providing only transport services, but if they also perform sorting or logistics, they become eligible to pay into the CF. This exemption is socially inefficient, since it distorts the market by favoring disintermediation of the value chain vis-à-vis its vertical integration. Let's consider the following example. Two firms A and B provide the same postal service found to be interchangeable, hence their revenues are subject to the CF. A is a fully integrated provider, while B uses an external hauler for transport. Absent a transport exemption, A and B pay the same charge to the CF. With the exemption, however, B pays a lower charge than A, because B, with hauling expense excluded, can deduct the part of its revenues attributable to transport.

In theory, an ideal CF's tax base could be defined by considering both the benefit principle (implying to charge all main USO according to benefit received) and interchangeability with USO products, regardless of the postal nature of their providers. As described at Sect. 2.1, in some countries as Italy and France the government greatly benefits from USP's PO network since state-owned institutions aimed at financing public infrastructures (*Cassa Depositi e Prestiti* in Italy and *Caisse Dépots et Consignation* in France) collect revenues by selling special state-guaranteed bonds at postal counter. In both countries, the USP sells also retail loans[14] and in Italy basic and profitable insurance services as well. The benefit principle would then require including as contributors to a CF the government, banks, and insurance companies, all main beneficiaries of the PO's ubiquitous USO network.

Regarding interchangeability, undoubtedly most e-substitution with USO mail comes from email. An interchangeability test between them would be probably found positive.[15] This would suggest having email providers contribute to the CF. However, this measure could deter innovative service providers. Traditional services as telephone SMS and voice, taxi, long-distance transport buses, and postal

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[14]In France La Poste holding a bank license directly supplies this service, while Poste Italiane sells bank's third parties loans branded as postal.

[15]Theoretically, the test would require including both transaction costs and the willingness to pay for privacy.

services increasingly face competition with products provided by innovative firms (such as Whatsapp, Über, Flixbus, Google) with new sometimes but not always, cheaper products. In Europe, these traditional services are included in the class of Services of General Economic Interest (SGEI), for which a special protection is granted. A CF, including only direct USP's competitors, would not a viable tool to correct for SGEI's unfair burdens.

By including all providers (postal or not) and institutions benefitting from PO's network to the CF, the tax rate would be low and not market distorting. However, this solution affects a large part of the economy and the CF would no longer be regarded as a use tax. The most reasonably less distortionary solution for unfair postal USO cost financing remains a public subsidy.

3.3 Parameters of the Fund

There are three approaches for implementing the fund, all of them with pros and cons: turnover, profit, and output. Regulators generally prefer to employ turnover since data are easier to collect and verify. Its disadvantage is that it requires affected markets being homogeneous in profitability. A profit tax approach in practice may lead to serious difficulties in allocating the contributions across operators due to the risk of inconsistent accounting policies being adopted (Borsenberger, Joram, Magre, & Roy, 2010; Jaag, 2011).

A per unit tax approach, i.e. allocating contribution according to volumes handled by each operator, generates a higher level of welfare and a larger likelihood of a break-even USP with respect to *ad valorem* approaches (Borsenberger et al., 2010). However, its disadvantage is practical. It may create wrong incentives to CF's participants to manipulate data to minimize their contribution since, in the postal industry, volumes are always estimated and adjusted as from revenues.

4 The Compensation Fund in Poland

In 2015 the European Commission cleared the adoption of a CF in Poland after considering its practicability, clarity, and proportionality. The Polish CF includes both USO and non-USO interchangeable services in the tax base, but not express services, because of its higher prices. This CF also entails a minimum turnover threshold for its participants, with the effect of including only the nine largest USP's competitors.

The applied 2% tax on turnover was assessed as affordable by comparing it to the USP's return on sales (ROS) in interchangeable services (5.5%). The Commission was aware that the adopted assessment was imperfect, since competitors, being small, do not benefit from economies of scale enjoyed by the USP. Nevertheless, citing a 7.6% ROS achieved in 2013 by Integer.pl Group, USP's main competitor,

the Commission (2015, p. 29, footnote 68) concluded that competitors would still be reasonably expected to serve the market profitably.

However, this evidence was flawed. This ROS figure related to Integer's overall operations in postal and non-postal services and manufacturing, not on ROS attributable to revenues subject to the CF. If Integer's ROS in business mail were lower that 4%, Integer would either remain—the tax being fully funded by other activities—or leave this market. Chołodecki (2018) provides evidences that the latter case arose in Poland. By 2016, competition in the business letter market in Poland evaporated, considering that Integer Group left this market having lost a public bid on registered mail for judicial courts.

Does the Polish postal market show common characteristics with other European markets, such that introducing the CF would end with similar outcomes? Great caution is required, for at least two reasons. Firstly, a proper ex post assessment of the Polish CF's effects on competitors' ROS, growth perspective, or behavior has never been performed yet. In some Member States' postal markets competition is so strong that the profit margin achieved by USP's mail competitors is the minimum for not leaving the market. As such, the CF could discourage investments necessary for gaining economies of scale and lead to a USP monopoly by pushing former competitors to either provide services as USP subcontractors or to exit the market. Secondly, in Member States considering a CF, exclusion of express services from its tax base as in Poland cannot be given for granted.

5 A Positive Explanation for Adopting the Fund

A loss-making USP, even after efficiency enhancements and USO adjustments, needs to look at external financial sources. In some Member States, for years the state subsidy effectively fulfilled this need. Nevertheless, both increasing public budget constraints and competition may generate for some USPs an interest in requiring and obtaining a CF.

WIK (2013) and its update by Copenhagen Economics (2018) provide useful data and information for explaining possible positive reasons for adopting a CF. The following analysis is aimed at investigating if a link exists between the likelihood of either the inclusion of the CF into National regulations or its declared adoption, and USP dominance in courier, express and parcel (CEP) markets.[16] The analysis relates to 29 countries (EU[17] plus Norway and Switzerland), provided by both National regulators and USPs in 2012 and 2016. Data collected show that 24 countries include a CF in their legislation, while 5 (Estonia, Cyprus, Italy, Poland and Slovak

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[16]Mail markets were excluded since USP's dominance is almost identical across countries (mean market share = 95.17%, coefficient of variation = 0.3256).

[17]Data for Luxembourg are not available.

Table 1 USP market shares in CEP services by not authorized, authorized or (at least partially) adopted compensation fund—unweighted mean values (n = 29)

Compensation fund	USP CEP m.s.%[a]	
Not authorized (n = 13)	42.0	
Authorized but not adopted (n = 11)	28.2	
Adopted (n = 5)	14.7	
F-test for differences in mean values between subsamples (α = 0.05)		
	T-value	*Two-tailed p-value*
Not authorized vs adopted	3.56	0.0004
Not authorized vs authorized but not adopted	1.72	0.09
Authorized but not adopted vs adopted	2.05	0.06

[a]Sources: WIK (2013), Copenhagen Economics (2018)

Republic) so far have declared partial adoption.[18] Table 1 shows USP market shares in CEP and relates them compensation fund's authorization or adoption.

In CEP markets where the CF is not authorized, the USP's average market share is much higher (42%) with respect to both authorizing (28.2%) and adopting countries (14.7%). However, the F-test (with α = 0.05) shows that the difference in mean values for not authorizing countries is statistically significant with respect to adopting countries, but not with respect to authorizing but not adopting countries. The same test performed confronting the second and the third subsample is just below the statistical significance. The correlation between USP's market share and Boolean values of the three subsample is 0.365, −0.097 and −0.356 respectively.

Although mainly descriptive, these results require some explanation. Their aim is to test the existence of a link between USP's market share in CEP and the CF, a regulatory measure: given a USP's market share, what is the likelihood that legislators exclude, include or adopt a CF? Here simple mean values matter, and member States included in the three main groups behave very differently, the two latter partially overlapping in terms of causal relation since both include the CF in their legislation.

These results are in some way partially flawed because of the absence of a measure of USO net cost, a variable probably affecting legislator's decision on the CF. Not surprisingly, 4 over 5 countries authorizing the fund declared to have performed by 2012 the USP's USO net cost assessment. The only statistically strong difference in mean values is between the first and the third group, but also the difference between the second and the third group is just slightly under the significance (6% chance of the null hypothesis). These results suggest that while the vast majority of member States includes the CF as a possible safety net for the USP only

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[18]Data were generated by averaging the 2016 declared range of values provided by Copenhagen Economics (n = 21). In case of missing data, 2012 values provided by WIK (n = 8) relating to Belgium, Bulgaria, Croatia, Cyprus, Denmark, Greece, Sweden and United Kingdom (four not authorizing, three authorizing, one enforcing) were taken. Although related to different years, these data seem to be comparable since USP's market share are generally slightly stable across time.

(i.e. a tool to be use in case things go wrong), two groups of countries may deviate in opposite directions from this long-term strategy. The first group of USP holding high market share, do prefer an unregulated CEP market, while the third, seemingly comprising USP facing high USO costs, may see the CF's adoption as a possible financial solution. The correlation results where each subgroup is compared with the whole sample confirm this hypothesis, being the sign of both the first and the third positive as expected. When official 2016 data provided by Copenhagen Economics will be available for all member States, a more precise estimate of the relation could be performed.

6   Conclusions

The e-commerce market is fast growing worldwide. The CF's adoption in some Member States could distort the e-commerce intercommunity market, since it may generate a misalignment in CEP price setting across member States. *Coeteris paribus*, prices would be higher in countries applying the CF if postal provider's additional costs due to the use tax passed on to consumers through higher prices and lower in countries not adopting it. It also distorts investment decisions for postal e-commerce providers operating in different member States. These may react to the CF by allocating their investment in International hubs in countries not charging the use tax to parcel carriers.

Also the minimum threshold exempting small firms from the CF may be used by set very low a USP able to influence its regulator's decisions. Being the market competitive but oligopolistic, for a USP, what matters is the tax level imposed on its targeted main competitors, the only able to affect its market shares, and not necessarily on small firms.

The extent of the USO and its regulation are different across Member States, but a CF's design and effects crucially depend on them. As a use tax charged to USP's competitors, a CF should comply with both the benefit and the competitive playing level field principles and, only if applicable, with the solidarity principle. Presently, the CF has been adopted in Poland only. Its mechanism raises at least three main concerns: (1) the affordability of the tax, where notably main competitors left the market; (2) the level of the minimum threshold before distorting competition; and (3) an implicit distortive funding of USP's non-postal activities.

More generally, adoption of a CF in other Member States with different market characteristics and USO regulation raises additional concerns. Such CFs would not comply with the benefit principle, since reduced demand USO mail services only partially benefits competitors; the USP's volume and revenue drop is overwhelmingly due to e-substitution. A CF that fully followed the benefit principle would require including email service providers in the tax base, as well as all the other beneficiaries of the USO network, i.e. the USP, banks, insurance companies, and the government, all of them being non-postal providers.

   To avoid distorting European markets, a CF requires a common USO regulatory framework. They also need competitive neutral interchangeability conditions with regard to e-commerce services, since those are multisided markets were consumers often do not pay the full cost of the service nor choose the postal provider. Applying an interchangeability test under present National USO regulation could incorrectly assess consumer's preferences. Therefore, a subsidy financed from the general budget probably remains the most efficient solution for USO financing needs since it implies the largest tax base, clear visibility for voters and taxpayers on the social cost of USO, and the consequent minimizing of welfare losses (Oxera, 2007).

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Compensation Fund in Postal Service: A Step Forward After the Polish Case

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1 Introduction

Mail volumes are decreasing all over the world due to ongoing digitization, and the trend will not be reversed. Hence, sustainability of the universal service obligation (USO) is becoming a primary topic, with direct subsidy made less likely by low economic growth and scrutiny of government expenditure. Article 7 of the Postal Directive 97/67EC states that if universal service obligations entail a net cost, a Universal Service Provider (USP) can be compensated through public funds or a Compensation Fund (CF). A CF envisions sharing of the net cost of the USO among postal services providers.

In this contest a relevant phenomenon is the growth in parcel delivery, due to the increase in e-commerce, as the stream of parcel revenues becomes more important for Postal Operators. More to the point, these parcel deliveries—often not requiring a time certain next or same day delivery—normally are priced low and interchangeable with other parcel products included in the USO. This interchangeability could be the reason to consider them eligible for contributing the CF, thus allowing it to become a crucial means for financing universal service.

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Recently the European Commission, interpreting this directive, took an important position with its Decision SA.38869 (2014/N), "Compensation of Poczta Polska for the net of USO 2013–2015", in which it approved a CF as a means of financing the universal service net cost in Poland ("Polish Decision"). This decision created a point of reference for future CF cases. AGCOM (2015b), the Italian regulatory authority, has recently determined the USP's net cost (years 2013 and 2014) (Delibera 298/17/CONS art. 1). However, although the Italian NRA has recognized a financial burden whose amount is higher than public funding, the CF has not been activated.

This paper, in the light of the Commission's decision, examines the features of a fair CF, based on the revenues and the rate of contribution required of postal operators. Our research updates Romito, Gori, and Scarfiglieri (2017), taking into consideration issues that emerged during the discussion at the 25th Annual Conference on Postal and Delivery Economics. We also examine the universal service products in different countries, with a special focus on parcel delivery and express courier service, in light of market definitions in EC decisions. As shipments generated by e-commerce are increasing, our research will also examine their legal standing for contributing to the CF.

After this introduction, Sect. 5 examines the main characteristics of the Polish CF and shows the services included in the universal service of five main countries (France, Germany, Spain, Netherlands and Italy). Section 3 compares the characteristics of universal services parcels in relation to other standard and express deliveries products according to EC past decisions. Section 4 analyzes different kinds of shipments generated by e-commerce and proposes a logic classification of standard and express deliveries in relation to the evidences. Section 5 concludes indicating a possible way forward for a larger use of CFs after the Polish decision.

2   The Polish Decision and USO

The Decision SA.38869 implemented the CF as a mean of financing of the universal service net cost (with state funding also contemplated). For present purposes, it is relevant to highlight the mechanics of implementing this CF. As noted by Gautier and Paolini (2011), if a CF is not set correctly, competition might be affected because new comers might enter a smaller scale or not enter at all.

The key elements of a CF are the contribution base and the contribution rate, both analyzed in detail in the Polish decision. It is first necessary to determine which services are to be included in the contribution base. The contribution base refers to the revenues of the companies offering universal services and their substitute services. Recital 27 of the2008/6/CE Postal Directive defines substitute services as those services that user's view as sufficiently inter-changeable with universal services, taking into account their characteristics (including the value-added features), intended uses, and pricing. Furthermore, the recital specifies that substitute services do not need to have all the features of the universal service to be considered inter-changeable. Including substitute services in the contribution base is relevant because of the development of the postal industry after liberalization.

The liberalization process has increased competition, and many new operators have naturally focused their activities on the most profitable customers and remunerative markets. As a result, the issue of the universal service sustainability has emerged as a result.

Universal postal services, given the regulatory constraints, involve relevant labor cost (especially in countries with strict labor laws and strong labor unions), limited price flexibility, and therefore are profitable only for certain categories of customers. For products or regions where provision is unprofitable, the net burden of universal service can be covered only by public compensation if higher revenues from profitable customers and remunerative markets are insufficient. Competitors that provide substitutive services and are not subject to the universal service constraints squeezes the universal service provider profitability. Those competitors should contribute with a part of their profits to the coverage of the universal service burden. Recently, the principle has been clarified in the Opinion of the Advocate General Campos Sànchez Bordona (Cases Confetra and others, 2017, at § 81): "The contributions by postal service providers to the financing of the universal service are intended to establish some parity between them, by requiring new entrants who do not incur the same costs as operators entrusted with the universal service to pay into that fund and contribute to the financing of certain obligations based on the "principle of solidarity".[1]

The second key element of the CF is the rate of contribution, which in the Polish decision is set up as a limited percentage (2%) of relevant revenues. The percentage is uniform among participants (principle of nondiscrimination[2]), and the same proportion of revenues they obtain from universal services or their substitutes (principle of proportionality, Postal Directive, article 7 subparagraph 5). Furthermore, there is also a revenues threshold below which postal operators do not contribute to the CF. Both the limit to the maximum percentage of relevant revenues to be paid and the threshold for exclusion reduce the possibility that the CF becomes a barrier for the development and competition of the postal industry. The Postal Directive, article 3, subparagraph 4, establishes a minimum set of facilities that the universal service provider has to provide. In reality, the definition of the universal service is different across the European countries, hence the services and their substitutes which may compose the contribution base may vary among them. Table 1 below shows the main categories of universal services of France, Germany, the Netherlands, Spain and Italy.

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[1]The principle of solidarity is a key pillar of European Union Treaties, more specifically it is based on sharing both the advantages and burden among members.

[2]Article 7, subparagraph 5 of the Postal Directive states that: "Member States shall ensure that the principles of transparency, non-discrimination and proportionality are respected in establishing the compensation fund and when fixing the level of the financial contributions".

Table 1 Main categories of universal services

2017 - Main categories of universal services	FR	DE	ES	NL	IT
Standard letter post	√	√	√	√	√
Bulk letters	√	√	√		√
Direct mail	√	√			
Periodicals	√	√			√
Standard parcel post	√	√	√	√	√

Note: it refers to only domestic services and excludes registered items
Source: PostNL (2017)
√ - Universal Service

Table 2 Benchmark on universal parcels

Benchmark on universal parcels						
Product name	Country	Weight (kilos)	Price up to 10 kilos (€)	Delivery time	Money back	Track and trace
Colissimo France	FR	Up to 20	19.20	D + 2	NO	Yes
Standard versand—Paket	DE	Up to 20	9.49	D + 2	NO	Yes
Paquete Azul	ES	Up to 20	19.34	D + 4/5	NO	Yes
Standard parcel	NL	Up to 10	6.95	D + 1	NO	Yes
Pacco ordinario[a]	IT	Up to 20	11.00	D + 4/5	NO	Yes

Source: Postal Operators web sites, Groupe La Poste (2018), PostNL (2018)
[a]There is also another weight band up to 5 kilos

The potential amount of the base of the CF, therefore, may substantially varies among countries depending on the universal services perimeter, the existence of substitutes and the level of competition.[3]

3 Universal Parcels, Express Courier and Standard Parcels in Relation to EC's Decisions

Universal parcels are a common part of universal service. To correctly define their substitutes, it is necessary to analyze their main features. Table 2 shows the main features of the universal parcels in the Countries examined above.

Table 2 shows that while the time of delivery is not completely fixed, there is always a presumed day of delivery that varies among different countries. Although there is some variation, the price, in general, seems to be affordable. All products have a track and trace feature, and there is no money back linked to the day of delivery.

The Polish decision excluded the courier express services from having to contribute to the CF. It is therefore necessary to correctly define express courier services

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[3]In The Nederland and in Germany the compensation fund is not required.

and why they substantially differ from universal services. The Opinion of the Advocate General Campos Sànchez Bordona (Court of Justice 2017, at § 87) stated that holders of general authorizations have to contribute to the CF only for the turnover related to conditions ("the inter-changeability to a sufficient degree with the universal service, taking into account the characteristics of the services, including added value features, as well as the intended use and the pricing", Directive, 2008/6, recital 27) referred in the recital 27[4] of the Directive 2008/6, This issue was further addressed by the Court of Justice Judgement (2018), Cases Confetra and others, § 76, national legislation can require "holders of a general authorization for the provision of postal services [have] to contribute to a compensation fund for universal service obligations, where, from a user's perspective, those services may be regarded as falling within the scope of the universal service as they display inter-changeability to a sufficient degree with the universal service".

The Commission Notice on the definition of relevant market (2003, at § 7) said, "A relevant product market comprises all those products and/or services which are regarded as interchangeable or substitutable by the consumer, by reason of the products' characteristics, their prices and their intended use." Recital 27 defines the substitutes of universal service, which should contribute to the CF, as inter-changeable services considered from a user's perspective. To identify interchangeable services, we could consider those included in a relevant market as defined in competition law.

Article 5, subparagraph 1, of the Postal Directive states that the universal service provision "shall evolve in response to the technical economic and social environment and to the need of users". This provision has been applied to a market that has seen during the past decade the implementation of advanced features. Many of these new features, although initially part of value-added services, have become common to traditional services, including those in the universal postal service.

The basket of services included in the universal service should not, therefore, be interpreted as a static set but in constant evolution in the light of technological, social and market developments. An example is the track and trace service, initially developed as a value-added feature of the express delivery services. It has been gradually incorporated as a basic feature of universal parcels (Table 2) in many European countries, as many USPs have included the track and trace in their standard parcel supply (WIK Consult, 2013). In Italy, in the resolution 396/15/CONS (AGCOM 2015a, at V.11), the national regulatory authority observed that tracing priority mail aims at improving the quality of service by responding to the changing needs of users who wish to enjoy advanced universal services.

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[4]Directive 2008/6/CE, recital 27, says, "whether the services provided by such undertakings may, from a user's perspective, be regarded as services falling within the scope of universal service, as they display inter-changeability to a sufficient degree with the universal service, taking into account the characteristics of the services, including added value features, as well as the intended use and the pricing. These services do not necessarily have to cover all the features of the universal service, such as daily delivery or complete national coverage".

As the Court of Justice has stated that services interchangeable to a sufficient degree with universal services has to contribute to the CF, defining correctly those services is a fundamental issue. The EU has divided the shipments delivery market in two different markets, courier express and the standard delivery. The EU has consistently followed the evolution of the courier express market and standard delivery market identifying special features that distinguish and clearly separate them. Important elements to define the courier express market may be found in the decision TNT Post Group/Jet Services (1999, at § 17) and Deutsche Post/Securicor (1999, at § 20). Both decisions observed that express courier services have a higher price respect to standard parcel services and are "next day/time certain services". In addition to the higher price, for next day delivery within a specified time frame, a money-back guarantee is available for the sender if the operator fails to meet the specified time of delivery. However, both decisions noted the evolution of supply insofar as value added services have been included in the standard parcel supply (TNT Post Group/Jet Services, 1999, at § 14, Deutsche Post/Securicor, 1999, at § 17) and new products have been developed within the standard services resulting in faster delivery (TNT Post Group/Jet Services, 1999, at § 17, Deutsche Post/Securicor, 1999, at § 20).

More recently with the Decision UPS/Tnt Express (2013), the EC has reconfirmed earlier definitions: express services have to arrive at a certain time next day (with customers are available to pay higher prices) and express suppliers not only advertise the reliability of express deliveries but also sell a money-back guarantee in case the delivery is late.[5] Furthermore, the same express services suppliers have supported the distinctive elements that characterize express delivery markets, for example, DHL has declared that the majority of courier customers would not have changed their services in relation to a price increase of 5–10%. Moreover this Decision says that La Poste noted that express service customers value a definite time of delivery as a relevant feature so a reasonable price increase will not determine their shift towards standard services. Furthermore, the Decision also stated that Fedex has identified that its express delivery customers give much value to the time lap commitment and consequently are willing to pay more for it (UPS/Tnt Express, 2013, at § 202). The EC decision Fedex/Tnt Express (2016, at § 91) defined express services as one with "committed delivery by next day".

This approach was also followed in the EFTA Decision Posten Norge (2015) where it is pointed out that express deliveries are faster, more reliable and more expensive. In fact, these express services are time certain, overnight and are sold with a number of value-added services (EFTA Decision Posten Norge, 2015, at § 38). Moreover, the EC has examined the framework and operational processes

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[5]Decision UPS/Tnt Express (2013), § 210, says, "Furthermore, the key point is that express services come with a commitment by the supplier to arrive at a certain time of the following day. Only express services provide customers with the certainty that their shipment will arrive on time and customers are ready to pay higher prices for a reliable service. Express suppliers such as UPS emphasize the reliability of their express services and actively market a money-back guarantee in case the committed delivery time is not met.".

used by express and standard deliveries. It has found that express deliveries mainly use an air network while standard deliveries use a ground network (UPS/Tnt Express, 2013, at § 218). In the use of the ground network there are important differences as express deliveries require faster means as vans while standard deliveries employs lorries. DHL, for example, has declared that its express and standard networks are essentially separated and have a completely different cost structure (Fedex/Tnt Express, 2016, at § 95).

In several decisions, the EC has defined standard parcel delivery. In its decision in Deutsche Post/Danzas/Nedlloyd (1999, at § 10), the Commission defined the standard parcel deliveries as "standard services contain no time guarantee but a general indication of the time laps, e.g. 24 hours, for the delivery". Furthermore in Deutsche Post/Excel (2005, at § 21) the Commission stated that standard deliveries are less reliable and slower than express deliveries and confirmed, in line with previous Decisions, that the delivery market is segmented into two separate markets "an express and a standard (also referred to as deferred) parcel".

More recently, with the Decision UPS/Tnt Express (2013), the Commission has confirmed again past Decisions stating that standard deliveries lack the "next day delivery commitment" (Decision UPS/Tnt Express, 2013, at § 156) that is the main feature of express deliveries. It said (Decision UPS/Tnt Express, 2013, at § 156), "In line with its decisional practice, the Commission identifies the relevant product markets on the basis of the speed of delivery (that is to say, express delivery services—commonly understood as services with a next day delivery commitment, and standard/deferred delivery services)". In its most recent decision regarding this issue, Fedex/Tnt Express (2016 at § 90), the Commission defined "deferred delivery services" as those "with a longer delivery time" comparing to express deliveries which are "also considerably more expensive". The same decision noted that Fedex (Fedex/Tnt Express, 2016 at § 92) has pointed out that "the one-day distinction fits well with the transit times of the 'priority' and 'economy' products, as all of the intra-EEA deliveries made within one day involve a 'priority' product, whilst the vast majority of deliveries that are made within two days or more are associated with an 'economy' service".

Copenhagen Economics (2015, 2017) explored the meaning of the recital 27 of the Third Postal Directive, with a focus on identifying a methodology able to determine the interchangeability of the postal services. The study first observed, in line with the Polish Decision, that express and courier services are different from universal postal services. It then analyzed different methods of identifying the interchangeability in the light of the practice of competition law and definition of relevant product markets. The study compared and analyzed different methodologies for measuring demand substitution.

Copenhagen Economics suggested the hypothetical monopolist or SSNIP (Small but Significant and Non-transitory Increase in Price) test as the best quantitative tool

to use in order to identify services that are actual substitute.[6] However, in UPS/Tnt Express, 2013, at § 154, the EC stated, "the characteristics of the industry render a direct empirical implementation of the SSNIP test unsuitable". It found that the price each customer pays is individually negotiated and thus, for similar transactions, customers may pay different prices. The EC in UPS/Tnt Express, 2013, at § 154 has further indicated that the proper analysis for the industry entails "identifying product characteristics for which conditions of competition are homogeneous (that is, identify groups of products for which a given set of suppliers are shown to be competitive alternatives for most customers) appears more appropriate". Even if the EC Decision raised doubts on the use of SSNIP test to define this specific problem of market definition in the postal markets, the Copenhagen Economics study raised important issues which will need to be addressed.

4 Towards an Appropriate Classification of the E-Commerce Deliveries

Parcel deliveries brought about by e-commerce continues to be a fast growing market segment, a trend that will probably continue. Eurostat (2018) has observed that the percentage of turnover on e-sales is equal to 18% of the total turnover of enterprises with ten or more employers. Moreover, in 2016, in the EU-28 the percentage of enterprises making e-sales is about 20%, with countries such as Ireland (33%), Sweden (31%), Denmark (30%), Germany, Belgium and Netherlands (26%) having higher percentages.

In UPS/Tnt Express (2013, at § 207), the EC observed that both express and standard deliveries have been rising during recent years, but standard deliveries have grown more. The reason may be linked to the e-commerce increase and the growth of B2C deliveries as these deliveries "are predominantly shipped by deferred shipments", which are standard deliveries. Further evidences that the e-commerce world uses mainly standard deliveries are given in ERPG (2013, p. 12), where courier shipments appear more expensive than standard deliveries and faster than usual market requirements. This is well explained by the Hungarian indication that e-commerce buyers are "rather delivery fee sensitive" (ERPG, 2013, p. 12) so that standard deliveries are not easily replaceable by courier express. Moreover, EPRG quoted France as saying that consumers buying on line would not choose couriers as these deliveries would be considered "too expensive" (ERPG, 2013, p. 12).

Copenhagen Economics (2013) contained similar findings, observing that the e-commerce market is dominated by standard deliveries, while express deliveries got

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[6]The US Antitrust Division (1982, Horizontal Merger Guidelines, Department of Justice, 1982) indicates the hypothetical monopolist test has an instrument to define the relevant market. The SSNIP test is used in this kind of analysis as it measures the customer reaction to a hypothetical permanent small price increase (from 5% to 10%).

only a small share. It asked to e-shoppers the importance of some different delivery features when they first buy on line (i.e. excluding repeat purchases) The survey allowed multiple choices. [1]n answer to the survey question, "How important are the following features of delivery services?" the most selected choice for "somewhat important" or "very important" delivery time was within 2–4 days in about 85% of responses, while express delivery was in only 60%. Moreover, about 90% of respondents consider free delivery important, while faster expensive delivery was selected by only about 50% of respondents (Copenhagen Economics, 2013, figure 17, p. 66).[7] The same questions posed to e-retailers led to similar results, with almost 90% choosing delivery within 2–4 days and only 70% choosing express delivery (Copenhagen Economics, 2013, figure 30, p. 66). In general, when the choice was between lower quality delivery service at a low cost versus higher quality delivery service at a higher price the prevalent option chosen has been the former.

In a recent study of e-commerce in the Nordic countries, Copenhagen Economics (2017, p. 80) found that 70% of e-shoppers indicated delivery time within 3–5 days sufficient and only 8 percent of them required a fast delivery within 1–2 days. The percentage choosing for fast delivery was even lower than that choosing very slow delivery, as 13% of e-shoppers would accept a delivery within 6 days or more as low price delivery is important.

WIK (2016) has also noticed that in the Netherlands letter box packets, small sized packets that can be delivered inside the letter boxes, are used to ship small object such as books, CDs and other low value objects. These shipments, linked to e-commerce, are delivered through the letter box packet, and not as parcels, because the price is lower. The study found that in the future this service will be used more, as it remains a less expensive option for the delivery of small low-value objects.

Examining new trends and preferences of e-shoppers, McKinsey (2014, 2016) noticed the development of same-day delivery. This service needs a critical mass of consumers willing to pay for this premium service. This would be associated with a high income per capita, high population density and the widespread use of e-commerce. However, the majority of online buyers still prefer the least expensive option for the shipments.

In synthesis, the EC, with its decisions, and a large number of studies have provided basic elements for defining an express delivery market and a standard delivery market. As previously discussed, the main elements for the discrimination are the time of delivery and the price. The express delivery market is characterized by deliveries with high prices and a defined time of delivery, normally next day within a definite time. Moreover, there is also a money-back guarantee of delivery time. The standard delivery market, on the other hand, is characterized by a slower delivery, a lack of a guarantee, but with lower prices. Universal parcels, having a lower time of delivery than courier and an affordable price, fall well within this

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[7]The percentage is referred to e-shoppers who have chosen the feature as "somewhat important" or "very important". The question answered is: "When placing the final order, how important are the following features of delivery services?"
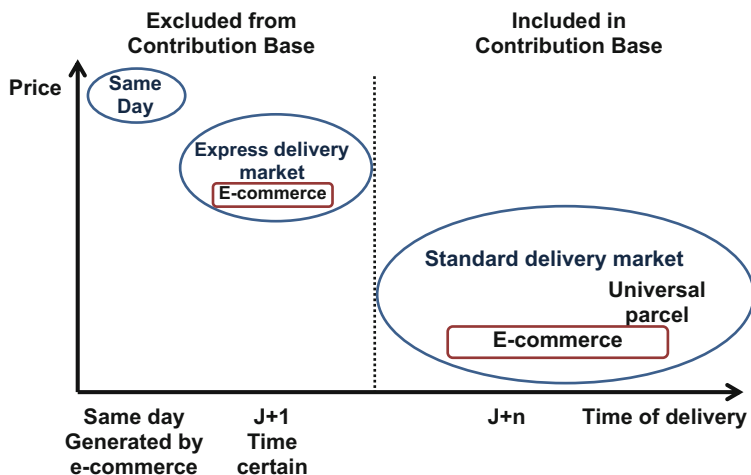
Fig. 1 Different delivery markets

standard delivery market. Most shipments arising from e-commerce have to be included in the standard delivery market. There appear to be little doubt that most online shoppers want to contain the price of shipment, particularly for small value items. This market evolution appear very positive and important especially in relation to the future possibility of financing the USO through a wider application of CF, considering that mail volumes will still decrease in the future.

Figure 1 below, using price and speed of delivery on the axes, allows us to visualize these different markets.

Possibly, at one extreme of the spectrum, e-commerce has also brought out a new market/segment—same day delivery. This market segment is characterized by a very high delivery price (because of high cost) and buyers willing to pay that price to receive items purchased the same day. There remains a limit to the delivery price, at least comparing it to the value to buyers of the items purchased. The demand for an extreme speed of delivery need not be large enough to generate sufficient revenue to cover the cost of the service.

5   Conclusions

The sustainability of universal service provision is a key issue faced by the postal sector in a market characterized by a significant decrease of volumes. Recently the EC has approved the CF proposed for Poland. That decision described appropriate characteristics for a CF. The contribution rate should be set at a level that should be financially sustainable by existing competitors and not limit entry of newcomers into the market. A fundamental task is to correctly identify services that are substitutes for those included in the universal service. In this paper the focus is strictly

on postal services and other considerations about diversification and digitalization are excluded. Exclusion of those substitutive services would squeeze the universal service provider, forcing it to raise price and cede market share to entrants.

Several EC Decisions have defined the boundaries and the characteristics of the products belonging to a standard parcel market, and the universal parcel service, with its features, is clearly part of it. These decisions also identified the characteristics and boundaries of the express delivery market. Copenhagen Economics (2015, 2017) addressed identifying a methodology appropriate for determining interchangeability of the postal services. The Opinion of Advocate General Campos Sànchez Bordona and the Judgment in Cases Confetra and others provided that the holders of authorization have to contribute to CF when the national legislation mandates doing so, only for the revenues of interchangeable service. Relatively to interchangeable services.

Financing the burden of universal service exclusively through state funds clashes with low economic growth and austerity policies for public spending implemented by European governments. While mail volumes are falling, parcel volumes are increasing because of e-commerce. Most of these shipments are low price and have a no next-day definite delivery time, which are also the main features of the universal parcel. In this context, a CF paid by firms offering standard parcel service, which is a substitute for the USP's parcel service, may become a relevant tool to support the burden of the universal service.

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Open-Data: A Solution When Data Constitutes an Essential Facility?

Claire Borsenberger, Mathilde Hoang, and Denis Joram

1 Introduction

Data is a type of raw material, most of the time unstructured, derived from observations, experiments, measures or computations, collected by a wide range of organizations and institutions. Once it has been analyzed or interpreted thanks to intelligent methods like data mining,[1] data becomes information (a set of contextualized and structured data making them meaningful) suitable for making decisions. Thanks to digital technology, data collection and processing have become easier and less costly. Consequently, the amount of data collected has increased exponentially during the last decades, and many digital firms have built their strategy and business model on data. Some firms have developed entirely new business models directly based on data monetization, such as data brokers, specialized in data collection, that process and analyze data in order to resell information to other economic actors.

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[1]Data mining is the process of discovering patterns in large data sets involving methods at the intersection of machine learning, statistics, and database systems.

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Other firms, such as Internet platforms (Facebook, Google Search, YouTube, as examples) provide "free" services to their customers in exchange of their data that they monetize.

Thanks to appropriate data algorithms, firms, especially those on-line, are able to extract detailed knowledge about consumers and markets. This raises the question of the essential facility character of data. Moreover, the features of digital markets lead to a concentration of this core input in the hands of few big "superstars" and arouse legitimate economic and societal concerns. In a more and more data-driven society, one could ask if data openness is a solution to deal with power derived from data concentration.

Section 2 examines the essential facility character of data. Section 3 summarizes recent initiatives to extend open data policies in France and at the European Union, and analyzes the consequences of a possible extension of openness to privately held data in light of economic theory with a particular focus on the case of postal operators. Section 4 concludes.

2   Is Data an Essential Facility that Should Be Opened?

2.1   Data Is an Impure Public Good

In economists' language, data is a non-rival good (Isaac, 2016; Lambrecht & Tucker, 2015; Sokol & Comerford, 2017), meaning that one person's consumption does not preclude another's: the collection and use of a piece of data by one firm does not induce its disappearance (contrary to the consumption, for instance, of an apple—a "private good").

Opinions are less definite over the non-excludable character of data, i.e. the absence of gateways on consumption.[2] According to Sokol and Comerford, no firm can, or does, control all of the world's data. It is difficult to request financial compensation to access a piece of data (Lambrecht & Tucker, 2015). If one provider has a piece of data, another provider is not prevented from collecting that very same piece of data.

However, companies are becoming increasingly aware that they are sitting on huge amounts of under-utilized data and looking for ways to increase its value. The fact that data is a strategic asset –data can improve decision making, produce more valuable goods and help optimize production—that has commercial value could be a barrier to disclose it freely, leading to situations in which few actors control it, excluding some potential users from its "consumption".

Excluding some users from essential data raises concerns about competition. New product or service providers could be prevented from entering a market.

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[2]For example, fresh air is non-excludable, because it is impossible to stop several people in the same area from breathing the same fresh air.

Even established providers could be forced to exit a market if they do not have access to some "essential" data. These threaten the viability of a competitive environment. In this context, two questions arise: First, is a given type of data an essential facility? Second, if yes, is open data the right solution to guarantee access to this essential facility?

2.2 Is Data an Essential Facility?

Heitzler (2009, p. 80) defines essential facilities as "inputs that are unconditionally necessary to provide certain goods or services and that are unfeasible or too costly to be duplicated or to be bypassed. At the same time there must not exist sufficient demand-side substitution possibilities for the service itself. Shortly, essential facilities not only have to be nonreplicable but also non-substitutable with regard to the service they are needed for". For example, data is sometimes considered as the new oil that drives the economy; without it, progress would halt. According to Gans (2018), like internal combustion engines with oil, data-driven markets need data to run. Digital firms rely on data to offer their services. For instance, Spotify's recommendation algorithm relies on past behavior of users to improve its recommendations. In this context, one could argue that new entrant who, by definition, does not own a database on users' profile and usages similar to incumbents, cannot compete with the latter. It seems then necessary to give entrants access to incumbents' data.

Isaac (2018) does not share this point of view. By itself, raw or primary data has no meaning: the simple fact to collect data is not sufficient to create profit-enhancing opportunities. The economic value of primary data comes from its consolidation with metadata,[3] its treatment by algorithms that transforms primary data into knowledge by crossing it with other data. This process of transformation and value creation lies on technical investments (collection and treatment infrastructure) but above all on human, organizational and strategic capabilities (Isaac, 2016). This view is shared by Lambrecht and Tucker (2015, p. 11), who claimed, "It is only when combined with managerial, engineering, and analytic skill in determining the experiment or algorithm to apply to such data that it proves valuable to firms".

Furthermore, Lambrecht and Tucker (2015) argued that data held by incumbents cannot be defined as non-replicable or rare. First, as we saw, it is a non-rival good with a near-zero marginal cost of reproduction. Second, tools and technologies to

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[3]Metadata is data (information) that provides information about other data. For example, a digital image may include metadata that describes how large the picture is, the color depth, the image resolution, when the image was created, the shutter speed, and other data.

collect, gather, store and analyze data are more and more powerful and affordable. Lambrecht and Tucker (2015) and Rubens (2014) speculate that storage costs may eventually approach zero; Altman, Nagle, and Tushman (2015) argued that information costs are rapidly approaching zero. Third, firms have developed a business model based on the sale of databases. Fourth, consumers leave more and more traces of their needs and preferences, sometimes unconsciously across the Internet. Moreover, entry into some digital markets, such as social networks, is also facilitated by the fact that consumers are not reluctant to use different services if the opportunity cost to multi-home is not high. Finally yet importantly, the value of some data decreases through time (Sokol & Comerford, 2017). In this case, the main concern of entrants should not be to get the incumbent's data but to collect updated and differentiated data to respond to sometimes evolving needs of users (Schepp & Wambach, 2015).

These arguments suggest that the market power of dominant firms (in other words, the roots of the dominant position of some "superstars" or giant tech) comes more from their ability to provide a reliable and high quality good, reinforced by network effects and the switching costs incurred by customers, than from primary data. However, it seems difficult to deny that to some extent the ability to satisfy consumers' needs and to exploit network effects come from information and knowledge provided by data. Moreover, one can find a counter-example that leads to the conclusion that data are a necessary or essential resource in the digital economy. Indeed, in some cases, the collection or reproduction of data will be costly, consumer will be reluctant to multi-home, the quality of data offered by third parties will be lower, and so on (see for instance Autorité de la concurrence and Bundeskartellamt, 2016; Graef, 2016; Grunes & Stucke, 2015).

Academic literature remains divided on whether data is an essential facility. The answer cannot be unequivocal: it depends on the type of data and market under review. For instance, in the markets on which Graef (2016) and Grunes and Stucke (2015) rely to support their opinions, search engines (the Google Search case) and digital maps (the TomTom/Tele Atlas case) collect a huge amount of data is an essential pre-requisite to develop their services. Such large datasets could be considered as an entry barrier since the costs of collecting, processing and storing the data are generally high whereas it has (almost) zero marginal cost of reproduction.

On the contrary, for social networks, which nevertheless exhibits high network effects and switching costs based to some extent on users' data, access to data has not protected incumbents from competition. This industry has experienced a succession of large firms: MySpace replaced Friendster and then was replaced by Facebook as the leading social network site. Facebook could be in the future replaced by another actor such as Instagram or a not yet existing actor (Lambrecht & Tucker, 2015). It seems more appropriate to have a case-by-case approach rather than to establish per se rules.

3 Towards a More General Open (Public and Private) Data Environment and a "Common European Data Space"?

For at least 10 years, we have observed a move from a closed proprietary data resources to a common shared resource, notably under the impetus of "Open Government Data" (OGD) policies. "Open data" is a piece of data or content that anyone is free to access, use, reuse, and redistribute (European Commission, 2014). This means that the piece of data is available in a convenient and modifiable form and under terms that permit its reuse, redistribution and mixing with other datasets by everyone (open license). There should be no discrimination against fields of endeavor or against persons or groups. For example, restrictions that would prevent 'commercial' use, or restrictions of use to certain purposes (e.g. only for research or in education) are not allowed. Accessibility implies affordability. Such data must be available at no more than a "reasonable" reproduction cost to be qualified as "open".

"Open government data" or open "public sector information" are defined as open data or information generated, created, collected, processed, preserved, maintained, disseminated or funded by or for the Government or public institutions (OECD, 2006). Open data policies have usually materialized with public sector datasets becoming easily accessible and reusable by the general public through governmental web portals. The Obama Administration was the first to launch an open governmental data portal (data.gov) in May 2009, rapidly followed by countries around the world (e.g., UK, Spain, Singapore, Australia, Chile, France). The original focus was on governmental data; recent initiatives extend obligations of openness to data held by private actors.

3.1 The French Precedent and the Revised PSI Directive at the European Level

In France, the law for a digital republic that came into force on October 7, 2016 has already introduced new provisions in French law to bolster and broaden the open data policy. Article 3(I) obliges not only central and local governments, but also public and *private legal entities having a public service mandate*, to exchange public information they produce or receive. Article 4 of the bill sets up a new public service mandate under which the government is tasked with making available and disseminating a new class of public data named "*benchmark data*"[4] (or *high-value data*) to foster its re-use. Last but not least, the Act introduced the new concept of "data of general interest" by expanding the open data policy to include public and

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[4]For the moment, nine datasets have been identified as benchmark data: National Address Database, Enterprise Database (SIRENE file), Geographic official code, Cadastral Map, Landing register, Reference document on the organization of State, Big Level Reference document, National file of associations and the Reference document of jobs and professions.

private entities, public service concession holders or entities *whose activities are subsidized by the public authorities*, and by providing streamlined access for INSEE (National Institute of Statistics and Economic Studies) to some *private* databases for the purposes of mandatory statistical surveys. Article 5 introduced an obligation for public service concession holders (potentially private firms) to allow the concession-granting authority to publish, as open data, the main data concerning the activity covered by the public service concession.

At the European level, the Commission published April 25, 2018 a proposal to revise the Public Sector Information Directive (PSI) Directive (European Commission, 2018a, 2018b). During the preparation phase of Directive's review, the concept of "reverse PSI" that would entail access for public sector bodies to re-use privately held data was examined. Fortunately, reverse PSI does not appear in the published proposal. It would have raised a number of difficult questions: How to deal simultaneously with proprietary and commercially sensitive/confidential information? How to balance commercial interests with public interest? How to reconcile the need for data protection with wider access to data? How to make datasets collection sustainable if collector bodies cannot charge anymore for their reuse? Last and not least, how to distribute the costs of facilitating access to and re-use of these data for the public good (the provider, the user/consumer or the citizen) knowing that the openness of these data will inevitably need additional infrastructure, data protection and security measures, as well as better data readability and interoperability?

Nevertheless, the Commission has not completely given up the possibility of reverse PSI. As stated in the Proposal for a Directive on the re-use of public sector information published the 25th April 2018, "the scope of application of the Directive shall be extended to documents held by public undertakings active in the areas defined in the Directive 2014/25/EU on procurement by entities operating in the water, energy, transport and postal services sectors and by public undertakings acting as public service operators under Regulation (EC) No 1370/2007 insofar as they are produced as part of the provision of services in the general interest, as defined by law or other binding rules in the Member State" (p. 9).

3.2 Motivations and Expected Benefits of OGD

Two main categories of objectives or benefits are expected to be reached by opening public data. The first one is rooted in the ethos of democracy and freedom of information. Government data openness is considered a means to promote democracy, to give citizens access to information, to increase transparency of government actions and to increase the participation, interaction, self-empowerment and social inclusion of open data users (e.g. citizens) and providers (Bertot et al., 2012; Janssen, 2011).

The second main objective pursued by public institutions through open data initiatives is rooted in increasing economic value and efficiency by reducing transaction costs. Data are no longer collected several times and saved in multiple

repositories. Exchanges are simplified by promoting machine-readable interoperable formats. More transparency can reduce asymmetries of information between economic agents' which can produce principal-agent problems such as moral hazard situations—those where the more informed party makes decisions in his own profit while the cost falls on others. Lowering transaction costs will help both the public and private sectors to provide better services, to develop new production methods and to introduce new products and services, generating economic value (Jetzek, 2013).

The expected benefits of OGD have been largely outlined by a number of ex ante studies (see Carrara, Chan, Fischer, & van Steenbergen, 2015 for a survey). However, ex post evaluations of concrete impacts of OGD are lacking. Koski (2015, p. 25) admits that "to [his] best knowledge, there is no reported comprehensive country-level ex-post impact assessment of opening up government data. The current research-based knowledge concerning the impacts of open data is limited only to narrow areas and largely based on case examples." He explains this lack of ex post analysis by newness of the OGD phenomenon, the lack of systematically collected statistical data on the use of data, and the absence of indicators or models to assess the impacts of open data. According to Zuiderwijk and Janssen (2014), suitable evaluative indicators for the assessment of the success of open data policies lack. Performance indicators often concentrate on the input of policies, such as the number of datasets that are publicly available (Bertot, McDermott, & Smith, 2012). Less attention has been given to the original intent or goals of open data policies and to the reuse of data by companies and citizens.

According to Janssen, Charalabidis, and Zuiderwijk (2012), many public organizations have jumped on the bandwagon of making data available without having a sound policy. This has resulted in central portals with poor quality data that were already publicly available, without feedback mechanisms. According to the 4th edition of the Open Data Barometer released by the World Wide Web Foundation (2017), even if 79 out of the 115 governments surveyed have an open government data portal, only seven governments include a statement on open data by default in their current policies. Moreover, according to this report, the data released are usually incomplete, out of date, of low quality, fragmented, and published with no metadata or guidance documentation, which makes the data hard to use. In addition, complete datasets are often published by other government agencies or national statistics offices (NSOs) on their own platform, reducing the expected cost savings.

The impact assessment accompanying the proposal to recast the PSI directive gives a more positive view of open data policy. According to the summary report of the "high level round-table discussion on Public Sector Information re-use under the PSI Directive" held on March 16, 2018 (European Commission, 2018c), the PSI Directive has induced an increase in the supply of data as well as an increase in the demand, while ensuring fair and proportionate conditions for reuse. Deloitte (2017) stated that the Directive improved the efficiency of the public sector itself and created economic gains for public sector bodies. Furthermore, Deloitte's economic analysis showed that the Directive enabled the creation of more than 8,000 data-related jobs since 2013. The authors concluded the analysis shows that the

benefits of the PSI Directive exceeded its costs. This explains why the Commission wishes to extend the concept of open-data to other entities, in particular to public undertakings providing utilities (even if she gives up for the moment the idea of a reverse-PSI). But such an initiative neglects the risks and costs of forcing economic actors to disclose their data.

3.3   The Risks and Costs of a Larger Open-Data Policy

Forcing private firms to disclose their data could be counterproductive. Such a policy may destabilize and distort the economy. In particular, if a "free of charge" scheme is imposed,[5] it could not only lead to underinvestment in data production but also harm the provision of public services when they are provided by private entities whose business models are driven by data. Such business model may become no longer sustainable and lead to the firm's collapse.

Such a policy may also distort competition between companies forced to share their data for a reuse for free and those that could reuse these data without supporting the cost of production of this input. The classical free-riding and prisoner's dilemma problems related to innovation, for instance, would appear.

Indiscriminately disclosing all data could also threaten individuals' privacy and national security. In general, national laws prevent the publication of personal data that can be traced back to the individual. Despite these legal provisions aiming to protect individuals' privacy, recent scandals show that security system can fail. (Consider for instance the Facebook/Cambridge Analytica scandal.) The most optimistic people think that the General Data Protection Regulation (GDPR), entered into force on May 25, 2018 in all European Member States, will be enough to protect privacy. But several authors underline the relative ease of re-identifying people thanks to large-scale metadata datasets. For instance, de Montjoye, Hidalgo, Verleysen, and Blondel (2013), de Montjoye, Radaelli, Singh, and Pentland (2015) showed that four spatio-temporal points are enough to uniquely identify 95% of people in a mobile phone database of 1.5 million people and to identify 90% of people in a credit card database of 1 million people. They furthermore showed that, in both cases, even coarse or blurred datasets provide little anonymity.

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[5]Economists generally support the marginal cost pricing of government data (de Vries et al., 2011, Pollock, 2008), or even zero pricing (Newbery, Bently, & Pollock, 2008). The imposition of access charges above the marginal costs of producing and distributing information results in a double of burden of economic inefficiency. The first-order effect is the curtailment of the use of the information or the increased cost of using it to produce conventional commodities and services, and hence the loss of utility derived from such products by consumers. A second round of inefficiency is incurred by the inhibition of further research which otherwise would be the source of more public goods in the form of new knowledge. But according to Pénin (2013), "gratuity is not a necessary condition for achieving openness. A piece of knowledge can be considered as open even if one has to pay in order to reuse it, provided that the fees are not prohibitive" (p. 134).

Last but not least, data of only good quality should be publicized. Open access to data that is unreliable, of low quality or that provides only one point of view of a more complex issue can result in discussions, confusions, a biased picture of the situation and wrong conclusions, wastes resources and, at the end of the day, could be detrimental for transparency and even trust in the government.

3.4 The Special Case of Postal Data

As mentioned in Sect. 2, the Commission proposes to add into the scope of the PSI Directive data held by operators acting as public service operators, such as postal universal service providers. In general, a limited set of obligations will apply to those public undertakings: they can charge above marginal costs for dissemination and are under no obligation to release data they do not want to release.[6] However, the Commission proposes to create a new category of data—data of high-value[7]—that will be defined by a delegated act. According to Article 13, these high-value datasets will have to be machine-readable, accessible via application programming interfaces (APIs), and provided for free except if an impact assessment has demonstrated that making the datasets available for free will lead to a considerable distortion of competition.

These new provisions of the PSI Directive could seriously hurt postal operators charged with universal service. Many datasets owned by postal operators risk being designated as "high-value" where allowing them to charge for their datasets, at least to recover costs of collect and maintenance, may be subject to a claim that it would lead to a "considerable" distortion of competition. How will the impact assessment be conducted? How will a "considerable" distortion of competition be determined?

Such a qualification of postal datasets could create an important distortion of competition between public undertakings and private companies that are not under the scope of the PSI directive but operate on the same markets. It could furthermore undermine the current efforts of postal operators to diversify their revenue sources by monetizing their datasets. Indeed, data monetization creates opportunities for operators that have significant data volume to leverage untapped or under-tapped information and to create new sources of revenue. Relevant data include postal codes, the name of street, the complete postal address of millions of households and businesses, the list of postal access points, and so on.

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[6]According to recital 22 and article 3 of this proposal, all documents that the public undertaking are made available for re-use will fall within the scope of the Directive and will be re-usable for commercial and non-commercial purposes under the conditions set in the Directive.

[7]According to article 2, high-value datasets means documents the re-use of which is associated with important socio-economic benefits, notably because of their suitability for the creation of value-added services and applications, and the number of potential beneficiaries of the value-added services and applications based on these datasets.

Clearly, under the current recast of the PSI Directive, this source of revenue is under threat. In particular, the national address database (NAD) is generally considered as highly valuable for the society since a broad variety of services depend on accurate, up-to-date address data, including emergency services, the police, transport services, and GPS systems. Yet, today, many postal operators monetize their own NAD (for instance, Deutsche Post has created a subsidiary Deutsche Post Direkt; Royal Mail monetizes through a license system its Postcode Address File (PAF); and so on). Open data policy puts NAD revenue at risk.

Facing the open data movement, some postal operators decided themselves to open some of their databases for free. As a test to start an exchange with the open data community, Swiss Post published at the end of 2017 an initial set of non-personal information—names of locations, municipalities and streets, details of physical access points or postcode directories—on its own platform set up especially for this purpose: swisspost.ch/open-data. In France, La Poste contributed to the creation of an open free National Address Database in 2015. This French NDA is the product of a collaboration between public authorities (Etalab, a mission of the General Secretariat for the Modernization of Public Action), public actors (the National Institute of Geographic Information and Forest and La Poste Group) and civil society (OpenStreetMap).

Nevertheless, one can question the relevance of a larger open data policy that would force postal operators to disclose data for free, whereas the maintenance of such database is clearly costly. Royal Mail's costs to manage the PAF are estimated to £24.5 million per year. Most postal databases are sensitive and constitute a strategic asset. Many data collected by postal operators during their activities are the property of their clients and cannot be disclosed without their explicit consent. Furthermore, in a time of declining volumes, revenues derived from data monetization could help finance the universal service.

As stated by the European Centre of Employers and Enterprises providing public services and services of general interest (2018), "'public services' enterprises must deliver their services in a cost-efficient way. As such, they should not be forced to give out value for free or at marginal costs to other enterprises. The risk is that the EC proposal about future delegated acts forces public undertakings to make high-value datasets available for free. This would hinder ongoing innovation in public services' enterprises by creating legal uncertainty and making investments in own data sets and existing cooperation with start-ups unstable and risky." All these considerations, together with those already mentioned about incentives to collect data and innovate, should be taken into account by public authorities in the open data debate.

4 Conclusion

Many persuasive reasons suggest not making public all government or privately held data. The most obvious is the protection of citizens' personal data and the safeguarding of strategic assets for private companies. Attempts to legally force

access to private data, even that classified as being of public interest, could be misleading and detrimental. Such measures could discourage market entry, investments and innovations, and thereby jeopardize the development of a future flourishing European Data Economy. Mandatory open data policy could be justified only by the existence of market failure, that is to say when private data of public interest are subject to under-provision due to antitrust issues or coordination failures. In this case, mandatory access might be a conceivable remedy.

Consequently, only a case-by-case approach should be followed to determine if obligatory access is the best solution among all other feasible remedies. Mandatory access should be used only to restore the functioning of markets, and only if it proves being the most effective and least invasive remedy. This assessment should take into account the resources needed, the competitive distortion involved by an asymmetric obligation, and the potential risks of misuse of these data against the hypothetical value that can be gained from publicizing the data. In other words, the decision should be taken on an ex ante cost-benefit analysis of disclosure.

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Vertical Integration in the E-Commerce Sector

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1 Introduction

We study the implications of *vertical* integration in the e-commerce sector. Specifically, we consider the possibility that a (major) retailer and/or a platform buys one or several of the parcel delivery operators, or sets up its own delivery network.

Horizontal mergers are typically considered "suspicious" and potentially anti-competitive. In the e-commerce sector, this includes the emergence of platforms, which may have significant market power both in the retail and indirectly in the upstream parcel delivery market; see e.g., Borsenberger, Cremer, Joram, and Lozachmeur (2016).

The economic literature on *vertical* mergers yields more mixed results. It generates a number of potential benefits. These include the reduction of transaction costs, technological economies, and probably most significantly, the elimination of successive monopolies or oligopolies and thus of the double marginalization they entail.[1] However, on the downside, it also involves the danger of "foreclosure". There is an extensive literature on this concept and its scope is quite large; see for

[1]See Viscusi, Vernon, and Harrington (1998) or Motta (2004) for a detailed overview of the various effects of vertical integration.

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143

instance Rey and Tirole (2007) or Motta (2004, Chap. 6). Probably the most extreme example is when the merger deprives the competing firms from an essential input and thus effectively excludes them from the market. But the concept also covers a wider range of anti-competitive practices made possible by a vertical merger, including various types of vertical restraints (tying exclusive territories, etc.), the extension of market power in one market segment (upstream or downstream) to a different market segment, the possibility to raise competitor's cost, etc.

In the postal sector this issue is particularly relevant. Some big retailers/platforms already have significant market power in their relevant markets. This would in turn lead to monopsony power towards parcel delivery operators.

In a first step, Sects. 2, 3 and 4, we assume that a major retailer buying a delivery operator and/or setting up its own delivery network will in the long run result in a vertically integrated monopoly (over both retailing and delivery). We revisit this assumption later and show how the integrated monopoly may come about when the number of active firms is endogenous. We compare the integrated monopoly to a competitive scenario with independent retailers and delivery operators. This comparison involves a tradeoff between reducing competition, which tends to increase prices, in the first scenario, and avoiding double marginalization, which will have the opposite effect, in the second scenario. Consequently, we cannot expect a general and unambiguous result. We show both theoretically and with simulations that with linear demand, the integrated monopoly sets a higher price and achieves a lower total surplus than the independent oligopoly, provided that there are at least three retailers and delivery operators. With a constant elasticity of demand, on the other hand, surplus is larger even for an independent duopoly. In this first step we concentrate on total surplus which accounts only for variable costs and not for fixed costs. In other words, social welfare is equal to total surplus minus fixed costs. This implies that a larger surplus may not be sufficient to yield greater welfare.

In Sect. 5, we define and study the equilibrium with a single integrated firm and several independent retailers and/or delivery operators. This enables us, in Sect. 6, to account for fixed costs and their impact on welfare and on the number of active firms in a setting where the number of firms is endogenous and determined by the opportunity to earn positive profits *net* of fixed costs. This issue is too complex to deal with analytically and we resort to numerical illustrations.[2]

The numerical results yield a number of interesting insights. Although the integration of a single retailer-delivery operator pair may initially improve welfare, the resulting market structure may not be sustainable when the induced decrease in the competitors' profits leads to their exit. If fixed costs are sufficiently large, which implies a small number of firms, this may well result in an integrated monopoly as the only sustainable configuration. There exists a range of fixed costs for which the integrated monopoly emerges (following a single integration) and reduces welfare

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[2]For the cases of linear and of constant elasticity demand, analytical solutions can be obtained. However, the expressions are not very telling so that examples are useful to illustrate the cases that can arise.

below that in the initial independent equilibrium, *even when the reduction in the number of separate fixed costs is taken into account.* However, multiple integration is typically welfare superior (for a given total number of firms) to the integration of a single retailer-delivery operator.

The settings discussed so far neglects one crucial characteristic of the parcel delivery sector, namely that delivery costs differ across customers. In Sect. 7 we consider a model extension in which we distinguish between two types of customers according to their location: urban or rural. Delivery costs are larger for rural than for urban customers. Based on observed business practices, we assume that delivery operators (when independent) charge a uniform delivery rate and retailers a uniform price. We also assume that a vertically integrated firm, on the other hand, is likely to deliver only in urban areas[3] and take advantage of an independent delivery operator's uniform pricing for customers in high cost areas.[4] Our assumption that the integrated firm finds it beneficial not to deliver in rural areas though perhaps intuitive, is not *a priori* obvious because the operators' delivery rate will include a markup above marginal cost. In a second step, we show through some numerical examples that this is not an empty assumption.

We reexamine the implications of vertical integration in this context, while considering the simplest possible initial situation, namely an independent duopoly (two retailers and two delivery operators). We show through analytical and numerical examples that urban integration is more likely to have an adverse effect on welfare than full integration. A crucial factor in the comparison turns out to be the proportion of rural customers (which must be sufficiently large), but at least for the considered demand functions the result obtains for proportions which are consistent with stylized empirical facts.

Throughout the paper we concentrate on presenting the assumptions and the specification of the model. Then we illustrate the main results mostly by presenting and discussing numerical simulations. We skip most of the formal developments and analytical results, which add little to the intuitive understanding of our analysis and its policy implications. Their main interest lies in showing that our results are robust and not just an artifact of the numerical specification. They can be found in the

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[3]Speaking about Shipping by Amazon service, Neil Saunders, GlobalData Retail Managing Director, said "As much as it makes sense to do this in urban areas, it is unlikely that Amazon will make a move on trying to service the American hinterland (. . .) Order densities and volumes, along with long travel times between deliveries, in many parts of the country do not justify such an investment":

https://www.marketwatch.com/story/amazon-has-a-multibillion-dollar-reason-to-build-its-own-shipping-business-2018-02-09.

In the same vein, Morgan Stanley analysts, including Ravi Shanker, expect Amazon to build out its network in "dense urban areas":

https://www.thestreet.com/story/14481908/1/amazon-sends-fedex-ups-shares-tumbling-with-reported-plans-for-business-delivery-service.html.

[4]This practice, often referred to as "cream skimming" or "cherry picking" has been a widespread concern in the postal sector both for mail and for parcels.

more extended working paper version Borsenberger, Cremer, Joram, and Lozachmeur (2018).[5]

2 Independent Retailers and Delivery Operators

There are (potentially) I upstream delivery operators $i = 1,\ldots,I$. Each delivers y_i parcels at a constant marginal cost k_i and fixed cost F_i. There are J downstream retailers $j = 1,\ldots,J$ who sell a homogenous product x_j at a variable cost $c_j(x_j)$ and pay a per unit delivery rate of t. Retailers also face a fixed cost $G_j \geq 0$. The demand for the final good is represented by its demand function $X(p)$ or equivalently, the inverse demand function $p(X)$, where X is the quantity and p its consumer price.

The timing of the game is as follow:

– Stage 1: Each delivery operator i, simultaneously with its rivals, sets a quantity of parcels y_i, anticipating the inverse input demand function induced by the second stage equilibrium.
– Stage 2: Retailer j, simultaneously with its rivals, sets a quantity of the final good x_j.
– Stage 3: Demand is realized at a price $p(X)$.

We study the subgame perfect (Cournot-)Nash equilibrium, solving the model by backward induction. We derive general price formulas and illustrate them using analytical and numerical examples. All of these assume that marginal cost is constant, $c_j(x) = c_j x$, and that demand is either linear $p(X) = a - bX$, or that demand elasticity ε defined by $|X'(p)p/X(p)|$ is constant.

2.1 Stage 2

Each retailer j chooses x_j such that

$$\max_{x_j} \quad p(X)x_j - c(x_j) - tx_j - G_j$$

where $X = \sum_j x_j$. Deriving the FOCs for each retailer $j = 1,\ldots,J$, and rearranging yields

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$$\frac{p(X) - c'_j(x_j) - t}{p(X)} = -\frac{p'(X)x_j}{p(X)} \tag{1}$$

This system of J simultaneous equations defines the (second stage) Nash equilibrium quantities $x_j(t)$ and the total output $X(t) = \sum_j x_j(t)$, and we can define an inverse demand function for the upstream market as

$$t(X) = t\left(\sum_j x_j\right). \tag{2}$$

Let us illustrate this procedure through the two examples mentioned above.

Example 1: Linear Demand

In this case, Eq. (1) is given by

$$a - b\sum_{k=1}^{J} x_k - bx_j - c_j - t = 0, j = 1, \ldots, J.$$

Summing over all j and rearranging yields

$$X(t) = \frac{J}{J+1}\frac{(a - t - \bar{c})}{b},$$

where $\bar{c} = \sum_k c_k / J$ is the average marginal cost of the retailers, excluding delivery. Inverting this function we obtain

$$t(X) = a - \bar{c} - \frac{J+1}{J}bX \tag{3}$$

Example 2: Constant Elasticity Demand

Summing (1) over j and rearranging yields

$$\frac{p(X) - \bar{c} - t}{p(X)} = \frac{1}{J\varepsilon},$$

which is the classical expression, best known in the monopoly case with $J = 1$. This equation holds for any demand function, but it yields a closed form solution only when ε is constant. Solving for t yields

$$t(X) = p(X)\left(1 - \frac{1}{J\varepsilon}\right) - \bar{c}. \tag{4}$$

2.2 Stage 1

Each delivery operator chooses y_i to solve

$$\begin{aligned} \max_{y_i} \quad & ty_i - k_i y_i - F_i, \\ \text{s.t.} \quad & t = t(X), X = Y = \sum_i y_i. \end{aligned} \tag{5}$$

This is exactly like a traditional Cournot oligopoly with inverse demand $t(X)$. Subgame perfection requires that the level of t induces a second stage equilibrium with aggregate output $X = Y = \sum_i y_i$. The FOC associated with delivery operator i's problem is given by

$$y_i \frac{\partial t(Y)}{\partial y_i} + t(y_i) - k_i = 0; i = 1, \ldots, I. \tag{6}$$

To obtain the equilibrium of the full game, one has to substitute $t(\cdot)$ from (2) and solve this system of equations. This gives us the y_i's from which we can obtain t and thus also the equilibrium outputs of the retailers x_j. The fixed costs play no direct role in this problem as they are a constant in the profit maximization problem. However, the equilibrium is sustainable only if all delivery operators realize a positive profit in equilibrium. We assume for the time being that this is the case.

To illustrate these conditions and to show how they can be used to determine the equilibrium of the full game, we return to our two examples.

Example 1

Substituting (3) into (6) yields the following equations for $i = 1, \ldots, I$

$$-\frac{J+1}{J} by_i + a - \bar{c} - \frac{J+1}{J} bY - k_i = 0$$

Simplifying, summing over I, using $X = Y$ and rearranging yields

$$X = \frac{I}{I+1} \frac{J}{J+1} \frac{\left(a - \bar{c} - \bar{k}\right)}{b}, \tag{7}$$

where

$$\bar{k} = \frac{1}{I} \sum_{i=1}^{I} k_i$$

denotes the average of the delivery operator's marginal delivery costs.

Example 2

We now substitute $t(\cdot)$ from (4) into (6) to obtain

$$y_i p'(Y)\left(1 - \frac{1}{J\varepsilon}\right) + p(Y)\left(1 - \frac{1}{J\varepsilon}\right) - \bar{c} - k_i = 0$$

Summing over i, using $X = Y$ and rearranging successively yields

$$p(X)\left(1 - \frac{1}{J\varepsilon}\right)\left(1 - \frac{1}{I\varepsilon}\right) - \bar{c} - \bar{k} = 0,$$

so that

$$p(X) = \frac{\bar{c} + \bar{k}}{\left(1 - \frac{1}{J\varepsilon}\right)\left(1 - \frac{1}{I\varepsilon}\right)} \tag{8}$$

3 N Integrated Firms

We now suppose that there are N integrated firms denoted by subscript $n = 1,\ldots,N$; here is no independent retailer or parcel delivery operator. An integrated firm maximizes total profits obtained from its up- and downstream activities. This implies that the two stages collapse into a single stage, where firm n chooses x_n that solves

$$\max_{X_n} p(X)x_n - c_n(x_n) - k_n x_n - F_n - G_n$$

The FOC is

$$p'(X)x_n + p(X) - c'_n(x_n) - k_n = 0 \tag{9}$$

We once again present the solution for the two examples.

3.1 Example 1

The FOCs are then given by

$$a - bX - bx_n - c_n - k_n = 0.$$

Summing over N and solving for X yields

$$X = \frac{N}{N+1} \frac{a - \bar{c} - \bar{k}}{b}, \tag{10}$$

3.2 Example 2

Summing condition (9) over N and solving for p shows that

$$p(X) = \frac{\bar{c} + \bar{k}}{\left(1 - \frac{1}{N\varepsilon}\right)}. \tag{11}$$

which, once again, represents a closed form solution when ε is constant.

4 Independent vs Integrated Operators

We now compare the independent and integrated equilibria for our two examples. We assume for the time being that $\bar{c}$ and $\bar{k}$ are the same under the two scenarios, and focus on symmetric equlibria. To compare total surplus we can then either compare X or p, keeping in mind that the best solution is the one which gives the larger output and the lower price. For the time being, we restrict our attention to surplus, which does not account for fixed costs. These will be reintroduced and included in the welfare analysis in Sect. 6.

4.1   Example 1: Linear Demand

In this setting it is easier to compare equilibrium aggregate output levels. Using (7) and (10) shows that the equilibrium with independent operators yields a larger output than the integrated solution if and only if

$$\frac{I}{I+1}\frac{J}{J+1} > \frac{N}{N+1}.$$

With $N = 1$, this condition is violated for $J = 2$, $I = 2$, since $4/9 < 1/2$. Consequently the integrated monopoly yields a better solution than two independent retailers and delivery operators. In other words, with two firms at each level, competition is not strong enough to compensate for the double marginalization that occurs when delivery operators are independent. Furthermore, when $J = 3$ and $I = 2$ or $J = 2$ and $I = 3$ the two solutions are equivalent. To obtain a better solution than under the integrated monopoly it takes at least three retailers and three delivery operators.[6]

4.2   Example 2: Constant Elasticity Demand

Turning to the constant demand elasticity case, we use (8) and (11) to show that an integrated monopoly yields a higher price and is welfare inferior if and only if

$$\left(1 - \frac{1}{N\varepsilon}\right) < \left(1 - \frac{1}{J\varepsilon}\right)\left(1 - \frac{1}{I\varepsilon}\right) \tag{12}$$

Suppose again that $N = 1$, $J = 2$, $I = 2$, so that (12) reduces to

$$\left(1 - \frac{1}{\varepsilon}\right) < \left(1 - \frac{1}{2\varepsilon}\right)\left(1 - \frac{1}{2\varepsilon}\right)$$

$$4\varepsilon(\varepsilon - 1) < (2\varepsilon - 1)^2 = 4\varepsilon(\varepsilon - 1) + 1$$

a condition which is *always* satisfied. Consequently, competition under vertical separation dominates as long as there are at least two retailers and two delivery operators if integration implies monopoly. It thus turns out that constant elasticity demand leads to a more intense competition. Its downward pressure on the price outweighs the cost of double marginalization even for a duopoly.

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[6]Or 2 retailers with 4 delivery operators, etc.

5   A Single Integrated Firm Competing with Non Integrated Retailers and Delivery Operators

So far we have assumed that the integration of one of the retailers and delivery operators results in a monopoly. To show how this can come about we shall now consider a setting where the number of actors is endogenous and determined as the maximum number of retailers and delivery operators who can realize positive equilibrium profits. In other words, their profits gross of fixed costs must exceed their fixed costs. The no integration equilibrium with I independent delivery operators and J retailers has been studied in Sect. 2. The equilibrium profits determine the range of fixed costs for which this equilibrium is sustainable. Alternatively one can set given levels of fixed costs and determine I and J endogenously. Either way the relevant equilibrium to consider is that determined in Sect. 2.

To study the equilibrium number of delivery operators and retailers when one pair is vertically integrated, we have to study the equilibrium with $J - 1$ independent retailers, $I - 1$ independent delivery operators and one integrated retailer cum delivery operator.

To avoid tedious repetitions, we concentrate on the proper specification of the game and the general conditions. Their counterparts for the two considered examples are given in Borsenberger et al. (2018). They are used to solve the numerical illustrations presented in the next section.[7]

5.1   Stage 2

Retailers 2,...,J solve

$$\max_{x_j} \quad p(X)x_j - c(x_j) - tx_j - G_j$$

while the integrated retailer 1 solves

$$\max_{x_1} p(X)x_1 - c_1(x_1) - k_1 x_1 - F_1 - G_1$$

The FOC's are given by

$$p(X) + p^{'}(X)x_j - c_j - t = 0, j = 2, \ldots, J \tag{13}$$

$$p(X) + p^{'}(X)x_1 - c_1 - k_1 = 0 \tag{14}$$

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[7]The other operators' prices are above marginal costs. With a single delivery area the integrated retailer will then always use its own delivery services.

5.2   Stage 1

Delivery operators $2,\ldots,I$ solve

$$\max_{y_i} \quad ty_i - k_i y_i - F_i,$$

$$\text{s.t.} \quad t = t(X_{-1}), X_{-1} = Y_{-1}.$$

The first order condition yields:

$$t^{'}(X_{-1})x_i + t(X_{-1}) - k_i = 0, i = 2, \ldots I \tag{15}$$

6   Numerical Examples

These numerical examples bring together the specifications considered in Sects. 2, 3 and 5. We use the equilibrium profits they yield to study which market structure is sustainable when the number of delivery operators and retailers is endogenously determined. This shows that for suitable levels of fixed costs, the integration of a single retailer-delivery operator pair indeed results in an integrated monopoly.

For each scenario we report only the most relevant properties of the equilibrium, including, total output as well as profits and total surplus, both of these being defined gross of possible fixed costs. However, we do examine the role played by fixed costs, both for entry and exit and for welfare comparisons.

All scenarios considered in this section assume $k = 0.05$ and $c = 0.1$.

6.1   Examples Starting with $\mathbf{I = J = 2}$

Assume that the inverse demand function is given by $p(X) = X^{-1/\varepsilon}$, so that demand elasticity is constant and equal to ε. We start from the independent equilibrium with two delivery operators and two retailers. We concentrate on a single example, namely the case where $\varepsilon = 2$ which shows the main point. Simulation results are shown in Table 1. Additional examples can be found in the companion paper Borsenberger et al. (2018).

With $I = J = 2$ the independent equilibrium (Sect. 2) yields a total output of 14.06 and a total surplus (TS) of 5.39. When retailer 1 and delivery operator 1 integrate (Sect. 3) total output is 18.04 and TS increases to 5.78. Thus in a first step, integration has a positive impact on welfare. However, when $G_2 > 0.15$ or $F_2 > 0.26$ (if one of the two independent actors disappears, there is no room for the other actor to exist

Table 1 Simulation results for constant elasticity demand ($\varepsilon = 2$) with initially 2 independent retailers and delivery operators—case where a single vertically integrated firm is formed

Scenario	2*2	1i, 1r, 1o	1i
Total surplus	5.39	5.78	5
Total output	14.06	18.04	11.11
Profit integrated	–	1.11	1.11
Profit retailer(s)	0.46	0.15	–
Profit delivery operator(s)	0.35	0.26	–

since there is no available market for them), the integrated monopoly is the only sustainable equilibrium where total output is 11.11 and *TS* is equal to 5. The independent 2*2 equilibrium is thus the only sustainable equilibrium and better than the integrated monopoly if the avoided fixed costs are not too large: $F_2 + G_2 < 5.39 - 5 = 0.39$ while we have either $G_2 > 0.15$ or $F_2 > 0.26$.[8]

6.2 Examples Starting with $\mathbf{I} = \mathbf{J} = 3$

Now for each scenario, we study whether integration leads to the exit of firms (retailers or delivery operators) for some configurations of fixed costs and study whether the equilibrium with exit leads to a lower or higher social welfare for this configuration of fixed costs. In the process we also study scenarios with multiple integrated firms.

Linear Demand

Assume $p(X) = a - bX$, $a = 20$, $b = 1$ (low elasticity of demand). Starting with the scenarios where at most one retailer-delivery operator pair integrates we obtain the results presented in Table 2.

We obtain 1i (one integrated firm) as a free entry equilibrium when $G_2 > 10.94$ and $F_2 > 16.41$. The 1i equilibrium implies a loss in total surplus of $559 - 547 = 12$ compared to the 3*3 setting but this is not enough to justify the extra fixed costs incurred in the 3*3 case. In this case integration of a single retailer-delivery operator pair appears at first beneficial.

However, Table 3 shows that for any given total number of firms multiple integration always welfare dominates that of a single retailer-delivery operator pair. Specifically, 3i dominates (2i, 1r, 1o) which in turn dominates (1i, 2r, 2o).

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[8]We use the following notation to identify the scenarios. 2*2 or 3*3 etc. refers to a market with 2 or 3 independent delivery operators and retailers; 1i, 1r, 1o, for instance, means that there is one integrated firm, one independent retailer and one independent operator. The other labels follow the same logic and should be self-explanatory.

Table 2 Simulation results for linear demand with initially 3 independent retailers and delivery operators—case where a single vertically integrated firm is formed

Scenario	3*3	1i, 2r, 2o	1i, 1r, 2o	1i, 2r, 1o	1i, 1r, 1o	1i
Total surplus	559	575	567	569	562	547
Total output	11.16	13.23	12.13	12.40	11.57	9.92
Profit integrated	–	43.78	59.58	55.40	68.40	98.50
Profit retailer(s)	13.85	10.94	19.45	6.15	10.94	–
Profit delivery operator(s)	18.46	10.94	7.29	24.62	16.41	–

Table 3 Simulation results for linear demand with initially 3 independent retailers and delivery operators—case where multiple vertically integrated firms are formed

Scenario	3i	2i, 1r, 1o	2i
Total surplus	584	580	575
Total output	14.88	14.06	13.23
Profit integrated	24.62	33.51	43.78
Profit retailer(s)		6.15	
Profit delivery operator(s)		8.20	

Table 4 Simulation results for constant elasticity demand ($\varepsilon = 2$) with initially 3 independent retailers and delivery operators—case where a single vertically integrated firm is formed

Scenario	3*3	1i, 2r, 2o	1i, 1r, 2o	1i, 2r, 1o	1i, 1r, 1o	1i
Total output	21.43	25	20.81	20.95	18.04	11.11
Total surplus	6.04	6.25	6	6.01	5.78	5
Profit integrated	–	0.625	0.90	0.89	1.11	1.66
Profit retailer(s)	0.257	0.156	0.31	0.07	0.159	–
Profit delivery operator(s)	0.214	0.156	0.11	0.37	0.26	–

Similarly, 2i yields a higher level of welfare than (1i, 1r, 1o). This is not surprising: with multiple integration double marginalization is eliminated while the number of competing retailers remains constant.

To test the robustness of these results we have considered a number of alternative scenarios with different parameter values of a and b and they all give exactly the same pattern of results. To avoid repetitions we do not report them and instead now turn to a different specification of demand.

Constant Elasticity Demand

Scenario 1 $\varepsilon = 2$

Considering the same scenarios as in the linear case we obtain the results summarized in Tables 4 and 5.

Suppose we start from 3*3 and that in a first step a single retailer-delivery operator pair integrates. Suppose that $G_j > G_{min} = 0.159$ and $F_i > F_{min} = 0.156$. While this integration yields initially a welfare gain, the resulting equilibrium is not

Table 5 Simulation results for constant elasticity demand ($\varepsilon = 2$) with initially 3 independent retailers and delivery operators—case where multiple vertically integrated firms are formed

Scenario	3i	2i, 1r, 1o	2i
Total output	30.86	27.93	25
Total surplus	6.48	6.38	6.25
Profit integrated	0.30	0.45	0.625
Profit retailer(s)		0.077	–
Profit delivery operator(s)		0.11	–

Table 6 Simulation results for constant elasticity demand ($\varepsilon = 1.1$) with initially 3 independent retailers and delivery operators—case where a single vertically integrated firm is formed

Scenario	3*3	1i, 2r, 2o	1i, 1r, 2o	1i, 2r, 1o	1i, 1r, 1o	1i
Total output	3.72	4.23	3.27	3.07	2.42	0.63
Total surplus	10.84	10.91	10.76	10.72	10.56	9.46
Profit integrated	–	0.259	0.39	0.43	0.539	0.86
Profit retailer(s)	0.114	0.064	0.14	0.030	0.066	–
Profit delivery operator(s)	0.079	0.064	0.05	0.167	0.122	–

sustainable and with endogenous entry and exit we end up with 1i as shown in Table 4. This implies a gross social welfare loss of $6.04 - 5 = 1.04$. The social welfare gain stemming from decreased fixed costs is at least $2 * G_{min} + 2 * F_{min} = 0.63$. Moving from 3*3 to 1i thus involves a welfare loss if $1.04 > 2 * G_j + 2 * F_i > 0.63$. Notice that when 3*3 is sustainable (along with $G_j > G_{min} = 0.159$ and $F_i > F_{min} = 0.156$) then the move to the integrated monopoly involves a welfare loss even when the savings in fixed costs are accounted for.

Table 5 shows the results obtained under multiple integration. Like in the linear case it shows that for any given number of firms multiple integration is welfare superior.

Scenario 2 $\varepsilon = 1.1$

As in the previous case we start from 3*3 and consider integration of a single firm. Results are presented in Table 6. When $G_j > G_{min} = 0.066$ and $F_i = F_{min} > 0.064$, we end up with an integrated monopoly 1i for which total surplus is 9.46. The gross welfare loss brought about by integration is thus 1.38. The welfare gain due to saved fixed costs is at least equal to $2 * 0.066 + 2 * 0.064 = 0.26$. Integration of a single firm and the subsequent changes in market structure thus lead to a welfare loss if the following three conditions hold: (1) $1.38 > 2 * G_j + 2 * F_i$, (2) $G_j > G_{min} = 0.066$, and (3) $F_i = F_{min} > 0.064$. The first condition is necessarily satisfied if 3*3 is sustainable.

Considering the possibility of multiple integration yields the results shown in Table 7. The pattern of results is exactly the same as in the previous scenario.

Comparing the two scenarios suggests that the range of fixed costs for which the integrated monopoly obtains and yields to a welfare reduction (even when the fixed

Table 7 Simulation results for constant elasticity demand ($\varepsilon = 1.1$) with initially 3 independent retailers and delivery operators—case where multiple vertically integrated firms are formed

Scenario	3i	2i, 1r, 1o	2i
Total output	5.53	4.88	4.23
Total welfare	11.03	10.98	10.91
Profit integrated	0.12	0.18	0.26
Profit retailer(s)		0.03	
Profit delivery operator(s)		0.04	

cost is accounted for), is larger the smaller is the demand elasticity. This is also not a surprise; a monopoly will have more market power, the lower is the demand elasticity.

The qualitative results obtained in these two scenarios carry over to other scenarios with different parameter values and particularly different demand elasticities.

7 Extension: Two Delivery Areas

We now distinguish between two types of customers according to their location: urban or rural. Delivery costs are larger for rural than for urban customers. Delivery operators (when independent) charge a uniform delivery rate and retailers a uniform price. A vertically integrated firm on the other hand delivers only in urban areas. Urban and rural customers have identical demand functions. Let α^U and $\alpha^R = 1 - \alpha^U$ denote the share of urban and rural customers respectively. Total demand is then given by $X(p) = \alpha^U X(p) + \alpha^R X(p)$. Rural and urban deliveries involve specific fixed costs denoted by F_i^U and F_i^R. Marginal delivery costs of delivery operator i, are denoted k_i^U and k_i^R.

The specification of the game and the main analytical results are presented in the companion paper, Borsenberger et al. (2018). This shows that the integrated scenario yields a lower level of output and thus a larger price and a lower welfare than the setting with independent actors as long as the share of rural parcels is sufficiently large. We show that with linear demands this is the case when $\alpha^R \geq 0.42$, a condition that appears empirically reasonable. In this paper we restrict our attention to some illustrative examples.

7.1 Numerical Illustrations

Tables 8 and 9 show cases where "full" integration of a single firm increases welfare (given the number of firms) but where urban integration decreases output and surplus.

Table 8 Simulation results for constant elasticity demand ($\varepsilon = 2$) with initially 2 independent retailers and delivery operators—case where a single vertically integrated firm delivers to the whole territory or to only urban areas

Scenario	2*2	Integration (1i + 1r + 1o)	Urban integration
Total output	11.98	15.37	10.74
Uniform delivery rate t	0.113	0.116	0.156
Total surplus	4.97	5.34	4.89
Profit integrated	–	1.03	1.07
Profit retailer(s)	0.43	0.14	0.05
Profit delivery operator(s)	0.32	0.24	0.47

Table 9 Simulation results for constant elasticity demand ($\varepsilon = 1.11$.) with initially 2 independent retailers and delivery operators—case where a single vertically integrated firm delivers to the whole territory or only to urban areas

Scenario	2*2	Integration (1i + 1r + 1o)	Urban integration
Total output	1.99	2.22	0.65
Uniform delivery rate t	0.19	0.26	0.80
Total surplus	10.39	10.47	9.48
Profit integrated	–	0.53	0.55
Profit retailer(s)	0.24	0.06	0.03
Profit delivery operator(s)	0.13	0.12	0.27

Furthermore these examples allow us to compare profits of the integrated firm across the different scenarios. When introducing this extension, we have assume that it is optimal for the integrated firm to integrate urban delivery only. While this is in line with intuition, it is not *a priori* obvious because the rural delivery rate faced by the integrated firm is subject to a markup (it is above the firm's marginal cost). Tables 8 and 9 illustrate situations where this is indeed true: the integrated retailer's profits are larger with urban-only integration.[9]

Scenario 1: $k_U = 0.05$, $k_R = 0.1$, $\alpha^R = 0.25$, $c = 0.1$, $p(X) = X^{-1/\varepsilon}$, $\varepsilon = 2$

Table 8 is based on the demand function with elasticity of 2 already used above.

Scenario 2: $k_U = 0.05$, $k_R = 0.1$, $\alpha^R = 0.25$, $c = 0.1$, $p(X) = X^{-1/\varepsilon}$, $\varepsilon = 1.11$

Table 9 revisits the case where the demand elasticity is smaller.

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[9]These are of course just illustrations. However, try as we might, we did not manage to find a counter-example.

8   Summary and Conclusion

We have studied vertical integration of a retailer and an operator in the e-commerce sector. Our main results can be summarized as follows.

First, the comparison between independent oligopoly and integrated monopoly involves a tradeoff between competition and double marginalization which will have the opposite effect. No general, unambiguous result can be obtained. However, for Cournot-Nash competition based on choosing quantity rather than price, we have shown that with linear demand we need at least 3 firms (upstream and downstream) for the independent oligopoly to yield larger surplus than with a vertically integrated monopoly. With constant elasticity demand, on the other hand, this is always true.

In the EU e-commerce markets meet these requirements. According to European Parliament (2016), three key categories of players operate in the parcel delivery sector: the so-called global integrators, such as DHL, UPS, FedEx and TNT; pan-European networks set up by national operators, such as DPD or GLS and national operators who typically provide the universal service. On the retailers' side also, more than 3 retailers compete.

Second, we have considered a setting wherein the number of firms is endogenous and determined such that gross profits cover fixed costs. We have shown that while the integration of a single retailer-delivery operator pair may initially be welfare improving, the resulting market structure may not be sustainable. Furthermore, there exists a range of fixed costs for which the integrated monopoly emerges (following a single integration) and is welfare inferior to the initial independent equilibrium *even when the reduction in the number of fixed costs is taken into account.* Within this setting we have also show that multiple integration is typically welfare superior (for a given total number of firms) to the integration of a single retailer-delivery operator.

Third and last, we have considered an extension incorporating an important feature of the delivery sector, namely that customers differ according to their location, urban or rural, involving different delivery costs. We have shown, given our assumptions that vertically integrated firms supply only urban locations and that unintegrated delivery companies charge the same fee to urban and to rural locations, that urban integration is more likely to have an adverse effect on welfare than full integration. Finally, we have provided examples where the integrated firm finds it indeed beneficial not to deliver in rural areas, even though the operators' delivery rate will include a markup above marginal cost.

All these findings echo the strategy of a major retailer who has already acquired or partly controls delivery logistics players in several European countries. It is now also entering into delivery logistics under its own banner with a cherry picking strategy: it makes its own deliveries in the most attractive urban neighborhoods.

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Prices and Conditions of Access to the Postal Network: The Principle of Non-Discrimination

Til Rozman

1 Introduction

Access to an incumbent postal operator's (PO) delivery network is an instrument for promoting competition in the postal services market.[1] Competition should create more choices for postal users, reduce prices and improve quality.[2] However, compared to other network industries, the postal sector has numerous differences including low sunk costs,[3] the questionable applicability of a "ladder of investment" theory,[4] and a reduced risk of market failure.[5] In addition, the letter market is declining and thus becoming less attractive for new entrants. Therefore, positive effects of (mandatory) access to the postal network should not be presumed. Access to the PO's network is not only provided to alternative postal operators but also to businesses, bulk mailers, consolidators and other entities that provide services involving mail preparation and/or carrying out part of the distribution process. POs often offer rebates, most typically based on volume and operational work-sharing and presorting activities.

This chapter does not necessarily reflect the views of the institution that the author belongs to.

[1]Parcu and Silvestri (2017, p. 29). See also Recital 34 in the preamble to the PSD 2008/6/EC. See also the ERGP Report (2016, p. 3).

[2]See for instance the European Commission webpage http://ec.europa.eu/competition/general/overview_en.html (penultimate sentence in the first paragraph).

[3]Geradin (2015, p. 9).

[4]Ibidem, p. 3.

[5]Parcu and Silvestri (2017, p. 27).

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Promoting access-based competition may chill innovation and harm investment incentives; whereas, promoting mixed bypass competition may threaten the financial sustainability of universal service obligations (hereinafter the "USO"). Two alternative but not necessarily exclusive[6] policy approaches, competition law (*ex post*) and sector specific regulation (*ex ante*), address access issues. The principle of non-discrimination is firmly embedded in the very core of the competition law and (postal-) sector specific regulation of access. In the EU, Article 102 Treaty on the Functioning of the European Union[7] and Articles 11, 11a and 12 of the Postal Services Directive (hereinafter "PSD")[8] form the relevant legal bases. This chapter deals with the regulatory side.

From the perspective of the principle of non-discrimination, this chapter addresses the relation between access prices and rebate arrangements and associated conditions. Building on a legal analysis of the relevant EU jurisprudence, the aim of this chapter is to answer the following hypothetical question: Does the principle of non-discrimination oblige the PO to grant identical quantity and operational rebates for access-seeking operators[9] (hereinafter "ASOs") and business senders (hereinafter "BSs"), if they both deposit the same volume of equally pre-sorted postal items at the same access points?

This chapter is organized as follows. Section 2 explains the content of the principle of non-discrimination and highlights its importance as one of the general principles of EU law. Section 3 identifies, analyses and synthesizes relevant EU postal-sector specific parts of the legal framework to assess rebates. It distinguishes legal economic reasoning for granting quantity rebates from operational rebates. Section 4 shows three possible but mutually exclusive interpretations of the principle of non-discrimination and clarifies how to properly apply the principle of non-discrimination to ASOs. Section 5 explains why, instead of a mechanical application of the relevant jurisprudence, a *mutatis mutandis* approach recognizing necessary changes is advisable. This section identifies a non-exhaustive list of arguments supporting lower tariffs and/or more favorable associated conditions for either BSs or ASOs. Section 6 concludes that different interpretations of non-discrimination enable flexibility but should not lead to arbitrariness.

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[6]Competition law and regulation address some of the same market problems and the use of one does not necessary exclude the application of the other (Dunne 2015, p. 56).

[7]OJ C 326, 26/10/2012, pp. 1–390.

[8]OJ L 15, 21.1.1998, p. 14, OJ L 176, 5.7.2002, p21, and OJ L 52, 27.2.2008, p. 3.

[9]For the purpose of this chapter, expression "access-seeking operator" refers to mixed-by-pass and access-based alternative postal operators.

2   Non-Discrimination as a General Principle of EU Law

The principle of non-discrimination is not a postal-sector specific principle. It is a general principle of EU law.[10] Therefore, to provide the "big picture" and to properly apply this (general) principle to the postal sector, we need to address the role of the principles as compared with the rules in the law (Sect. 2.1) and the content and significance of the principle of non-discrimination as a general principle of EU law (Sect. 2.2).

2.1   The Role of Principles as Compared with Rules

Most often, law is defined as a system of legal rules and legal principles.[11] Some of the rules and principles are codified, whereas others are developed through jurisprudence. From the perspective of this chapter, the most important difference between rules and principles is that rules should not conflict, whereas principles often do conflict.

The content of rules should be unambiguous and two conflicting rules cannot coexist since one of them is not valid.[12] In contrast, the content of principles is broad and equivocal. The role of principles is significant in the legal syllogism, *i.e.* the process of, first, assessing the facts of the case (minor premise) and the legal rule(s) (major premise) and, secondly, connecting the minor premise with the major premise, thus making a legal decision/conclusion. Legal rules should be interpreted and applied within the spirit of the principles. In other words, the principles play an essential part in the arguments supporting legal decision. The existence of two conflicting principles does not require a court's declaration that only one of them is valid. The court and/or the National Regulatory Authority (NRA) weigh(s) the importance of potentially conflicting principles with flexibility, since the relative importance of principles changes.

2.2   The Content and Significance of the Principle of Non-Discrimination as a General Principle of EU Law

In the jurisprudence of the Court of Justice of the European Union (hereinafter the "Court"), non-discrimination has been established as a general principle of EU

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[10]Craig and de Búrca (2015, pp. 564–566).

[11]This understanding of law is prevalent in a legal theory and has strong backing in one of the most influential legal theorist, Ronald M. Dworkin. See *e.g.* Dworkin (1967).

[12]Interpretation rules decide which of the conflicting rules is not valid. The most commonly used interpretation rules include, *lex superior derogat legi inferiori, lex posterior derogat legi priori, lex specialis derogat legi generali etc.*

law.[13] The EU legal framework and the jurisprudence of the Court have increasingly relied on equal treatment as a general principle of EU law.[14] All EU laws and measures must be read in the light of the principle of equal treatment.[15]

The general principles are part of the primary EU legislation, meaning that, on the one hand, they sit below the constituent Treaties and can be used when interpreting particular Treaty Articles. On the other hand, they sit above secondary legislation and can be used not only to interpret such acts, but also as a ground for invalidation in case secondary legislation contravenes these principles. This significant role of the general principles of EU law derives from the jurisprudence of the Court.[16]

Since non-discrimination is a general principle of EU law, its content is the same in all (postal and non-postal) settings. Similar situations must not be treated differently unless such treatment is objectively justified, but different situations can be treated in the same way.[17] It follows that prohibition of discrimination is not absolute. Infringement of the principle of non-discrimination is committed only when discrimination is not justified. Thus, discrimination may be justified and permissible.[18]

With regard to the postal sector, the principle of non-discrimination applies to all public authorities acting in the exercise of state authority (*iure imperii*), *e.g.* Article 11 PSD applies to the European Parliament and the Council, acting on a proposal from the European Commission and Article 11a PSD applies to member states (hereinafter "MS"). In addition, to applying to the state or to agencies of the state, the principle of non-discrimination applies also to treatments between private parties. As a private party and according to the fifth indent of Article 12 PSD, the PO is, when using special tariffs, obliged to apply them non-discriminatory.

The most challenging part of applying the principle of non-discrimination is to find whether two situations are comparable. To answer this question, the relevant factor for the comparison must be identified. If they both deposit the same volume of equally pre-sorted postal items at the same access points, an analysis of the relevant legal framework is necessary to determine any factor for comparing treatment of ASOs and BSs.

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[13]Craig and de Búrca (2015, pp. 550).

[14]Craig and de Búrca, EU Law, Oxford, sixth edition, 2015, pp. 932.

[15]Case C-401/11 Blanka Soukupová v Ministerstvo zemědělství.

[16]A category of general principles of EU law was affirmed for the first time in the Stauder v City of Ulm (Case 29–69).

[17]Case 117/76 and 16/77 Albert Ruckdeschel and Others v Hauptzollamt Itzehoe, paragraph 7. See also Case, C 441/12 Almer Beheer BV and Daedalus Holding BV v Van den Dungen Vastgoed BV and Oosterhout II BVBA, paragraph 47.

[18]From the economic point of view, nondiscriminatory (monopoly) prices can harm consumers more than do discriminatory prices.

3 Relevant EU Legal Framework

The relevant EU postal-sector specific legal framework to assess the meaning of the non-discrimination principle in this context comprises PSD (Sect. 3.1.) and the leading judgments of the Court (Sect. 3.2.).

3.1 Articles 11, 11a and 12 PSD

General

The aim of universal service (hereinafter the "US") is to make all users able to easily use the postal network, especially through a sufficient number of letter boxes and post offices and by ensuring satisfactory conditions with regard to the frequency of collections and deliveries.[19] Postal items may be deposited with the postal network by senders.[20]

Three Articles in the PSD are relevant for our assessment. Article 11 governs downstream access, Article 11a deals with access to the elements of postal infrastructure and provides a non-exhaustive list of such elements, whereas Article 12 sets out tariff principles applicable to each of the services forming part of the US.

Downstream Access

Article 11 PSD governs downstream access and permits adoption of harmonizing measures necessary to ensure that users and postal service providers have transparent and non-discriminatory access to the postal network concerning access to the delivery network. Such measures have not been adopted by the EU; therefore, regulation of this issue is subject to MS discretion.[21]

Access to the Elements of Postal Infrastructure

Article 11a PSD provides an instrument for MS to ensure that transparent and non-discriminatory access conditions are available to the elements of postal infrastructure or services provided within the scope of the US. The aim of this Article is to ensure that all MS assess whether some elements of the postal infrastructure or certain services generally provided by the POs should be made accessible to other

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[19]Recital 12 in the preamble to the PSD 97/67/EC.

[20]Point 3 of Article 2 PSD.

[21]Okholm et al. (2012, p. 229).

operators providing similar services, in order to promote effective competition, and/or protect all users by ensuring the overall quality of the postal service.[22]

Tariff Principles

Article 12 PSD sets out tariff principles applicable to each of the services forming part of the US and requires, *inter alia*, that tariffs and special tariffs granted by the PO must be provided in a transparent and non-discriminatory way. The aim of the tariff principles is to guarantee financial equilibrium of the USO and to limit market distortions. The US prices must reflect normal commercial conditions and costs and can depart from them only when necessary to protect public interests. For example, this Article allows MS to maintain uniform tariffs for single piece mails and for some other mail items to protect access to culture, participation in a democratic society (freedom of press), or regional and social cohesion.[23]

For the provision of services for all users, including businesses and consolidators, the PO enjoys more price flexibility in line with the cost-orientation principle. Tariffs should take account of the avoided costs, as compared to the standard service where all steps in the postal delivery chain (*i.e.* clearance, sorting, transport and distribution) are provided by the PO.[24]

Synthesis of Articles 11, 11a and 12 PSD

Reading Article 11 in combination with Article 11a PSD leads to the conclusion that the former leaves it to the MS to decide whether to regulate downstream access, whereas the latter obliges MS to ensure transparent and non-discriminatory access to elements of postal infrastructure or services provided within the scope of the US (whenever necessary to protect the interest of users and/or to promote effective competition).

As regards Article 12 PSD, combined reading of the fourth and the fifth indent leads to the finding that both types of tariffs, *i.e.* the 'tariffs' and the 'special tariffs', must comply with the principle of non-discrimination. Consequently, from the perspective of this principle, subsumption of the tariff under either the fourth or the fifth indent of Article 12 PSD is not relevant. However, only the fifth indent explicitly stipulates that non-discrimination (and transparency) apply not only to the (special) tariffs but also to the associated conditions. In addition, fourth indent applies only to the US, whereas fifth indent applies to the PO.

At this point, we can conclude that, at least to a certain extent, all three Articles prohibit discrimination between ASOs and BSs. Article 11 PSD stipulates that "/.../

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[22]Recital 34 in the preamble to the PSD 2008/6/EC.

[23]*Ibidem*, Recital 38.

[24]*Ibidem*, Recital 39.

users and the postal service provider(s) have access to the postal network under conditions which are transparent and non-discriminatory." Further, Article 11a PSD applies the "/.../interest of users and/or [promotion of] effective competition /.../" when obliging MS to ensure that transparent and non-discriminatory access conditions are available to elements of postal infrastructure or services provided within the scope of the US. Finally, according to Article 12 PSD, when applying special tariffs and associated conditions, the PO is not allowed to discriminate neither between "/.../ different third parties...[nor]...between third parties and universal service providers supplying equivalent services."

3.2 Court's Judgments

The interpretation of the principle of non-discrimination relating to the PO's rebate schemes was the cornerstone of two Court's judgments, namely Vedat Deniz v Bundesrepublik Deutschland[25] (hereinafter "Vedat Deniz judgment") (see section "Vedat Deniz Judgment") and bpost SA v IBPT[26] (hereinafter "bpost judgment") (see section "bpost Judgment").

Vedat Deniz Judgment

In the Vedat Deniz judgment, handed down in a preliminary ruling, the Court considered the following question: Is a PO that grants special tariffs to business customers that deliver postal items to the sorting office pre-sorted obliged to apply those special tariffs to other entities that collect postal items from the senders and give them pre-sorted for the postal network at the same access points and on the same terms and conditions as business customers?

The Court explained that the principle of non-discrimination requires that, if the PO applies special tariffs, they must be applied equally to third parties. The fact that certain postal services were reserved for the PO was considered as irrelevant because the PO granted its business customers, in an even more liberal way than required, access to its postal network at points other than the traditional access points and agreed special tariffs for them on that basis. Thus, in line with the principle of non-discrimination, consolidators are entitled to enjoy the same tariffs under the same conditions. In other words, PSD does not oblige the PO to apply any special tariffs but if the latter does apply them, it must apply them equally, in particular between third parties.[27]

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[25]Case C-292/06 Vedat Deniz v Bundesrepublik Deutschland.
[26]Case C-340/13 bpost SA v IBPT.
[27]Vedat Deniz judgment, paragraphs 28, 30, 41–42.

bpost Judgment

In the bpost case, it was not disputed that the PO applied quantity rebates based on turnover generated individually by each sender. Consequently, handing over equivalent volume of mails resulted in different quantity rebates for senders and consolidators. The latter received lower quantity rebates since the rebates were calculated according to the volumes generated by each sender (and not according to the sum of volumes generated by all of the senders using consolidators' services). The question referred for a preliminary ruling was whether the principle of non-discrimination in postal tariffs laid down in Article 12 PSD must be interpreted as precluding a system of quantity rebates per sender.

The Court reconfirmed its interpretation of the essence of the principle of non-discrimination, finding that comparable situations must not be treated differently, and different situations must not be treated in the same way, unless such treatment is objectively justified.[28] The Court reasoned that the objective of the quantity rebates is to stimulate demand for postal services, to exploit economies of scale. The Court found that senders are the only ones in a position to increase demand since they are responsible for originating postal items. It also stated that when the consolidators hand over mail already collected from different senders to bpost this does not have the effect of increasing the overall volume of mail. It follows therefrom that senders and consolidators are not in comparable situations as regards the objective pursued by the system of quantity rebates per sender, which is to stimulate demand. Consequently, the different treatment as between those two categories of clients does not constitute discrimination.[29]

Synthesis of the Vedat Deniz and bpost Judgments

Both cases dealt with the principle of non-discrimination regarding tariffs applicable to senders and consolidators. In both cases, the PO refused to treat both categories equally. Comparison of the Court's outcome leads to the conclusion that pre-sorting/work-sharing activities provided by either senders or consolidators generate equal cost savings (Vedat Deniz judgment), whereas handing over the same volumes of mail does not reflect equal cost savings (bpost judgment). In this context, senders and consolidators are similar with regard to operational rebates but different with regard to quantity rebates. Consequently, in the first case, the PO's different treatment constitutes discrimination, whereas, in the second case, the PO's different treatment did not constitute unjustified discrimination. Although all three analyzed Articles are relevant for our hypothetical, only one (Article 12 PSD) directly obliges

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[28]This interpretation of the principle of non-discrimination has become settled case law, *e.g.* see Case C-550/07 P Akzo Nobel Chemicals and Akcros Chemicals v Commission, paragraph 55; Case C-356/12 Wolfgang Glatzel v Freistaat Bayern, paragraph 43; see also bpost judgment, paragraph 2.

[29]Bpost judgment, paragraphs 33, 36–38, 47 and 48.

the PO not to unjustifiably discriminate. Therefore, the Court focused especially on the interpretation of the principle of non-discrimination as set out in Article 12 PSD.

4   Non-Discrimination Between Access-Seeking Operators and Business Senders

4.1   *Different Interpretations*

Building on the findings of the Sects. 2 and 3, the following Section clarifies how to properly apply the principle of non-discrimination, particularly as set out in Article 12 PSD, to ASOs.

The fourth and fifth indents of Article 12 PSD stipulate that the PO's (special) tariffs shall be non-discriminatory. Two mutually exclusive interpretations are possible. According to the first interpretation, both categories, *i.e.* ASOs and BSs, must be subject to identical (access) conditions and (special) tariffs. The opposite view, *i.e.* that the two categories are not similar, implies that lower tariffs or more favorable conditions must be given to the ASOs compared to the BSs, or vice versa. What is the difference (if any) between the fourth and the fifth indent of Article 12 PSD (Sect. 4.2) and which of the three possible interpretations is the correct one (Sect. 4.3)?

4.2   *Subsumption Under Fourth or Fifth Indent of Article 12 PSD?*

As regards the subsumption of the operational and quantity rebates under Article 12 PSD, the Court recognizes operational rebates as a special tariff under the fifth indent of Article 12 PSD. On the other hand, it avoids giving a clear answer about the quantity rebates. In the bpost judgment, the Court took the view that since the fourth and the fifth indents of Article 12 PSD stipulate (one and the same) the principle of non-discrimination, the subsumption of the (per sender) rebate scheme assessed there under either the former or the latter indent is not crucial.

Though this is correct, it creates a certain level of uncertainty whether special tariffs refer only to pre-sorting/work-sharing activities, as indicated in the Opinion of the Advocate General (AG) in the bpost case or whether they also refer to the savings from economies of scale. Unlike the fourth indent of Article 12 PSD governing (non-special) tariffs, the fifth indent of Article 12 PSD governing special tariffs explicitly requires non-discrimination with regard to both (special) tariffs and associated conditions. Consequently, the subsumption of a specific PO's pricing strategy under either the fourth or the fifth indent of Article 12 of PSD is not just

theoretical. Furthermore, the first, the second and the fourth indents apply to the US, whereas the third and the fifth indent apply to the PO (and not solely to the US).

Though the bpost judgment could be interpreted as implicitly recognizing quantity rebates as special tariffs,[30] the Court explicitly avoided giving clear answer on this question. Therefore, we follow the opinion of the AG in the bpost case and the judgment in the Vedaz Deniz case, which both stated that special tariffs refer only to operational rebates and not to quantity rebates. In these two cases, special tariffs were found to differ from ordinary tariffs in that the former "/. . ./ take account of the avoided costs, as compared to the standard service covering the complete range of features offered for the clearance, sorting, transport and distribution of individual postal items."[31]

Special tariffs apply to pre-sorting/work-sharing activities, which take into account cost savings from which the PO benefits. Pre-sorting/work-sharing activities require downstream access to the postal network, particularly to the sorting or delivery facilities of the PO.[32] Special tariffs apply only for carrying out preparatory work with mail and seeking access to the postal chain under conditions and at points different from those that apply to the traditional service.[33] Consequently, non-discriminatory special tariffs prohibit the PO's practice of treating different categories of customers differently with regard to the operational rebates. Special tariffs and associated conditions apply regardless of the identity of the customer.[34]

Unlike pre-sorting/work-sharing activities, large volumes of mails do not lead to cost avoidance but rather cost savings for the PO in the form of economies of scale. Handling and distribution of larger volumes of mails enable the PO to benefit by spreading fixed costs over a greater number of mail items. However, avoided costs relate to the third parties carrying out part of the postal handling chain. Since economies of scale do not reflect such cost avoidance, quantity rebates do not fall within the concept of special tariffs.[35]

4.3 Application of the Court's Reasoning to the Situation of Access-Seeking Operators

As indicated above, the bpost and Vedat Deniz judgments explain the similarities and differences between senders (businesses, bulk mailers etc.) and consolidators. With regard to operational rebates, the Vedat Deniz judgment clarified that both categories are sufficiently similar that the principle of non-discrimination requires

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[30]See Bpost judgment, paragraph 12.

[31]Recital 39 in the preamble to the PSD 2008/6/EC.

[32]Opinion of the AG in the bpost case, paragraph 15.

[33]*Ibidem*, paragraph 35.

[34]*Ibidem*, paragraph 41.

[35]*Ibidem*, paragraphs 41–57.

that the PO grant equal operational rebates and associated conditions. With regard to quantitative rebates, the bpost judgment clarifies that both categories are not similar, since only senders generate more volume with lower prices and, consequently, higher returns due to economies of scale. Different treatment is thus not discriminatory.

Reasoning from the bpost and Vedat Deniz judgments is applicable to the situation of ASOs. With regard to quantity rebates, the relevant factor is stimulation of demand for postal services. With regard to operational rebates, the relevant factor is cost avoidance resulting from work-sharing activities. Since ASOs are not responsible for originating postal items, they do not stimulate demand for postal services, which is the justification for quantity rebates. Consequently, ASOs and BSs are not sufficiently similar. On the other hand, if ASOs and BSs undertake identical preparatory work-sharing activities, then the PO avoids identical costs. Consequently, identical operational rebates should be granted to both categories. In other words, with regard to both types of rebates, quantity and operational, the Court's reasoning in the Vedat Deniz and bpost judgments can be applied to ASOs. In addition, consolidators and ASOs are similar in that they are the PO's but not BSs" competitors.

5 Arguments for Departure from the Court's Reasoning

The argument that "one interpretation fits all specific situations" seems oversimplified and incorrect. Instead of the uncritical application of the above reasoning to the situation of ASOs, all relevant facts and circumstances must be taken into account. Depending upon specific circumstances, departure from the application of Vedat Deniz and bpost reasoning to the situation of ASOs may be justified. In general, there are arguments supporting lower tariffs and/or more favorable associated conditions for BSs as compared with the ASOs (Sect. 5.1) and in the opposite direction as well (Sect. 5.2). The following four arguments are identified, two in each direction.

5.1 Arguments Supporting Lower Tariffs and/or More Favorable Associated Conditions for Business Senders as Compared with the Access-Seeking Operators

Prevent Cherry-Picking and Safeguard the Financial Sustainability of the USO

Uniform US tariffs for low-cost and high-cost delivery areas and uniform (*e.g.* "retail minus") access prices create opportunities for (mixed-by-pass) ASOs to use the PO's network only for delivery in high-cost areas at low prices. For delivery in low-cost

areas, the operator would use its own network, thus enabling delivery (in low-cost areas) at prices lower than the PO's (uniform) prices. In order to prevent cherry-picking and to safeguard the financial sustainability of the USO, (mixed-by-pass) ASOs should be charged more under different conditions as compared with the BSs.

Access-Seeking Operators are Not Users of the US

Article 3 PSD obliges MS to ensure that users enjoy the right to the US, whereas Article 2 defines such users as "any natural or legal person benefiting from postal service provision as a sender or an addressee". It follows that the US is reserved for users, *i.e.* senders and addressees. Since ASOs are neither senders nor addressees, they do not have the right to the provisions of the US. Instead, they have the right to access the postal network. Articles 11 and 11a PSD governing the access do not stipulate the cost-orientation principle, contrary to the second indent of Article 12 PSD governing prices of the US. Consequently, access prices and the US prices may be subject to different tariff regimes. The former are not necessary cost-oriented, whereas the latter shall be cost-oriented. For instance, in Spain, this reasoning was recognized as a sound argument for higher tariffs and less favorable conditions for ASOs as compared with the BSs, although the Spanish NRA ruled otherwise in February 2018.[36]

5.2   Arguments Supporting Lower Tariffs and/or More Favorable Associated Conditions for Access-Seeking Operators as Compared with the Business Senders

Saved Marketing and Other Costs

Even absent end-to-end competition, the PO may market or promote access to its network, even though doing so would reduce demand for upstream services that compete with the ASOs. However, if facing access-based competition, the PO's marketing activities would focus on the promotion of its full range of postal services, *i.e.* clearance, sorting, transport and distribution. The PO would target (especially business) senders that it could attract from ASOs, while saving costs by not marketing to ASO' clients that would not use the PO. In addition, the PO may save some other costs for handling postal items from ASOs as compared with the costs of handling postal items from BSs. For the former, the PO acts as a subcontractor of the ASOs. However, the PO does not incur costs (in money or time) of dealing with their senders, for instance building and maintaining business relations,

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[36]Spanish NRA's Decision of 15 February 2018 put ASOs and BSs on equal footing. [https://www.cnmc.es/en/node/367009].

handling senders' complains, etc., since these senders are not theirs but rather ASOs' clients.

Incentives for Investments in Postal Infrastructure

Lower tariffs and/or more favorable associated conditions for ASOs allow them to accumulate capital and then invest these savings in building alternative network(s). As compared with ASOs, Bs are in a different economic situation, as they do not invest in the development of their own distribution network and they do not compete with the PO operator for distribution services.[37] To promote competition between postal operators, lower tariffs and more favorable associated conditions for ASO as compared with the tariffs and/or conditions for BS could facilitate the eventual development of competing distribution networks.

6   Conclusions

EU law and the PSD have established the principle of non-discrimination, meaning comparable situations must not be treated differently. The application of this principle to the situation when consolidators and business senders provide the same volume of equivalently pre-sorted postal items at the same access points, has been addressed in the Court's jurisprudence. When comparing both categories, the Court based its decisions not on the nature of the subject (*i.e.* consolidator v. sender) but rather on the economic rationale for lower prices (*i.e.* avoided costs resulting from the preparatory/work-sharing activities and taking advantage of economies of scale). It follows that pre-sorting/work-sharing activities provided by either senders or consolidators generate equal cost savings (Vedat Deniz judgment), whereas handing on same volumes of mail by one and the other category does not reflect equal cost savings (bpost judgment).

The above reasoning should be *mutatis mutandis* applicable to the situation when an ASOs hand on same volumes of equally pre-sorted postal items at the same access points as a BS. However, a cautious approach is recommended and national specific circumstances, if they exist, should be taken into account. This chapter identified four arguments that are capable of preventing full application of bpost and Vedat Deniz judgments to the situation of ASOs. These arguments are contradictory. Two arguments support lower tariffs and/or more favorable associated conditions for ASOs and, vice versa, two arguments support lower tariffs and/or more favorable associated conditions for BSs.

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[37]This interpretation is presented as a possible one in the ERGP Report on recommendations and best practices in regulation for access to the postal network of the incumbent operator (in terms of competition, prices and quality of service) 2017, p. 24.

In some MS, such arguments can support *mutatis mutandis* application of the Court's reasoning to the situation of ASOs. But at the same time, these arguments might be seen as wrong in other MS. The ERGP report confirms that the principle of non-discrimination as set out in the EU postal legal framework can be subject to different interpretations.[38] Considered from a national perspective, they are all correct.[39]

Since non-discrimination is a legal principle, it affords NRAs/national courts greater flexibility of interpretation. In case the promotion of competition and the sustainability of the USO are conflicting, the interpretation of the principle of non-discrimination with regard to the question at issue is most likely subject to NRA's prioritization of one of the conflicting principles. To avoid arbitrariness, it is crucial that NRAs' and national courts' decisions are well understood and that predictability of law remains unquestionable, since legal certainty is fundamental.

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[38]ERGP Report on the application in access regulation of the principles of transparency, non-discrimination and proportionality as incorporated in the postal services directive (2018, pp. 44–45).

[39]These words were used by the Advocate General Nils Wahl in his opinion of 20 June 2018 in the ongoing case C-256/17 (Sandd BV v ACM) to describe different MS interpretations of PSD concepts.

The Impact of Increasing Competition for Non-Contract Parcels on Postal Prices and Efficiency Decisions

Philippe De Donder, Frank Rodriguez, and Soterios Soteri

1 Introduction

Letter volumes in countries with advanced postal networks have been declining for many years, increasing the pressure on postal universal service providers (USPs) to seek new revenue streams and increase efficiency to meet their regulatory and financial obligations. The increase in e-commerce over the past decade and associated increased demand for parcels has provided USPs an opportunity to counterbalance some of the challenges they are confronting. However, as the parcel market expands, USPs face the threat of increasing competition in the single-piece or non-contract parcel segment, especially from competitors that may be operating at the margin of regulatory requirements. In particular, private individuals and small businesses, both of whom have traditionally sent parcels via USP Post Office outlets, are being offered an increasing range of options to send them via other parcel operators using alternative acceptance points, such as local convenience stores, retail outlets and locker banks.

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This chapter develops and calibrates a theoretical model to assess USPs' finances resulting from the trade-offs they face between efficiency gains and pricing, when operating within a regulatory framework. It builds on the model developed by De Donder, Rodriguez, and Soteri (2018, referred to as DRS henceforth), where a USP operates in several postal markets (single-piece mail, bulk letters and bulk contract parcels) and faces competition in some of them. The model produces qualitative and directional insights of interest for public policy rather than numerical forecasts for a particular jurisdiction. The USP there was assumed to maximize profits over two periods during which market conditions are changing, and it is subject to regulatory price controls and uniform price constraints on some products as well as maintaining specific quality of service targets.

This chapter extends that model and the existing literature by introducing competition for non-contract parcels. More precisely, the single-piece mail market is disaggregated into single-piece letters, where the USP does not face competition from other postal operators, and single-piece parcels, where the USP faces increasing competition. This added dimension expands the trade-offs being managed by a USP to achieve a feasible rate of efficiency and deliver a normal economic rate of return. Furthermore, increasing competition in the parcels market creates added uncertainty for the regulator in regulating the overall postal market.

Section 2 outlines the model, and Sect. 3 calibrates and applies this to consider tensions and trade-offs associated with the USP achieving different levels of efficiency under different degrees of competition in the SPP market. An important and, at first sight, somewhat surprising result from our model is that an expanding and competitive parcels market can potentially result in higher letter price caps instead of reducing them. Section 4 reports model sensitivities, Sect. 5 concludes, and an appendix provides further details on the calibration of the model.

2   The Model

2.1   Operators and Markets

The model developed in this chapter extends the one presented in DRS by modelling explicitly and separately the single-piece letter and parcel markets, which were previously merged under the heading "single-piece mail". A full description of the analytical model is provided below.

There are two types of postal operators: a USP, denoted by I, and a set of competitors, denoted by E. There are five postal services: single-piece letters (SPL), bulk letters (BL), an access service for delivery of competitors' BL through the USP's network, single-piece parcels (SPP) and contract parcels (CP). In addition, there are two delivery areas in each postal market, urban (U) and rural (R). Each of the five postal markets is described sequentially.

2.2 Single-Piece Letters (SPL)

The USP is subject to a USO including provision of an SPL service of a given quality, collecting mail and delivering it at the same price to all addresses each working day in both delivery areas. It is assumed that the USP has a monopoly in the SPL market or enjoys a de facto monopoly on the SPL market as competitors do not find it profitable to offer an SPL service that can compete with all these features.

The net utility that consumers in zone $i \in \{U,R\}$ obtain from sending quantity x of SPL at unit price p is denoted by $u_i(x) - px$. The demand function for SPL in zone i is obtained by maximizing utility with respect to x, and is denoted by $x_i(p)$. We assume utility is quadratic in quantities, so that the demand function is linear, of the form $x_i(p) = \alpha - \beta p$. The unit variable cost for SPL is denoted by c_i. The contribution to USP profit of SPL in zone i is then $(p - c_i)x_i(p)$. The USP also incurs a fixed cost F in order to meet the USO in all postal markets.

2.3 Bulk Letters (BL) and Access

The USP faces competition in the BL, SPP and CP markets. Competition in the former can be end-to-end (E2E) or through access, with the USP selling both an E2E BL product to final consumers and an access service to competitors that is subject to regulatory price constraints (as outlined in Sect. 2.6). In the case of access, each unit of competitors' BL requires one unit of access to the USP delivery network. The BL products offered by both operators (I and E) are imperfect substitutes that differ with respect to non-price factors such as collection times and terms of doing business. Competitors can choose the cheapest way to deliver BL traffic, that is, they offer an E2E product if the access charge is larger than their own delivery cost, and access the USP delivery network otherwise.

The net utility obtained by consumers in zone i from consuming BL is $v_i(y_i^I, y_i^E) - q_i^I y_i^I - q_i^E y_i^E$, where q_i^j denotes the consumer price operator $j \in \{I, E\}$ posts in zone i, and y_i^j the quantity consumed of that good. The demand for goods in each zone is obtained by maximizing consumers' utility, and is denoted by $y_i^I(q_i^E, q_i^E)$ and $y_i^E(q_i^I, q_i^E)$. Note that both operators' prices influence demand for both goods, because the function v_i is non separable in y_i^I and y_i^E. The utility function $v_i(.)$ is quadratic in quantities, so that BL demand functions are linear in prices.

As for BL costs, d_i^j denotes operator j's (constant) marginal delivery cost in zone i, and b_i^j operator j's upstream constant unit cost in zone i. The competitors charge an exogenous mark-up m_L^E over their marginal cost in both cases whose level reflects the intensity of competition on the market. If the access charge a_i is smaller than the competitor's delivery cost d_i^E, the competitor chooses to access the USP's delivery network in zone i and charges a price $q_i^E = (1 + m_L^E)(a_i + b_i^E)$. If $a_i > d_i^E$, the competitor prefers to offer an E2E product in zone i, whose price is $q_i^E = (1 + m_L^E)(d_i^E + b_i^E)$.

The contribution to USP's profit of BL in zone i is given by $\left(q_i^I - b_i^I - d_i^I\right)y_i^I\left(q_i^I, q_i^E\right) + \left(a_i - d_i^I\right)y_i^E\left(q_i^I, q_i^E\right)$, in the access case, and by $\left(q_i^I - b_i^I - d_i^I\right)y_i^I\left(q_i^I, q_i^E\right)$ in the bypass case.

2.4 Contract Parcels (CP)

Competition on the SPP and CP markets is assumed to be of the E2E variety only. CP products sold by the USP and competitors are assumed to be imperfect substitutes with service specification of products differing with respect to non-price attributes such as collection times and tracking. Furthermore it is assumed that there is no substitution between CP and SPP.

The net utility obtained by consumers in zone i from consuming CP is $w_i\left(z_i^I, z_i^E\right) - s_i^I z_i^I - s_i^E z_i^E$, where s_i^j denotes the consumer price operator $j \in \{I, E\}$ posts in zone i, and z_i^j the quantity consumed of that good. The demand for goods in each zone is obtained by maximizing the consumers' utility, and is denoted by $z_i^I\left(s_i^I, s_i^E\right)$ and $z_i^E\left(s_i^I, s_i^E\right)$. Both operators' prices influence demand for both goods, because the function w_i is non separable in z_i^I and z_i^E. The utility function $w_i(.)$ is quadratic in quantities, so that CP demand functions are linear in prices.

The constant unit variable cost for CP for operator j in zone i is denoted by f_i^j. There is no need to distinguish upstream and downstream costs as no access is provided for this good. Competitors charge an exogenous mark-up m_P^E over their marginal costs: $s_i^E = \left(1 + m_P^E\right)f_i^E$.

The contribution of CP to the USP's profit is $\left(s_i^I - f_i^I\right)z_i^I\left(s_i^I, s_i^E\right)$.

2.5 Single-Piece Parcels (SPP)

Competition in the SPP market is of the E2E variety, as in the CP market, but with two caveats. First, both the USP and competitors are assumed to post a uniform price in U and R.[1] Second, consumers are assumed to bear a cost, beyond the price charged, to use the competitors' product. This cost reflects the fact that the density of contact points is, at least initially, lower for competitors than for the USP. This user cost is borne by the sender of SPP and is additional to that incurred to use the USP's SPP service. In addition, the USO obligations are assumed to require that I provides SPP at a minimum quality level.

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[1]This assumption is adopted for ease of modelling and broadly reflects conditions in European markets.

The amount of SPP sent to area $i = \{U, R\}$ by using the services of operator j is denoted by $x^j_{SP,i}$. Operator j charges the unit price p^j_{SP} for this good and the unit variable cost in area i for operator j is $c^j_{SP,i}$. As for the user costs (time and transportation) borne directly by senders, these are normalized to zero when using the I's services and denoted by cu for the additional cost senders bear in using E's products.

The net utility obtained by consumers in zone i from consuming SPP is $w^S_i\left(x^I_{SP,i}, x^E_{SP,i}\right) - p^I_{SP}x^I_{SP,i} - \left(p^E_{SP} + cu\right)x^E_{SP,i}$. The demand for goods in each zone is obtained by maximizing the consumers' utility, and is denoted by $x^I_{SP,i}\left(p^I_{SP}, p^E_{SP} + cu\right)$ and $x^E_{SP,i}\left(p^I_{SP}, p^E_{SP} + cu\right)$. The contribution of SPP to the USP's profit is $\left(p^I_{SP} - c^I_{SP,i}\right)x^I_{SP,i}\left(p^I_{SP}, p^E_{SP} + cu\right)$.

Entrants are assumed to post the mark-up m_{SP} (representing the degree of competition in the SPP market) over their average variable costs when setting their uniform price:

$$p^E_{SP} = (1 + m_{SP}) \left[\frac{x^E_{SP,U}}{x^E_{SP,U} + x^E_{SP,R}} \; c^E_{SP,U} + \frac{x^E_{SP,R}}{x^E_{SP,U} + x^E_{SP,R}} \; c^E_{SP,R} \right]$$

2.6 USP Pricing and Regulation

The USP chooses the level of its prices $(p, q^I_i, s^I_i, p^I_{SP})$ in order to maximize its profit, subject to the following constraints. First, the regulator's primary objective is to ensure the USP is able to provide universal service on a continuing basis by allowing it to make a normal rate of return (that is, the USP achieves zero economic profit and the margin made by selling all five types of services exactly covers its fixed cost F, which we assume includes a reasonable return to investors). To achieve this aim, we assume the regulator sets price caps on SPL and SPP using the same equi-proportionate mark-up on variable costs, m^R_{SP}, so that SPL and SPP consumers are safeguarded to the same extent against the possibility of excessive pricing by the USP[2]:

[2]The use of price caps in this context is qualitatively similar to the approach followed in the UK by Ofcom (Ofcom, 2012). See Cowan (2018) for a general theoretical analysis of price regulation requiring a uniform profit margin. An alternative would have been to model the constraints on securing universal service by either of the measures proposed in the Third EU Postal Directive of public funding or a compensation fund although doubts exist regarding the design and enforcement of the latter in a European context following recent court cases (see Fratini and Chovino, 2018).

$$p \le \left(1 + m_{SP}^R\right) \left[\frac{x_U}{x_U + x_R} \, c_U + \frac{x_R}{x_U + x_R} \, c_R\right],$$

$$p_{SP}^I \le \left(1 + m_{SP}^R\right) \left[\frac{x_{SP,U}^I}{x_{SP,U}^I + x_{SP,R}^I} \, c_{SP,U}^I + \frac{x_{SP,R}^I}{x_{SP,U}^I + x_{SP,R}^I} \, c_{SP,R}^I\right].$$

Second, the access charge in the BL market is set by the regulator such that $a_i = \left(1 + m_L^I\right)d_i^I$, as applied in the numerical simulations in this chapter. The regulator also sets a margin squeeze constraint such that the difference between the USP's BL price and access charge, in any zone i, must satisfy: $q_i^I - a_i \ge b_i^I$ $(1 + \phi)$, where ϕ is the mark-up over the USP's upstream cost. Third, the difference between the (higher) SPL price p and the USP's (lower) BL price q_i^I, in each zone, must be greater than the upstream preparation cost b^p of the USP's BL customers: $p - q_i^I > b^p$, $i \in \{U, R\}$.

The Appendix summarizes the calibration values of the demand and cost parameters which retain the same calibration assumptions as in DRS for all aspects of the model, except the new SPP and SPL markets.

2.7 Timing and Decisions

The model considers two periods, denoted by P_1 and P_2. All firms announce prices during P_1 at the beginning of P_1. The regulator then announces details of the price constraints it will set during the next regulatory cycle, which is assumed to last 5 years, based on its assessment of prospects for mail demand and efficiency improvements. The regulator assesses the value of e, which is the yearly percentage reduction in (both variable and fixed) costs the USP could be expected to attain, and sets the values of m_{SP}^R and the BL access price constraint for the second regulatory cycle. Reductions in costs may arise from improvements in productivity or lower wage costs or a mix of both factors. The value of e is assumed to be obtained from a rigorous efficiency review process undertaken during P_1 that yields a challenging yet achievable estimate for P_2.

The USP announces (in P_1) efficiency targets to be achieved during the next regulatory cycle, but the value of e it chooses need not equal that used by the regulator to set its price constraint.

Moving on to P_2, it is assumed that the USP efficiency targets announced in P_1 are achieved in P_2 and, with a regulatory cycle of 5 years, USP costs decrease by $5e$ by the end of P_2. For simplicity, competitors' costs are assumed to be the same as in P_1, such that e can be interpreted as the amount by which the USP lowers its costs each year relative to competitors. At the same time, and independently from the variation in costs, market volumes of both operators are assumed to follow the same trend, with volumes varying by the same proportion for any given set of prices. This variation is given by the parameter λ so that, for any given set of prices, volumes are

$\lambda\%$ higher in P_2 than in P_1.[3] Letter volumes are assumed to face a negative trend ($\lambda = \lambda^L < 0$ due to e-substitution) while parcel volumes benefit from a positive trend ($\lambda = \lambda^P > 0$, due to e-commerce).

The USP then chooses prices for P_2 to maximize profit in P_2, subject to the price constraints set above, its costs (given its choice of e) and market demand during P_2. Competitors post their prices for P_2 simultaneously.

3 Results from the Model: Single-Piece Letters and Parcels

The operation of the model in the BL and CP markets adopts the same calibration assumptions as in DRS and hence the profit-maximizing prices and volumes for these segments are identical to their reported results.[4] Some of the key results from that model are reported in Table 1 for ease of reference. The discussion below focuses on the disaggregation of single-piece mail into SPL and SPP traffic streams. The calibration values for these sectors reflect broadly the characteristics of these markets in developed economies; further information is provided in the Appendix.

The first column of results contains the base case calibration in P_1, where the regulator is assumed to set price caps for the USP's SPL and SPP services by some proportion above variable costs to allow the USP to earn a zero economic profit (that is, an accounting profit equal to 2.4 bn€ to cover fixed costs and a normal rate of return) after taking into account the impact of competition in the BL, CP and SPP markets. With respect to the SPP market, it is assumed that parcel competitors to the USP compete for traffic by offering prices at a mark-up of 3% over their variable costs for a more restrictive service in terms of sender acceptance points relative to the USP. This latter point is captured in the model by cu and set equal to 0.6€ in P_1. At the base case calibration values, the USP's SPL price is 1.105€, equal to the maximum price allowed by the regulatory cap. However, due to the competitive nature of the SPP market the USP's profit-maximizing price of 5.636€ is below the price cap of 6.63€ and competitor price of 6.00€ resulting in competitors capturing 21% of total SPP market volumes.

Letter volumes are declining by significant amounts in most developed countries while parcel volumes are growing rapidly. In the numerical simulation, similar to DRS, it is assumed that the regulator expects letter volumes in P_2 to decline by 20% over a 5 year period relative to P_1 and parcel volumes to increase by 20% and, in the light of these assumptions, sets price controls for the USP in P_1 that will allow the USP to earn a normal rate of profit in P_2 if it achieves efficiency improvements of 2%

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[3]So that, for instance, the demand function for SPL in P_2 becomes $x_i(p) = (1+\lambda)(\alpha - \beta p)$.

[4]In particular, see the results for the USP and Competitor BL and CP volumes and prices contained in DRS Table 1, under the column headings "P1 no strike" and "P2 with 2% efficiency and no strike". In both these cases competitors offer BL through access to the USP's delivery network (rather than bypass) and the prices set by the USP satisfy the margin squeeze condition set by the regulator.

Table 1 Prices, volumes and economic profit under different conditions of competition and efficiency in the single-piece parcel market

	P_1 with $cu = 0.6$	P_2 with $cu = 0$ & e = 2% p.a.	P_2 with $cu = -1$ & e = 2% p.a.	P_2 with $cu = 0$ & e = 3% p.a.
Prices, euro				
USP SPL	1.105	0.926	0.926	0.926
USP SPP	5.636	5.201	4.674	5.141
Parcel competitor SPP	6.000	6.000	6.000	6.000
All other prices as per DRS and not repeated here				
Volumes, billions of items				
Total across all markets (SPL,SPP, BL,CP)	12.766	11.485	11.503	11.558
USP SPL	1.581	1.336	1.336	1.336
USP SPP	0.153	0.173	0.143	0.176
Parcel competitor SPP (% market share in brackets)	0.040 (20.8%)	0.070 (28.8%)	0.118 (45.3%)	0.066 (27.4%)
Total SPP	0.193	0.243	0.261	0.243
All other volumes (BL, CP jointly)	10.992	9.905	9.905	9.979
USP economic profit net of fixed costs, billions of euro	0	0	−0.166	0.215
USP contribution to profit, of which:	2.400	2.160	1.994	2.255
USP contribution from SPL	1.114	0.756	0.756	0.783
USP contribution from SPP	0.497	0.526	0.360	0.547
USP contribution from BL, CP	0.790	0.878	0.878	0.925
Net consumer surplus (SPL)	2.620	2.329	2.329	2.329

Note that P_1 and P_2 refer to the last year of a 5 year regulatory cycle

per annum and avoids industrial action. The regulator monitors evolving trends in the parcels market and takes account of increasing competition in the SPP market where it expects competitors to expand their number of collection points making it easier for senders of low volume parcels to do business with them. This is captured in the model by a decline in cu from 0.6€ in P_1 to zero in P_2, a value which the market could be expected to move towards over the longer term if both the USP and competitors have equal rights to establish and use access points.

The second column of results in Table 1 contains the P_2 prices and volumes for the USP and competitors if the regulator's assumptions made in P_1 for P_2 turn out to be correct. In this specific case, while increased competition in the SPP market results in a higher market share for competitors (from 20.8% in P_1 to 28.8% in P_2) the increase in the demand for parcels and improvement in USP efficiency levels allow the regulator to reduce the letter and parcel price caps in P_2 so that the USP can

still earn a normal rate of return. Similar to P_1, the impact of competition in the SPP market results in the USP's profit-maximizing price being lower than the SPP price cap (of 5.557€).

However, the future need not turn out as expected. The results reported in the third column refer to the situation where competition in the SPP market in P_2 is higher than expected in P_1, due to say parcel competitor access points to send SPP traffic exceeding those of the USP, and is modelled by reducing cu from zero to -1€ in P_2.[5] The model results are directionally intuitive, such that when the USP faces higher levels of competition in the SPP market its profit-maximizing prices decline (from 5.201 to 4.674€), parcel competitors gain market share (from 28.8% to 45.3%) and total market volumes increase (from 243m to 261m items). In this scenario, despite achieving its regulatory efficiency target of 2% per annum, the USP makes an economic loss of 166m€ in P_2 as it is prevented from raising SPL prices by the regulatory price cap which is binding (equal to 0.926€).

The final column of results in Table 1 refers to the situation where the USP is assumed to increase efficiency by 3% per annum without incurring any industrial action, which is 1% higher per year than the assumption adopted by the regulator to inform the price control it set in P_1. In this case, the USP's costs are lower which increases the contribution to profit from all segments of mail and also leads to lower profit-maximizing prices for its SPP traffic (declining from 5.201 to 5.141€) with parcel competitors losing market share in this segment of the market (from 28.8% to 27.4%). The end result of the USP's higher than expected efficiency performance in P_2 is a positive economic profit of 215m€.

The relationship between SPL and SPP price caps and increasing levels of competition in the SPP market (represented by the sender user cost parameter, cu) in P_2 is examined further in Fig. 1 assuming both BL and CP markets remain as in the base. This plots the USP's SPL price caps and profit-maximizing SPP prices after normalizing them to equal unity in the P_2 base case where cu equals zero and the level of the SPP price caps associated with different degrees of competition in the SPP market. Table 1 reports prices for just two states of competition in the SPP market (where cu is equal to 0 and -1€). The schedules for both the SPL and SPP price caps are approximately linear[6] and slope downwards to reflect the need for higher prices to counter-balance the increasing loss in contribution from SPP traffic at higher levels of competition.

The profit-maximizing prices set by the USP in Fig. 1 result in the SPL price cap schedule always acting as a binding constraint in our calibrated model while the SPP price cap does not. In the latter case, where competition in the SPP market is low the

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[5]Amending the competitor SPP user cost parameter is the most direct way to model the impact of increasing competition in the model. The directional effects of this change would be similar to shifting the parcel competitor switching function such that competitors were more competitive at all price points which might be due to, say, an upward shift in the quality of services provided by competitors at any given price.

[6]This is due, among others, to assuming that the regulator adopts an equi-proportional mark-up rule in setting caps to derive a zero economic profit.
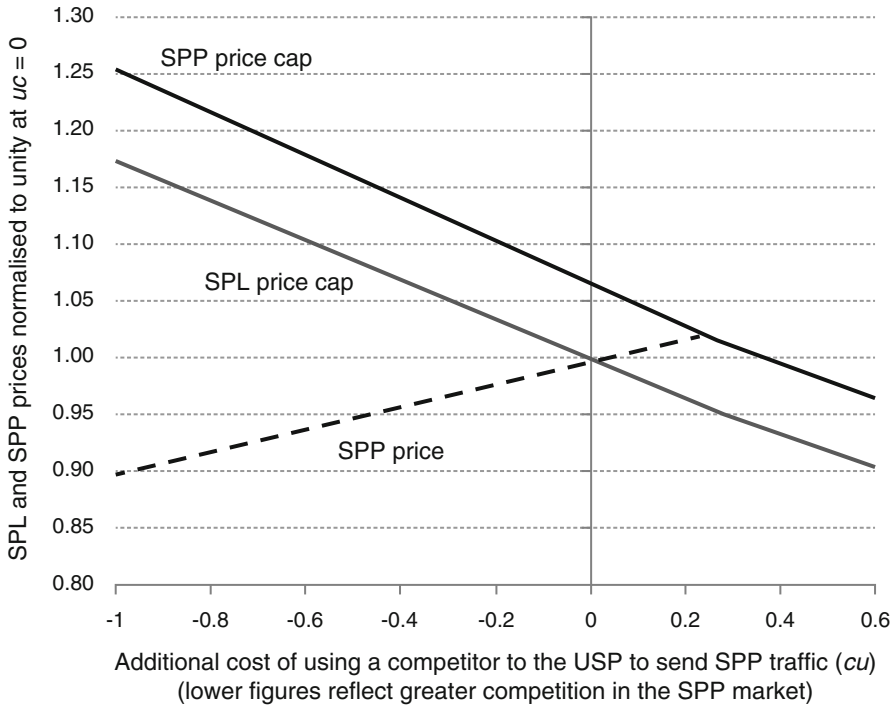
Fig. 1 USP prices in P_2 at break-even under different degrees of competition in the SPP market (e = 2%)

parcels price cap is binding but when competition increases beyond a certain point the USP's profit-maximizing price falls below the price cap. With our calibration, this switching occurs when the user cost value is below about 0.3€ and the USP's SPP price is the lower of the regulated price cap and its profit-maximizing price. An important point to note from this analysis is that the greater is the intensity of competition in the SPP market, the lower are both the profit-maximizing SPP price and the contribution of the SPP market to the USP's profit. With all the USP's products already at profit-maximizing prices except SPL and an efficiency improvement in line with the expectation of the regulator, this situation requires the regulator to raise the SPL price cap to allow the USP to earn zero economic profit. For example, with regards to the 166m€ loss in profit reported in Table 1 (penultimate column), due to competition in the SPP market in P_2 being greater than the regulator expected in P_1, this loss could potentially be offset by raising the SPL price cap from 0.926 to 1.085€ in P_2. Following the equi-proportional rule the SPP price cap would also be raised but redundant.

4   Sensitivities

This section considers the impact of additional sensitivities to the calibrated model assumptions. In each case, the sensitivity impact is a change in the USP's economic profit in P_2 relative to the base case reported in Table 1 (second column of results). The sensitivities focus on four unexpected external shocks that could impact the USP's financial position and are reported in Table 2. The first three assume that only one model assumption changes while all others remain as in the base case. However, in the fourth sensitivity the USP responds to a negative shock by adjusting its efficiency target to protect its financial position but in doing so raises the risk of industrial action taking place.

The first two sensitivities examine the impact of unexpected declines in mail volumes due to external factors. In the first, letter volumes are assumed to be 10% lower in P_2 (and so 30% below their level in P_1) due to, say, increasing e-substitution. In this sensitivity, prices and volumes remain unchanged in all segments of the parcels market, as do bulk letter prices. Furthermore, since the SPL price in the base case is at the maximum allowable under the price cap set for P_2 in P_1 the USP is prevented from raising SPL prices to offset the impact of lower letter demand and this results in a loss of economic profit of 134m€. Note that if the regulator had expected letter volumes to decline by 30% rather than 20%, then given the price inelastic nature of SPL traffic it would have set a higher letter price cap to allow the USP to breakeven, but senders of SPL mail would suffer a loss of net consumer surplus. The second sensitivity assumes parcel volumes unexpectedly

Table 2 Sensitivities to assumptions and USP changes to economic profit in P_2 relative to the base case with sender user cost equal to zero

Changes in assumptions relative to base case		Change in economic profit in P_2, €bns[a]	
1	Letter volumes lower by 10% in P_2[b]	−0.134	
2	Parcel volumes lower by 10% in P2[b]	−0.091	
3	Parcel competitor costs increase by 5% in P_2	0.163	
4	Competition in SPP market more intensive, such that $cu=-1$, and USP responds by:		
		No strike case	Strike case
	a) USP raises its efficiency target to 2.8% and increases the risk of industrial action occurring[c]	0.003	−0.460
	b) USP maintains its original 2% efficiency target and does not increase the risk of industrial action occurring[c]	−0.166	−0.516

[a]Figures refer to P_2 which is the final year of a 5 year regulatory cycle and are not comparable with the results in Table 2 of DRS which contain present value estimates covering 6 years (the final year of the previous regulatory cycle, P_1, and the 5 years of the following cycle to P_2)
[b]Changes affecting volumes are approximately symmetric in the opposite direction
[c]The assumptions underpinning the cost of a strike occurring in P_2 are similar to those contained in DRS (p.244). However, note that the strike in this sensitivity occurs in P_2 in contrast to the assumptions contained in DRS which assume it takes place in P_1

outturn at 10% higher in P_2 as opposed to the 20% increase assumed by the USP and regulator. This has no effect on the SPL or BL markets in the model. Furthermore, the downward shift in demand for parcels does not impact profit-maximizing prices for the SPP or CP segments. However, the decline in parcel volumes results in a lower contribution to profit compared to the base case, resulting in a 91m€ loss in P_2. Both these sensitivities indicate that uncertainty associated with the demand for mail can have a substantial impact on the USP's financial position and sustainability of universal service. In terms of addressing such challenges there is no simple regulatory solution, although aspects of setting price caps in an environment where a range of factors might impact the appropriate level of caps have been explored by Brennan and Crew (2016).

The third sensitivity assumes stricter labor legislation, or stricter adherence to existing legislation, results in parcel competitor costs being 5% higher in P_2 than the USP or regulator anticipated when the price cap was set in P_1. Higher parcel competitor costs feed directly through to their prices as they are a mark-up over costs. In this environment, the USP's profit-maximizing solution is to raise prices a little and also win more parcel volumes, both of which contribute to increasing profit by 163m€ in P_2 relative to the base case.[7]

The fourth sensitivity assumes that competition in the SPP market is higher than the regulator expected. This is examined by lowering the SPP user cost value to −1€. In the absence of any response from the USP and no strike action taking place, its economic profit would decline by 166m€ (as in Table 1, third column of results). However, financial pressures, especially for privatized USPs, are likely to incentivize them to respond and implement initiatives to increase efficiency faster than would otherwise have been the case.[8] In such a scenario the USP would be forced to balance the competing pressures of incurring an economic loss against offsetting this by pressing for higher efficiency gains that could lead to costly strike action taking place. For example, the results reported in sensitivity 4a suggest that if the USP could achieve a higher level of efficiency of say 2.8%, compared to the base case of 2%, and avoid a strike in P_2 it could avoid a financial loss and achieve a zero economic profit. However, the results also show that if a strike were to occur and the assumptions concerning the loss in USP traffic following a strike in P_2 are as described in the Appendix, then this would lead to a substantial loss in P_2 of 460m€. The results reported in sensitivity 4b indicate, this loss would be somewhat lower than the 516m€ loss the USP would suffer if it maintained its original efficiency target of 2%, although it is likely that the risk of a strike would be higher when targeting efficiency gains of 2.8%.

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[7]Note that the increase in parcel prices in the SPP market occurs as a result of the price cap not binding in our calibrated model. If it were to this would constrain the USP's price and only volumes would adjust.

[8]Most USPs are attempting to diversify into adjacent markets and an additional response might be for the USP to intensify further its initiatives for diversification.

5   Summary and Conclusions

The increase in e-commerce and demand for parcels has provided postal USPs with an opportunity to counter-balance to some extent the decline in letter volumes. However, as parcel markets have expanded and evolved to meet changes in consumer patterns this creates new challenges as well as opportunities for USPs. In particular, while competition is intense in some domestic bulk contract parcel markets in Europe, USPs face the threat of increasing competition for single-piece (or non-contract) parcel traffic, especially from competitors that may potentially be operating at the margin of regulatory requirements.

This article extends the model developed by De Donder et al. (2018) to examine the impact of increasing competition in the single-piece parcel (SPP) market. The model structure and assumptions consist of four key elements. First, letter volumes are in long term decline due to e-substitution. Second, the USP, unlike competitors, is required to meet a pre-specified USO. Third, the USP is subject to price controls set by a regulator seeking to secure the provision of universal service on a continuing basis. Fourth, fixed costs are inherent in meeting the USO.

Similar to De Donder et al. (2018), the model assumes the regulator sets a price control that requires the USP to achieve a specific rate of efficiency if a number of market conditions hold during the price control period for the USP to earn a zero economic profit. The model assumes the USP maximizes profit subject to regulatory constraints and the external environment it operates within, which may differ from that assumed by the regulator when setting price caps for single-piece letters (SPL) and SPP. However, since the future rarely turns out to be as expected, this article explores the impact of a number of unexpected events using sensitivity analysis to provide some important insights. In particular, if competition in the SPP market turns out to be greater than expected at the time of setting regulatory price caps, a USP could incur a significant financial cost if it was unable to increase its operational efficiency program to counter-balance losses. Or, if as a result of trying to achieve higher efficiency savings, it triggered costly strike action. Our results also show that increasing competition in the SPP market implies higher price caps should be set for SPL and possibly also for SPP, although the latter may not always be binding if there is sufficient competition in the SPP market.

The article models a number of other sensitivities resulting from unexpected shocks, including lower levels of demand for letters and parcels, higher parcel competitor costs resulting from changes in labor regulations (or stricter adherence to existing legislation) and higher efficiency levels while avoiding strike action. The direction of movement in the USP's financial position resulting from these sensitivities is consistent with economic theory. Furthermore, to a first approximation the individual sensitivities are symmetric in terms of their direction of movement and broadly additive which, to some extent, allows these to be combined numerically.

A key point to note from these sensitivities is that a range of plausible external shocks could have a substantial impact on the USP's financial position, even if it were to deliver its efficiency targets, and that fixed pre-determined single-piece price

caps could impose a significant constraint on the USP's ability to achieve a normal rate of return. Aspects of setting price caps in an environment where a range of factors might impact on their appropriate level have been addressed in recent literature (Brennan & Crew, 2016). This chapter has highlighted the importance of allowing for a number of such factors, and the uncertainty inherent in many of them, in setting a framework which is able to underpin the financial sustainability of universal service.

Appendix: Calibration for Simulations

(A) *Demand*. For SPL, BL, SPP and CP markets, when the retail price of the good considered is the same in both zones, the urban zone represents 80% of total volumes, and the rural zone 20%.

SPL market: at a price of $p = 0.667€$, total volume of 1.8bn items, and direct price elasticity of demand of -0.2.

SPP market: hypothetical monopoly setting: at a price of $p_{SP}^I = 4$, demand price elasticity of -0.2 (in both zones), and total volume of 0.2 billion items. With competition, displacement ratio $-\left[\partial x_{SP,i}^I\left(p_{SP}^I, p_{SP}^E + cu\right)/\partial p_{SP}^E\right]/\left[\partial x_{SP,i}^E\left(p_{SP}^I, p_{SP}^E + cu\right)/\partial p_{SP}^E\right] = 0.75$. USP market share of 70% when $p_{SP}^I = p_{SP}^E = 6$ and cu $= 0.6$ and of 90% when $p_{SP}^I = 6, p_{SP}^E = 6.6$ and cu $= 0.6$.

BL market: hypothetical monopoly setting: at a price of 0.4, demand price elasticity of -0.4 (in both zones), and total volume of 7.5 billion items. With competition, displacement ratio $-\left[\partial y_i^I\left(q_i^I, q_I^E\right)/\partial q_i^E\right]/\left[\partial y_i^E\left(q_i^I, q_I^E\right)/\partial q_i^E\right]$ of 0.9. Market share of 25% for competitors when $q_i^I = q_i^E = 0.4$ and of 50% when $q_i^I = 0.4$ and $q_i^E = 0.36$.

CP market: assuming that the USP price in the urban (resp., rural) area is 1.9 (resp., 2.4) and that competitors are 10% more expensive than the USP, demands are calibrated so that (i) the displacement ratio is 0.75, (ii) the demand price elasticity is -0.2, (iii) the USP volume is 0.4 (resp., 0.1), (iv) the USP's market share is 35%. For equal USP and competitors' prices, the USP's market share is 10%.

(B) *Costs (in P_1)*.

SPL market: unit variable cost c_i of 0.38 in urban area ($i = U$) and 0.48 in rural area ($i = R$).

SPP market: unit variable costs: $c_{SP,U}^I = 2.28, c_{SP,R}^I = 2.88, c_{SP,U}^E = c_{SP,R}^E = 5.83$.

BL market: same upstream variable cost in both zones for both operators: $b_U^I = b_U^E = b_R^I = b_R^E = 0.02$. Upstream preparation cost of the USP's BL final customers: $b^P = 0.15$. USP's downstream cost: $d_U^I = 0.19$ and $d_R^I = 0.34$. Competitors' downstream cost: $d_U^E = 0.28$ and $d_R^E = 0.74$.

CP market: unit variable costs: $f_U^I = 1.14, f_R^I = 1.44, f_U^E = 2, f_R^E = 2.6$.

USP: fixed cost of $F = 2.4$. All (variable and fixed) USP costs decrease by $5e\%$ between P_1 and P_2.

(C) *Mark-ups*. USP mark-up for access charge set by the regulator: $m_L^I = 0.1$ and $\phi = 2/3$. Competitors' mark-up in BL market: $m_L^E = 0.02$; in SPP market: $m_{SP} = 0.03$; and in CP market: $m_P^E = 0.03$.

(D) *Exogenous variations in volumes*. Exogenous volume trend between P_1 and P_2 for letters are $\lambda^L = -0.2$ and for parcels $\lambda^P = 0.2$.

 If a strike occurs in P_2 (see sensitivities 4a and 4b in Table 2), USP volumes are assumed to decrease by a fraction $\gamma^L(e)$ in the SPL and BL markets, and by $\gamma^P(e)$ in the SPP and CP markets. The functions γ^L and γ^P are both increasing in e, as the announcement of a larger decrease in costs is likely to result in more severe industrial action. In particular, the volume loss by the USP in the case of a strike in P_2 as a proportion of the USP's pre-strike volume is equal to $\gamma^L(e) = 0.04 + 4e$ and $\gamma^P(e) = 0.08 + 8e$, where e is expressed as a proportion (for example, $e = 2\%$ as $e = 0.02$). Competitors' volumes are similarly affected in the BL market (since the USP delivers these volumes on the competitors' behalf, at equilibrium). As for the SPP and CP markets, a fraction $\beta = 0.8$ of the volumes assumed to be lost by the USP due to the strike is diverted towards the competitors. So, for instance, in the CP market, USP demand when a strike occurs in P_2 becomes $\left(1 + \lambda^P\right)\left(1 - \gamma^P(e)\right)z_i^I\left(s_i^I, s_i^E\right)$ while the competitors' demand becomes $\left(1 + \lambda^P\right)\left(z_i^E\left(s_i^I, s_i^E\right) + \beta\gamma^P(e)z_i^I\left(s_i^I, s_i^E\right)\right)$.

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Disoriented No More: An Economics Compass for the EU's Cost Orientation Principle

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1 A Key Technical Topic for Postal Policy and Market Development

Postal incumbents across the world are often subject to price-cost rules. The motivation for our paper is the discussion within the EU and elsewhere of this relationship, against a backdrop of a somewhat ambiguous framework and uncertain and diverging implementation of regulatory price-cost tests.

In practitioner parlance in Europe—and in this paper—the cost orientation principle refers to a legal provision in Article 12 (second indent) of the EU Postal Services Directive (hereafter the "Postal Directive"), which states that "prices shall be cost-oriented and give incentives for an efficient universal service provision.. . ." The Article 12 text is only a generic statement on cost orientation. As a result, Member States have implemented different approaches (Copenhagen Economics, 2012). Depending on how the cost orientation principle is implemented via regulatory-mandated and postal operator-designed rules and policies to cost orientation, this can become the basis for allocating costs among postal services and for pricing restrictions.

Different interpretations of the cost orientation principle, while conceptually possible within the Postal Directive, may have vastly differing implications on postal prices and thus on the functioning of postal and delivery markets. Thus, although cost accounting and pricing rules may superficially be the domain of the technical, they can significantly affect service output, competition and market performance. Regulators regularly engage with firms, scrutinizing their pricing and appraising reported cost information.

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The European Commission has sought to provide some clarity in its staff document accompanying its review of the Postal Directive, stating that the purpose of a cost orientation principle set out in Article 12 is two-fold: "The cost-orientation requirement aims not only to prevent prices of basic postal services from being too high, but also to prevent pricing below service specific costs, which could restrict competition and could therefore lead to higher prices in the long run." (European Commission, 2015, p. 20).

Moreover, it is not just specialists who have considered the policy implications of the relationship between postal costs and prices. High-level policymakers from the executive branch have also expressed concerns in this area, raising open questions. For example, not long ago the European Commission Vice President for Digital Single Market highlighted what were perceived as unexplainably high cross-border single-piece parcel prices (European Commission, 2017). More recently, the US President issued a high-profile series of statements on the pricing of the US Postal Service negotiated bulk parcel agreement with Amazon, based on a concern that the price does not cover the "real cost" (Bloomberg, 2018, April 21; The New York Times, 2018, April 4).

The judiciary has been called to adjudicate on the limits of the interpretation of regulatory price-cost tests in the postal sector. The US Postal Regulatory Commission has a stated requirement that all products cover the costs they impose on the Postal Service; this has been debated at length in regulatory and court proceedings.[1] The cost orientation principle set out in Article 12 of the EU Postal Services Directive was the subject of a recently closed European Court of Justice case.[2]

As a result, cost orientation is increasingly receiving attention from academics, policy makers, regulators and postal operators alike. The present paper contributes to the literature and policy discussion by reappraising the policy objectives underpinning a cost orientation principle, in particular, the use of price-cost tests for the purpose of ex-ante regulation of postal markets. We set out a conceptual framework and a practical toolbox to inform regulatory practice on how best to navigate the open-ended nature of the cost orientation principle. This can help regulators and operators to select the relevant cost benchmark and level of application to test cost orientation of postal prices.

To interpret cost orientation, it is key to identify first the policy objectives to be pursued via cost orientation rules (Carslake et al., 2017). Indeed, multiple parallel economic policy aims are potentially associated with the cost orientation principle in the EU Postal Directive (Copenhagen Economics, 2012). We will focus

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[1]US Court of Appeals for the District of Columbia Circuit. (2018). Case No. 16–1354, United Parcel Service Inc. vs Postal Regulatory Commission.

[2]See Advocate General opinion issued on 20 June 2018 in the case Sandd BV v Autoriteit Consument en Markt (Case C-256/17) with a particular focus on the interpretation of Article 12 of the Postal Directive.

on interpreting cost orientation in terms of three objectives, namely to promote efficiency, prevent prices that may lead to unlawful foreclosure of competition, and prevent prices being too high from the exercise of market power.

Based on these policy objectives, we set out which economic interpretations of the cost orientation principle are conceptually consistent and useful for policy makers to achieve their aims with the least unintended consequences and distortions. We discuss how the choice of cost benchmark and level of application (granularity) are interlinked and have to be analyzed in combination in order to define their impact on the above three policy objectives linked to the cost orientation principle.

Trade-offs between policy objectives are inherent, and cost orientation is no exception, as remarked in the European Court of Justice Advocate General Opinion in the Sandd case.[3] The promotion of efficiency can be in conflict with other objectives that may also be pursued via cost orientation. The paper considers the impact of applying cost orientation rules at a granular (service-specific) level on the trade-off between efficiency and the other two policy objectives identified.

Section 2 starts by reviewing the economic theory of pricing in multi-product regulated firms, which establishes the importance of retaining pricing flexibility in order to promote economic efficiency. Section 3 considers the application of cost orientation rules as a way to prevent too low postal prices; it discusses the conditions for cross-subsidization concerns under EU regulation and the relevant cost measures to test for anti-competitive effects (i.e. foreclosure or predatory pricing enabled by cross-subsidization). Section 4 analyses the application of cost orientation rules as a way to prevent too high postal prices; it discusses concerns for excessive pricing vs safeguarding the affordability of postal services and the role of cost orientation tests. Last, Sect. 5 concludes by setting out an economic interpretation of the cost orientation principle and discusses the flexible adaptation of the application of such principle to market circumstances across countries so to meet national-specific market context and policy aims.

2 Regulatory Economics Literature Highlights Pricing Flexibility in Order to Promote Efficiency

2.1 Allocative Efficiency Depends on Pricing Matching Demand Elasticity

Efficient use of postal services implies that market output should be at the appropriate level. In economic terms, this is referred to as a component of *allocative efficiency* (Cabral, 2000, p. 26). In addition, general economic literature is clear that

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[3]See Advocate General opinion issued on 20 June 2018 in the case Sandd BV v Autoriteit Consument en Markt (Case C-256/17).

in a first-best scenario without fixed and common costs, efficient prices should depend on marginal costs[4] and demand.[5]

The reasoning is as follows: First, the buyer should bear the costs her consumption generates for the provider. For a multi-service company such as a postal operator, under a theoretical ideal, allocative efficiency would imply that prices are set at marginal cost. However, real-world provision of postal and delivery services entails a degree of fixed and common costs. Unlike other network industries where fixed capital costs are prevailing, delivery is labor intensive; however, labor assets have often tended in the postal sector towards a fixed asset due to employment terms.[6] Moreover, labor and other resources support the concurrent provision of multiple different services.

Thus, for postal operators to cover their total costs, pricing all services only at marginal cost is not a viable alternative, because this will not ensure full cost coverage. Hence, at least some prices have to exceed marginal costs. On the other hand, postal operators cannot price too high above marginal costs, because it may reduce demand of postal services too much. The efficiency maximization question thus becomes how to ensure prices that distort the use of postal services as little as possible. To find this balance, prices have to depend on demand, since demand for each service determines what share of the common costs this service can and should efficiently bear.

Economic theory shows that, from a welfare perspective, the optimal (ideal) way to set prices is Ramsey pricing (Baumol, 1979; Braeutigam, 1980; Bradley & Price, 1988). This pricing approach implies that prices are set according to price sensitivity, such that prices are low for services with high price sensitivity and high for services with low price sensitivity. Consequently, customers with low willingness to pay are able to acquire a service that they might have found undesirable if they had faced the prices set with all the direct and common costs included in such price.

Box 1 Ramsey Pricing vs FAC-Based Pricing
The following possible approaches to pricing both achieve the recovery of the costs of the whole firm, e.g. past costs:

- *Pricing at Fully-allocated/fully-distributed costs (FAC, i.e. FDC), or average total costs (ATC):* a cost standard that consists in allocating categories of costs, which can be directly or indirectly attributed to services, so that no costs are left unallocated. These categories of costs are direct costs, joint costs and common costs. When an Equi-Proportional Mark-Up rule (EPMU) is adopted, this induces equal margins across products.

(continued)

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[4]Cost variation of changing output by one unit.
[5]Tirole (1988), Varian (1990).
[6]The specific degree to which this takes place may differ from case to case.

> **Box 1** (continued)
> • *Ramsey pricing: w*hile the approach based on FAC&EPMU allocates all costs with equal margins, Ramsey pricing takes marginal costs as a starting point and then sets prices so to obtain product margins based on the inverse elasticity of demand facing the firm for each product.[7]

2.2 Implications on the Role of FAC for Regulatory Price Rules

Based on relevant contributions from economic theory, we consider that a cost orientation principle should not be interpreted to imply that each particular service must cover all its Fully Allocated Cost (direct costs plus a share of common costs allocated to such particular service, often based on an equal markup of the price for each service). In a nutshell, Ramsey pricing suggests that such an interpretation of cost orientation would reduce economic welfare.

Let us consider a situation where a regulator gathers the FAC info (product by product) from regulatory accounts of the postal operator and then wishes to test cost orientation on each product by making a comparison between product price and its FAC. Most regulators can gather this information (even if the approach to building the FAC can vary) and it is apparently straightforward to compare known product prices to corresponding FAC entries.

Nevertheless, several studies confirm the inefficiency of FAC. Bishop (2005) finds that pricing different from FAC is likely to improve consumer welfare in cases where this pricing leads to an increase in total sales and a wider selection of products for users; see also Schmalensee (1981) and Varian (1990). Consequently, prohibiting firms from setting non-cost-oriented prices that are different from FAC may not benefit users if it creates a fall in total output and reduced choice of products and services for mailers. This might happen, for example, if prices rise above the thresholds some consumers are willing to pay, who therefore stop buying the product in question.

Because postal operators may have better information about demand sensitivities (i.e. elasticities) than their regulators, regulators often give the regulated firm flexibility in their pricing. An example would be a price cap where the regulated firm is free to set the individual prices as it prefers as long as the weighted average price stays below the allowed price cap (depends on choice of weights, prior year output for instance). Notably, prices under price cap regulation are expected to converge to Ramsey-like prices (Brennan, 1989).[8]

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[7]ERGP (2012).

[8]In the original Ramsey approach, the regulated firm earns no profit.

In other words, a profit-maximizing postal operator will choose Ramsey pricing if it is given flexibility. Therefore, all regulatory approaches based on price flexibility will not function if there is a rule forcing each price to match exactly the FAC.

In contrast, fully distributed methods used to allocate common costs are essentially discretionary and not fit for pricing purposes. Brown and Sibley (1986, p. 49), referring to FAC (also known as FDC), point out that, "Different FDC allocation methods are essentially arbitrary, yet can lead to widely different results. [. . .] there is no effort in FDC pricing to increase economic efficiency; Also, price elasticities of demand have no place in setting FDC rates, except perhaps in forecasting revenue, so FDC prices will generally be much different from Ramsey prices."

The granularity of the level of analysis matters too. When NRAs in the EU rely on FAC information to interpret the cost orientation principle, it is common to do so on a higher level than the FAC of each specific service—instead considering the set of FAC across a basket of services (or entire USO). This is a comparison of basket-wide revenues (i.e. volume-weighted prices) to (volume-weighted) costs. This allows USPs to price flexibly within the limits of competition law and prevent excessive profits on the overall basket of services, e.g. the set of universal services as a whole.

Insofar as a national regulator wishes to analyze FAC cost info, considering it at a higher level than individual services also supports the policy objective to promote efficiency, as it permits the regulated postal operator to pursue efficient pricing (Ramsey prices) within the broad basket considered. If instead a regulator were to interpret cost orientation to imply that each individual service (tariff) should be equal to its FAC, efficiency will be reduced, because there would then be no room to differentiate prices according to demand. In order to increase efficiency, the broader the basket, the more flexibility the USP will have to match prices with demand. Therefore, if a regulator chooses to apply price (or revenue) tests based on FAC information, economic welfare is maximized when such tests are applied at a higher level of aggregation.

3   Testing that Prices Are Not Too Low

3.1   The Role of Common Cost Allocation in the Economic Test for Cross-Subsidization

As discussed in the previous section, the existence of fixed and common costs induces a second-best scenario that creates a pricing challenge for multi-product firms. The recovery of fixed and common costs is the rationale for flexible, demand-based pricing. The flip-side of the question is how little of the common costs can be recovered by an individual product? At what point do prices of a postal product become too low?

Box 2 Key Cost Concepts for Price-Cost Tests
All of the following cost standards are forward-looking (based on counterfactuals) and estimate the variation in costs for specific product(s):

- *Long run incremental costs (LRAIC):* the cost variance when the production output increases or decreases in a discrete increment, for example a service line—i.e. the average of all the (variable and fixed) costs that a firm incurs to produce a specific product. LRAIC and average total cost (ATC) are good proxies for each other, albeit from a different perspective. For multi-product firms with economies of scope, LRAIC would be below ATC for each product, as true common costs are not taken into account in LRAIC. Instead, in the opposite extreme case of a single product firm, LRAIC and average total cost (ATC) converge
- *Average avoidable costs (AAC):* the average of the costs that could have been avoided if the company had not produced a discrete amount of (extra) output. Avoidable costs can measure also the firm's activities taken over by a user or competitor when they use some of the firm's network resources (but not the full service). Where it is only variable costs that can be avoided, AAC and the average variable cost (AVC) will be the same, as it is often only variable costs that can be avoided (European Commission, 2009, §26, footnote 2).
- Stand-alone cost (SAC): a cost standard that measures the cost of providing a service by the operator in isolation to other services of the company.

A range of contributions in the economic literature (Areeda and Turner, 1975; Faulhaber, 1975; Baumol, Panzar and Willig, 1988; Braeutigam, 1989; Viscusi, Vernon and Harrington, 2005) finds that, when testing for cross-subsidies, the least economically distortive cost benchmark is incremental costs (either LRAIC or AAC measure, depending on the case). When pursuing an antitrust benchmark, the economic test for cross-subsidization does not include allocation of common costs. In the regulatory domain, an antitrust-informed test of distortive cross-subsidies could be to check whether prices are below incremental costs for services with strong competition (Heald, 1996, p. 59). O'Donoghue & Padilla (2013, Sect. 6.4.4) and Eccles (2010, p. 41) have discussed what level of costs should be covered, before a service in the more competitive market would be considered as being cross-subsidized.

Notwithstanding a degree of open-endedness in the literature, a shared conclusion is that when the cross-subsidized service covers less than its *incremental* costs, in this case cross-subsidization will negatively affect competition. Additional circumstances may exist, such as evidence of an anti-competitive intent for the pricing policy.[9]

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[9]See e.g. in EU law the criteria set out in the CJEU AKZO Chemie BV vs European Commission case C-62/86.

Where prices are below incremental costs, competitors who could provide the services at or below the incremental costs of the dominant provider can be foreclosed. This means that one key situation where competition is harmed is when services in competitive markets do not cover their incremental costs. Where this pricing is enabled from the pricing of services in uncompetitive markets (covering more than their stand-alone costs) this is a clear instance of anti-competitive cross-subsidy. The Court of Justice of the EU confirmed this approach in the Post Denmark I case,[10] following an earlier European Commission decision in the Deutsche Post case.[11]

It is not fully-allocated cost but instead it is incremental cost which ultimately should be used to test for cross-subsidies (Braeutigam, 1980). Therefore, a mere comparison of price to FAC is unlikely to be truly informative on whether prices are too low to be held cost oriented. Instead, a deeper analysis is required to reach a conclusion about harmful cross-subsidies. When considering ex-ante whether a price is so low to be exclusionary, a regulator—in situations where the price is below FAC—would have to establish that the price is below incremental cost. In EU case law, the cost standard is LRAIC (Deutsche Post and Post Danmark I), not FAC. Hence, FAC information at the level of each individual service will not provide what is needed for the relevant price-cost test. Besides, the relevant product market differs from case to case and may not be identical to an individual service.

Moreover, on this point, the European Commission Deutsche Post ex-post antitrust enforcement case provides detailed guidance.[12] In fact, the Commission, upon assessing anti-competitive cross-subsidization, stressed that the relevant incremental cost measure should not include fixed and common costs.[13]

3.2   Orienting Concerns Based on Market Conditions and Directions of Cross-Subsidies

We have discussed above the possibility of anti-competitive cross-subsidization, which would go against the EU regulatory cost orientation principle. While the focus of our paper is on cost analysis under ex-ante regulatory powers, separately, competition law assigns to competition agencies the responsibility to enforce ex-post anti-competitive pricing abuses and (for the European Commission) to enforce State Aid rules.

A postal operator provides a multitude of services; a very large number of potential cross-subsidy flows exist at any point in time. Not all of them may be harmful from a competition viewpoint. On the contrary, efficient Ramsey pricing is

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[10]CJEU Case Post Danmark A/S v. Konkurrencerådet, European Court of Justice Case C-23/14.

[11]European Commission (2001), p. 6.

[12]European Commission (2001), pp. 16.

[13]European Commission (2001), footnote 7.

expected to generate different margins across a postal operator's set of products. Thus, the questions for a regulator, before considering concerns of too low pricing (excluded by our interpretation of the EU's cost-orientation principle) are how to screen for potential harm, where to look and what information to seek.

To answer these questions, it is useful to consider at a high level the likely theory of harm. Across Europe, a general (with exceptions) market situation has been that services included in the USO have been less competitive than those outside the USO. Against this backdrop, a main competition concern is that universal service providers (USPs) could use their less-competitive traditional mail business (e.g., USO services as a whole) to cross-subsidize in a foreclosing manner services outside the USO (exposed to a greater competition).

EU Member States and regulators, when defining and applying ex-ante powers in the postal sector, are informed by the architecture of the USO rules. This should naturally limit the extent and type of concerns that postal regulation can address. The EU Postal Services Directive does not distinguish between services based on whether they face weak or strong competition, but on whether they are part of the USO. This distinction is normally aligned with a distinction based on competitive pressure, yet some USO services may face competition too. Table 1 presents the four possible directions of cross-subsidy and implications for regulatory screening.

Cross-subsidization from USO to non-USO services, situation 1 in the table above, is the key theory of harm. This is since universal service providers historically (under the first and second Postal Directive) had reserved rights for all or a large part of the USO. Insofar as universal postal service providers may still have strong market power (even after liberalisation and the emergence of competing electronic communications services), this raises the potential concern of predatory conduct, complicated in the case of State-owned operators (Crew & Kleindorfer, 1986, 2002; Sappington & Sidak, 2003). Moreover, since EU law enables member States to grant lawful State Aid to postal operators for the provision of USO services, it is particularly important to prevent the set of USO services from enabling anti-competitive, predatory pricing in non-USO markets.

When the concern is between USO and non-USO services, cost information on individual USO services is not needed. This is so because the potential concern here is a situation where a cross-subsidy is generated from the USO as a whole. Thus, a

Table 1 Four possible directions of cross-subsidy

Situation	FROM Where is cross-subsidy profit generated?	TO Where is cross-subsidy received?	Where to focus the analysis?
1.	USO services	Non-USO services	USO vs. non-USO
2.	USO services	USO services	USO vs. USO based on degree of competition for different services
3.	Non-USO services	Non-USO services	Outside the scope of the EU postal services directive
4.	Non-USO services	USO services	USO vs. non-USO

Source: Copenhagen Economics

sufficiently effective test to check whether there is a source or not of cross-subsidy is to compare the USO-wide costs to its revenues (i.e. a price-cost test applied at a basket level).

Second, in theory, harmful cross-subsidization could also happen among services inside the USO, situation 2 above. This situation is unlikely where the USO scope is very narrow (e.g. limited to single piece mail). This type of cross-subsidy can only be a concern in countries where the USO covers services with very different competitive conditions, such that some USO services can generate profits that may be used to eliminate competition for other USO services. However, often the services within the Universal Service Obligation face similar competitive pressure. Therefore, situations with cross-subsidy concerns within the USO (i.e. situation 2 in the table) are not typical.

If market conditions justify a concern of this kind, it is important to note that, while a concern for cross-subsidy within the USO may warrant a breakdown of the USO costs into sub-categories, it does not imply that FAC information on each and every individual USO service is necessary. Instead, the focus of price-cost analysis (e.g. incremental cost test) should be determined by the market conditions including the exercise of defining relevant markets and the specific competition concern. If not, this could lead the regulator to absurd conclusions and inefficient analysis. Consider for example services with pricing set low due to socially-based requirements, such as free mail services for the blind: this would not be expected to be an area of pricing concern, even if prima facie it is a USO product by definition priced below cost.

Third, there may be cross-subsidies between non-USO services, situation 3, but that is outside the scope of the Postal Directive. The Postal Directive clearly does not oblige USPs to allocate all costs to individual services and we understand Article 14 to be considered only for services within the USO.

Fourth, there can be cross-subsidies from non-USO services to USO services, situation 4 in Table 1. This is a situation actually welcomed by policy makers because it supports achieving the policy aim of the sustainability of the universal service.[14] It may be relevant for policy makers to monitor the extent of any of these cross-subsidies and the information needed is cost data at the level of the USO (and possibly broad sub-categories of the USO, see discussion above regarding situation 2). Anyway, it is unlikely that cost orientation principle is to be applied to address concerns of harmful cross-subsidies from outside the USO towards the USO.

To sum up, it is appropriate that Member States and national regulators can choose where to focus when it comes to monitoring the risk of cross-subsidization. The most typical focus area will be from USO as a whole to non-USO services, but there can be exceptions.

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[14]The ECJ Advocate General opinion (§81) in the Sandd case stresses this point and refers to the Directive 2008/6 recitals 12, 26 and 41.

4   Testing that Prices Are Not Too High

We will now consider, more briefly, the alternative concern stated in the European Commission (2015) statement on cost orientation: the situation where prices of basic postal services become too high. The general trend of volume decline for many basic services leads, all else equal, to increases in unit costs. Thus, it is intuitive that a consideration of whether postal prices are too high should not be disjointed from costs.

Industrial Organization economists, when considering the basis for antitrust enforcement, have stressed the role of price-cost margins to test for market power. In the context of a USO regulated industry such as postal services in Europe, market failure is also an important consideration, given that some basic services would be expected not to be provided on a purely market basis—or provided to a different extent. Therefore, when considering the cost orientation question of whether postal prices are too high it is also relevant to consider the profitability of the USO.

A parallel question is that of affordability of postal services. However, the policy objectives underpinning cost orientation should not be confused with the aims of the tariff affordability principle which is set out in Article 12 (first indent) of the EU Postal Services Directive: "prices shall be affordable and must be such that all users, independent of geographical location, and, in the light of specific national conditions, have access to the services provided. Member States may maintain or introduce the provision of a free postal service for the use of blind and partially-sighted persons,"

Therefore, cost-oriented prices need not be affordable. Some vulnerable user groups may not afford to pay the full cost of the service. A clear example is that the above text in the EU Postal Services Directive enables free delivery for the blind users.

Leaving affordability aside, postal operators endowed with strong market power may be able to charge excessive prices on a basket of services that may negatively affect a wide group of postal users. In such case, at the level of a basket of services, a regulator may use overall profitability measures to consider whether pricing substantially exceeds cost in a way that would conflict with cost orientation. For example, this approach may be relevant in circumstances where no other means to control for excessive pricing—such as a price cap—is in place.

What about potential situations where affordability concerns are established? As discussed below, there can be a trade-off between incentivizing efficiency and ensuring affordable prices. There may be national circumstances in which policymakers may consider limiting the USP's pricing flexibility, e.g. if it is established that there exist customers with low price elasticity (e.g. if it is proven that customers like small and medium enterprises are dependent on postal services to a sufficiently strong extent) and that (ii) tariffs are very high to the point of being unaffordable. However, pricing flexibility should not be necessarily limited as that comes at the cost of economic efficiency.

Regardless, cost-oriented tariffs should include room for reasonable profit. Any tariff level based on a cost measure that would prevent a postal operator from earning reasonable profits, would be in direct conflict with the first objective linked to the cost orientation principle—promotion of efficiency.

Policy makers should keep in in mind *dynamic efficiency* (Cabral, 2000, p. 26), which entails innovations in how services are produced and what services are offered. In order to innovate, firms require investments and therefore dynamic efficiency requires that firms have incentives to invest. Any regulation that prevents firms from making profit on services reduces dynamic efficiency. Without investments, and therefore without a regulatory framework that incentivizes such investments, the universal service would become more expensive in the future. When mail volumes decline, postal operators need to invest in new technologies to improve efficiency, e.g. more efficient sorting equipment, vehicles to cover wider territory to distribute lower number of letters. Otherwise, the cost of providing universal services would rise even more.

This implies that legislators and postal regulators face at all times an important trade-off between ensuring a suitable framework for sustainability and investments that underpin the USO, while also controlling potential harmful conduct by the regulated firm. The EU cost orientation principle sits squarely in the middle of this fundamental tension, which is a constant in regulatory economics and policy. This is particularly fraught with tension in an industry like the postal sector, where demand, service attributes, business models and the extent of competitive interplay that affects universal service providers is evolving rapidly.

5   Conclusion: An Economic Interpretation of the Cost Orientation Principle

While the principle of cost orientation is not defined in the Postal Directive and there are multiple economic policy aims associated, the regulatory praxis in the EU is such that the application of cost orientation principle varies between Member States, namely, using different cost benchmarks and level of application of a cost orientation principle.

As the European Commission (2015) stated, "NRAs measure and test cost orientation in different ways, for example by scrutinizing individual prices, the price of a level of service (i.e. counting the different size or weight steps) or the price of a basket of services, and using regulatory and financial accounts. To test the principle of cost orientation, some NRAs regard price caps as sufficient, while others monitor specific criteria for cost orientation or perform other tests, primarily using either the regulatory or financial accounts of the USP." (European Commission, 2015, p. 20).

In terms of the level of application, we find that there are generally three approaches implemented by the Member States. The first step—individual price (points)—is for example the price of a D + 1 50 g letter in C5 format. The second

step—scrutinizing the price of a level of services—aggregates prices (revenue) of individual price points (e.g. weight categories) and compare it to unit costs. The third step—scrutinizing prices of a basket of services—aggregates revenue of individual services (e.g. priority and non-priority universal letter post services) and compares to costs.

Table 2 summarizes our conclusions as to the relevant cost benchmark and level of application to test cost orientation of tariffs.

The variance in how cost orientation is interpreted and applied in different countries in the EU can be explained by different market conditions. Such differences can lead to different legislative decisions on how broad or narrow to set the scope of the USO and to different regulatory implementations of the same overall

Table 2 Conclusions regarding relevant economic tests (interpretations) for cost orientation and its objectives

Objective	What is the relevant cost benchmark and level of applicationof the cost orientation principle?
Prevent prices that may lead to restriction of competition (cross-subsidization) (*see* Sect. 3)	• *Level of application:* Should be kept flexible, but typically, at a basket of services. The cross-subsidy concern is typically between USO as a whole and non-USO services. This is so because some USO services difficultly cover costs (services to the blind; to high-cost areas) and rely on cross-subsidies e.g. within the USO. Thus, what is relevant to address concerns whether a cross-subsidy is generated from USO as a whole. In theory, it may in some situations be relevant to break the USO down into sub-categories. If there are policy concerns on cross-subsidization within the USO. This may be the case if the USO is very broad (e.g. includes bulk mail) and features uneven competition • *Cost benchmark:* The relevant cost measure to test for predatory pricing is based on incremental costs approach (LRAIC or AAC), not FAC
Promote economic efficiency (*see* Sect. 4)	• It is important to retain pricing flexibility in order to promote efficiency • We conclude that efficiency and economic welfare is reduced if each individual universal service must cover fully allocated costs[a]
Prevent prices being too high (leading to excessive profits) (*see* Sect. 5)	• *Level of application:* Basket of services. The typical concern is that postal operators may price excessively on USO services as a whole or a basket of non-competitive universal services • *Cost benchmark* should include room for reasonable profit, in order to ensure dynamic efficiency of postal services

Source: Copenhagen Economics

[a]Our findings with regards to the level of service should generally also apply to the more granular level of application—practiced in some Member States—scrutinising individual price points

objectives pursued by NRAs, such as efficient provision of the USO, promotion of competition in certain areas, protecting specific users, and other goals. For instance, mail volume has declined faster in some countries than in others, which has exacerbated the need in the former countries to provide incentives to USPs to invest in new technologies and thus improve efficiency. Thus, also for this reason, limiting the ways cost orientation can be interpreted will be counterproductive from an economic point of view, as efficient national regulation should take into account policy objectives and national circumstances. These differences in regulatory praxis in the Member States endorse the flexibility provided in the Postal Directive concerning the application of cost orientation principle, including as to whether different countries can choose different levels of aggregation at which to apply cost orientation rules.

We conclude that from an economic perspective, cost orientation has concrete objectives that can be achieved in several different ways. Typically, the cost orientation principle can be implemented by comparing revenue and costs of the USO as a whole, or a large basket of services. Importantly, we find that the cost orientation principle should not be interpreted as meaning that each particular universal service must automatically cover all its fully allocated costs, i.e. direct costs and a share of common costs allocated to it. The reason is that such an interpretation would reduce market efficiency and reduce economic welfare—which would negate key policy aims of the EU Postal Services Directive.

For efficiency reasons, pricing flexibility is generally desirable to enable postal operators to intercept and adapt to demand. Regulators are not expected to have the commercial information and resources to calculate Ramsey prices, while postal operators are the closest to the market. Pricing is a key strategic decision for any firm and in particular for postal operators. This is because postal firms increasingly face a complex and somewhat uncertain evolution in demand and markets, as they embark on a sensitive path of evolution in the face of sectoral transformation. The interpretation of the EU cost orientation principle should thus be mindful of these trade-offs surrounding postal pricing decisions.

What about potential situations where affordability concerns are established? As discussed above, there can be a tension between incentivizing dynamic efficiency and ensuring affordable prices. There may be national circumstances in which policymakers may consider limiting the USP's pricing flexibility, e.g. if it is established that (1) there exist customers with low price elasticity and with a dependency on postal services to a sufficiently strong extent and that (2) tariffs are very high to the point of being unaffordable. However, restricting pricing flexibility should not be a foregone conclusion, given the negative impact on economic efficiency, as considered above.

Finally, the cost orientation principle in EU ex-ante postal regulation overlaps with competition enforcement of pricing abuses. As discussed, price-cost tests need to be based on the right cost concept and need to fit the specific case including empirical evidence supporting a relevant market definition and a consistent theory of harm conceived. Invoking the cost orientation principle does not justify a one-size-fits-all cost standard for regulation or a general requirement for ex-ante price rules applicable for each individual service supplied by a postal operator.

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How Price Sensitive Is Letter Advertising Mail in the UK?

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1 Introduction

Addressed letter advertising mail in the UK accounted for almost one-fifth of total UK advertising expenditure in 2003 but by the end of 2017 this figure had declined to approximately half this level.[1] Over the same time period, newspaper and magazine physical print media expenditure in advertising declined to an even greater extent while digital advertising spend increased from a near zero figure to almost half of total UK advertising expenditure.

The better performance of addressed letter advertising mail (henceforth referred to as direct mail) relative to other print media is likely due to a number of reasons. Two important and interrelated factors are, first, the extent to which advertisers using print media are willing to adopt alternative digital media and, second, the degree to which the different advertising media are believed to influence recipient behavior. In order to assess the latter, a number of postal operators have used new and innovative research techniques (such as neuro-marketing methods) to show that mail continues to remain an effective medium. Much of these research findings are available in the public domain and Althen, Ten-Kate, Stafford, & Thresher (2017) provide a good summary of this literature. More limited evidence is available on

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factors that postal operators have some control over. One key factor is price, which can be used to influence the demand for direct mail. Veruete-McKay, Soteri, Nankervis, & Rodriguez (2011) provide estimates for the UK direct mail market price elasticity that lie in the range -0.7 to -1.4 and Bzhilyanskaya, Cigno, & Pearsall (2015) estimate own-price elasticities for USPS advertising mail product[2] of -0.9 and net of switching to other products of -0.7. While these findings are useful in terms of informing high level direct mail and product pricing strategies, they are less so with respect to devising customer focused business initiatives in a competitive media market.

The econometric analysis contained in this article is a first attempt to bridge this information gap in the postal literature. In particular, we use a large data set covering Royal Mail addressed advertising customers over the period 2011–2017 to estimate price elasticities that take into account customer characteristics such as sector and firm size. Section 2 describes the data and estimation methodology for modelling price elasticities. Sections 3 and 4 contain results and Sect. 5 provides a summary and conclusion.

2   Modelling Advertising Mail Demand

Letter demand functions can be estimated as the relationship between letter traffic volumes, denoted by Q, for different types of letter mail products, denoted by j, sent by different customers, each denoted by i, the level of prices charged to send mail, denoted by p, at a specific point in time, t, and environmental (exogenous) variables denoted by X. Where data are available on these variables for n customers, empirical analysis can be undertaken of the demand function, which can be written as:

$$Q_{ijt} = f\left(p_{ijt}, X_{ijt}, u_{ijt}\right) i = 1, \ldots n, j = 1, \ldots, m \text{ and } t = 1, \ldots, T \qquad (1)$$

where u represents a random error term.

To the best of our knowledge, most econometric studies of letter demand that have been undertaken do not explicitly include the customer dimension, i, within their models. Instead, they have tended to examine the demand for individual products or groups of products over time (see for example Bzhilyanskaya et al., 2015; Veruete-McKay et al., 2011). While such studies are highly useful in terms of examining letter demand at an aggregate level they are less so in helping to devise customer focused strategies in competitive segments, such as advertising mail.

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[2]USPS estimated price elasticities refer to Standard Regular mail which is mainly used to send advertising mail.

One reason for the absence of customer focused demand functions may be the lack of high quality customer time series data or, possibly, the availability of such data to researchers. In contrast, this article explicitly includes a customer dimension and undertakes econometric analysis that uses a rich data set of Royal Mail retail customers to estimate letter demand functions consistent with (1) for addressed letter advertising traffic. The data covers eight product categories ($m = 8$) consisting of two sortation levels (low and high sort) and two speeds of delivery (second class and economy) for each of two letter format sizes (standard and large). Information was available for 2640 ($=n$) retail addressed advertising customers for the period July 2011 to September 2017 and the data was aggregated on a quarterly time period basis, t. Customer prices for a specific letter product for each quarter, period, p_{ijt}, were derived by dividing customer revenue data, R_{ijt}, by the corresponding volume, Q_{ijt}. The customers contained in this data accounted for almost a quarter of all addressed advertising sent in the UK over the time period examined and excluded mail sent via access operators as the vast majority of these customers could not be identified.

A traditional parametric econometric approach was used to estimate the demand function (1) considering a log-linear model, similar to Fève, Magnac, Soteri, and Veruete-McKay (2018). This is a commonly adopted approach whose parameter estimates can be immediately interpreted as elasticities. The model included letter mail volumes (Q), prices (p) and various environment variables (X) as a set of dummy variables to account for exogenous factors, heterogeneity in sender characteristics and differences in products. In particular, three sets of dummy variables were included. First, time series dummies, *dtime*, to capture the net impact of exogenous factors at each point in time, such as macro-economic variables, e-substitution and other external events. An alternative approach would have been to include additional variables into the model to explicitly estimate these effects, however the inclusion of time dummies is a common and more general approach that captures the net effect of all exogenous variables and allows us to more clearly focus attention on the parameter estimates for price which is our primary objective.[3] Second, customer characteristic dummies to account for differences in demand among 10 ($=k$) sender sector groups, *dsector*, and the size of each sender organizations, *size,* as measured by the number of employees. Third, shift dummies, *dproduct*, were included to capture differences in sender demand for different letter products.

Two model specifications, A and B, were estimated using these variables in order to provide insights into the heterogeneity of price elasticities by customer sector and size and took the following form:

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[3]Model specifications including various economic activity and other variables were initially included and yielded similar results.

Model A

$$\ln(Q_{ijt}) = \alpha + \beta_k dsector_k \ln(p_{ijt}) + \gamma \ln(size_i) + \delta_k dsector_k \\ + \lambda_j dproduct_j + \mu_t dtime_t + v_{ijt} \tag{2}$$

Model B

$$\ln(Q_{ijt}) = \alpha + \beta \ln(p_{ijt}) + \gamma_1 \ln(size_i) \ln(p_{ijt}) + \gamma \ln(size_i) + \delta_k dsector_k$$

$$+ \lambda_j dproduct_j + \mu_t dtime_t + v_{ijt} \tag{3}$$

with all variables in logarithmic form denoted by ln( ).

Model A allows for customer sector dummy interaction terms with the price variable and yields estimated price elasticities that differ for each of the individual k customer sector groups (that is, price elasticities are estimated for $\beta_{k=1}, \ldots, \beta_{k=10}$ from expression (2)). Where the sectors considered are: Commercial Services, Finance and Insurance, Information and Communications, Manufacturing, Other, Public Services, Postal Services, Retailers and Wholesalers, Transportation and Storage and Utilities. In contrast, model B provides price elasticity estimates that vary by customer size and equal to $\beta + \gamma_1 \ln(size)$ in expression (3), where "size" is measured by the number of employees of the customer centered at its mean value in logarithms, such that the price elasticity for the mean customer is β.

2.1 Dealing with Endogeneity

The advertising letter price variable in both the estimated demand models A and B, p_{ijt} is by construction highly likely to be an endogenous variable because it is derived using information on volume data which is the dependent variable in the demand equation. Any measurement error in volumes will therefore contaminate the measure of prices and introduce a spurious correlation between the left-hand side variable and the right-hand side variables (see for instance, Borjas, 1980). Furthermore, the use of price discounts to incentivize customers to mail additional volumes (such as Royal Mail incentive for growth schemes) means there is likely to be a degree of endogeneity present because price discounts are probably positively correlated with volumes. Given that price is constructed by dividing revenues by volumes, this spurious correlation is likely to be negative.

In order to address this issue, Instrument Variable (IV) estimation techniques were adopted to correct for endogeneity (see for instance Davidson & MacKinnon, 2004). In the first stage we used two instrumental variables, the average sectoral prices as constructed from the data and the standard rate card price that was available at the time. However, we tested and rejected over identifying restrictions when using both instruments and had to choose between the two. On that basis, the rate card

price is likely to be the least affected by customer shocks, customer heterogeneity or measurement errors and this variable was adopted.

The estimation proceeded as follows. First, an instrumental variable auxiliary equation was obtained by regressing the endogenous variable $\ln(p_{ijt})$ on the log of rate card prices and other control variables appearing either in model A or model B. Second, the two-stage least squares (2SLS) estimates of models A and B were obtained by using residuals from the instrumental variable equation. This numerical procedure is equivalent to the more common procedure which replaces the endogenous variable by its predictor derived from the instrumental equation (see Davidson & MacKinnon, 2004). This is a more convenient procedure because the endogenous price variable $\ln(p_{ijt})$ enters not only as a variable on the right hand side of models A and B but also through its interactions with either sectoral dummies in model A or log-size in model A. This is why the 2SLS estimates below were derived by including not only residuals of the instrumental variable equation in levels but also their interaction with sectoral dummies or log-size depending on which model was estimated. Furthermore, in order to more fully exploit variation in the data, separate instrumental regressions were estimated for each of the ten sender sector groups and those residuals constructed from these regressions were included in the second stage of the estimation procedure.

This approach yielded correctly signed and, in most cases, statistically significant estimated price elasticities which are reported in section three. In terms of the actual models estimated, these are equivalent to estimating the following models using ordinary least squares:

Model A

$$\ln(Q_{ijt}) = \alpha + \beta_k dsector_k \ln(p_{ijt}) + \gamma ln(size_i) + \delta_k dsector_k \\ + \lambda_j dproduct_j + \mu_t dtime_t + \varphi_k dsector_k \widehat{u}_{ijt} + v_{ijt} \tag{4}$$

Model B

$$\ln(Q_{ijt}) = \alpha + \beta \ln(p_{ijt}) + \gamma_1 \ln(size_i) \ln(p_{ijt}) + \gamma(\ln(size_i) + \delta_k d\,sector_k \\ + \lambda_j d\,product_j + \mu_t d\,time_t + \psi \widehat{u}_{ijt} + \varphi \ln(size_i) \widehat{u}_{ijt} + v_{ijt} \tag{5}$$

in which $\widehat{u}_{ijt}$ is the residual constructed from the instrumental regressions in each sector with $\ln(p_{ijt})$ as the dependent variable and as explanatory variables all the respective variables included in each of the estimated models (4) and (5).[4]

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[4]Note that $\ln(p)$ in (3) and (4) is equal to the sum of the instrumental variable for the price variable, $\ln(\widehat{p}_{ijt})$ and the residual constructed from the instrumental regression $\widehat{u}_{ijt}$. Specifying the model as in (3) and (4) can be considered to be more transparent as the test of endogeneity is performed directly by examining the estimated coefficients associated with $\widehat{u}_{ijt}$.

3   Estimated Price Elasticities for Retail Addressed Advertising Mail

Table 1 reports the estimated coefficients for the price terms and their respective standard errors for models A and B. It should be noted that the estimated price elasticities reported in this table relate to customers who mainly used Royal Mail retail advertising products during the time period analyzed.

The two models provide insights into retail customer price elasticities via different lenses. The results reported in model A suggest that price elasticities differ substantially by sector and the hypothesis that they are all equal is strongly rejected using a Fisher test. The estimated sector price elasticities can be grouped into four broad categories. First, sectors with customers that, on average, exhibit a high degree of responsiveness to price changes include the Utilities, Finance and Insurance and Postal Services organizations, with estimated price elasticities in the range -2.6 to -1.1. Second, sectors with estimated price elasticities that have an absolute magnitude of just below unity, on average, around -0.8 to -0.9 include customers from

Table 1 Retail addressed advertising mail estimated price elasticities

	Model A		Model B	
Market sector	Coefficient	Standard error	Coefficient	Standard error
Estimated price elasticities for sector β_k			Estimated aggregate price elasticity (β) varies by customer size (γ)	
Commercial services	-0.60^a	0.26		
Finance and insurance	-1.52^b	0.30		
Information and communications	-0.52^a	0.26		
Manufacturing	-0.48^c	0.26	$\beta = -0.71^b$	0.21
Other	-0.26	0.24		
Public services	-0.88^b	0.28	$\gamma = -0.06^b$	0.01
Postal services	-1.11^b	0.23		
Retailers and wholesalers	-0.84^b	0.43		
Transportation and storage	-0.11	0.28		
Utilities	-2.60^b	0.52		
No. of observations 34,075	$F(61, 34{,}013) = 287.2$		No. of observations 34,075	$F(61, 34{,}029) = 383.5$
$R^2 = 0.34$	Prob $> F = 0.0000$		$R^2 = 0.34$	Prob $> F = 0.0000$
Adjusted $R^2 = 0.34$	RMSE $= 1.3159$		Adjusted $R^2 = 0.34$	RMSE $= 1.3191$

Figures in parenthesis are standard errors for price coefficients which are statistically significant at the:
[a]5% level
[b]1% level
[c]10% level

Public Services and Retail and Wholesale sectors. Third, those with relatively lower estimated price elasticities which, on average, are around –0.5 to −0.6 and include the Commercial Services, Information and Communications and Manufacturing sectors. Fourth, sectors in which price effects are not statistically significant include Transport and Storage and Other sectors with estimated price elasticities of −0.1 and −0.3 respectively. The absence of statistically significant results for the fourth group may partly be due to the weakness of the instrument used for prices which is derived from rate card information and for the Other sector may also be related to the highly heterogeneous nature of customers contained within this group.

Model B examines the same customer data via an alternative lens and suggests that retail advertising customer price elasticities tend to increase in absolute terms with customer size and that the average price elasticity is around −0.71. This estimate is close to the aggregation of the individual sector price elasticities reported in model A weighted by their respective sector observations[5] which is −0.60. However, the results reported in Table 1 also indicate that, in general, larger firms tend to be more price sensitive than smaller firms. This may be due to the greater flexibility that larger firms have with respect to access to other media advertising channels, such as digital or television. The demand elasticity in model B, ε, is estimated to be a function of customer size (measured by the number of employees of the organization sending mail) and the formulae is $\varepsilon = -0.71-0.06 \ln(\text{size})$. On average, the estimated price elasticity for a relatively small company (say 20 employees) is equal to around −0.66 and for a very large firm (say, more than 2000 employees) around −0.94.

4   Estimated Price Elasticities for Sub-Sample Groups of Addressed Advertising Customers

In order to obtain further insights into the price sensitivity of retail advertising customers, model B was estimated for four subsample groups. In particular, the customer sample of 2640 organizations was partitioned into four categories: Stayers, Movers, Round-trippers and Occasional. These specific categories were chosen to examine the impact of customers registering different patterns of zero volumes in the sample period available and the results obtained should only be viewed as descriptive and directional in nature to the total sample. We estimate the same model as before under the assumption that these samples are not selected or censored. A full correction for selection is out of the scope of this article and left for further research because instruments for selectivity corrections are absent. In particular, we do not

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[5]The relative weights for the sectors where Commercial Services (9%), Finance and Insurance (2%), Information and. Communications (38%), Manufacturing (6%), Other (16%), Public Services (4%), Postal Services (1%), Retailers and Wholesalers (22%), Transportation and Storage (2%) and Utilities (<1%).

observe the prices of competitors. An interesting implication of the hypothesis of the absence of selection, however, is that elasticities in all subsamples should be the same. As they are not, this exploratory section shows the limitations of this simple approach although it remains informative as a descriptive device.

The Stayers included 376 customers who were defined as continuous users of Royal Mail retail advertising product until the end of the period examined and included new customers who entered the sample prior to the end date. Organizations in the Movers category included those who stopped using retail advertising products at some point prior to the end of the sample period, including those who may have moved to sending advertising letters via competitor access services, and accounted for 789 customers.[6] Round-trippers were defined as customers who continued to use retail advertising products until the end of the sample period but displayed some periods of time when they did not send any retail advertising mail and accounted for 312 customers. Finally, the Occasional users group included those who infrequently sent retail advertising mail (four times or less) over the period examined and numbered 1163 customers.

The results reported in Table 2 can potentially provide some useful insights to postal operators when considering customer focused pricing strategies while keeping in mind the limitations of the approach due to selection and censorship. In particular, they suggest that advertising mail senders who tend to be Stayers (that is loyal customers with a pattern of repeated purchase) are, on average, likely to be highly sensitive to price changes (with a mean price elasticity of demand, β, equal to -1.9). This result also seems to be the case for Occasional users of advertising mail, who are also estimated to, on average, be sensitive to price changes (with a mean price elasticity of demand, β, equal to -1.5), although unlike the Stayer group the sensitivity to price for larger customers is estimated to be not statistically significant. In contrast, the mean estimated price elasticities for Movers and Round-trippers (β) reported in Table 2 were both low and not statistically significant, although there was some evidence to suggest that the former's elasticity increased somewhat with the size of customer (γ).

The Mover and Round-tripper results are somewhat puzzling, in that one would expect the estimated price elasticities for these groups to be at least as high (in absolute terms) as the Stayers category. However, as previously mentioned, the results reported in Table 2 are likely to depend on the criteria used to select the sub-groups over the time period examined. It is therefore likely to be the case that the low and statistically insignificant estimated price elasticity for Movers may be due to selection bias. In particular, this group primarily consists of customers who have switched away from using Royal Mail retail advertising mail products to sending letter mail via a downstream access competitor. Under such circumstances,

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[6]In general, if a customer switched from using a Royal Mail retail product to sending mail via an access competitor, which is most likely to be the case when we observe a continuous string of zero values for a retail advertising customer, then all information on the customer becomes unobservable.

Table 2 Retail addressed advertising mail estimated price elasticities for sub-groups of customers

	Stayers	Movers	Round-trippers	Occasional
β	-1.88^a (0.24)	-0.25 (0.32)	-0.26 (0.25)	-1.47^a (0.12)
γ	-0.04^b (0.02)	-0.09^a (0.02)	-0.02 (0.02)	-0.02 (0.03)
No. of observations	14,652	11,534	5041	2787
R^2	0.3629	0.3559	0.2928	0.4292
Adj R^2	0.3609	0.3535	0.2968	0.4201
F-test	$F_{(45,14325)} = 185.2$	$F_{(42,11491)} = 151.2$	$F_{(43,4997)} = 48.12$	$F_{(44,2742)} = 46.9$
RMSE	1.3301	1.2822	1.2364	1.2061

Figures in parentheses are standard errors standard errors for price coefficients which are statistically significant at the:
[a]1% level
[b]5% level

the volume of advertising letters sent by customers who switch to a Royal Mail competitor, which is likely to be the vast majority of the Movers customer sample, will be recorded as a continuous string of zero values (as information sent via competitors is no longer available to Royal Mail). One of the main drivers underpinning this switching behavior will be competitor customer prices which tend to be individually negotiated and sensitive commercial information that is not publicly available. The absence of competitor downstream access prices is therefore likely to be an important factor contributing to the low and non-significant price elasticity estimate for the Movers category. A similar point applies to the price elasticity estimate for Round-trippers.

5 Summary and Conclusions

Addressed letter advertising mail in the UK as a share of total advertising expenditure has halved over the past 15 years, while physical print media (newspapers and magazines) have declined to an even greater extent and digital advertising increased to represent around half of total UK advertising spend. Postal operators have responded to this challenge by proving the effectiveness of advertising letter mail through new and innovative research techniques (such as neuro-marketing methods) to show that mail continues to remain a relevant medium even in a digital epoch. However, the extent to which advertising mail will remain a widespread medium will also depend on the pricing strategies adopted by postal operators.

This article examined the behavior of Royal Mail retail customers over the period 2011–2017 to provide insight into the degree to which they are responsive to price changes and the extent to which this differs by customer sector and firm size. It should be noted that the price elasticities estimated in Sect. 3 are conditional on the sample of customers analyzed (that is customers using retail advertising products over the period examined) and the sub-samples examined, therefore, care should be taken in interpreting and using these results. With this qualification in mind, the estimated elasticities suggest that the overall price elasticity for retail customers is around -0.7 but tend to increase in absolute value by customer size. In addition, the econometric analysis undertaken also suggests that some segments of customers are likely to be substantially more price sensitive than others. In particular, retail customers operating in the Finance and Insurance and Utilities sectors are estimated to be highly sensitive to price movements with estimated price elasticities of -1.5 and -2.6 respectively.

Additional analysis was undertaken for customer sub-samples. However due to potential issues related to selection bias these results should only be viewed as directional in nature. In particular, this analysis suggested that organizations that very frequently or very infrequently send retail advertising mail are likely to be highly sensitive to price changes (with estimated price elasticities in the range of around -1.5 to -2.0). In contrast, estimated price elasticities were low and not statistically significant for customers that stopped using retail advertising mail,

referred to as Movers in our analysis, or tended to intermittently not send mail, referred to as Round-trippers. The low estimated price elasticities for the latter two categories is a puzzling result and we suspect this may be due to selection bias resulting from the absence of information on customers who switch from sending advertising mail with Royal Mail's retail product range to sending mail via an access competitor (and therefore become non observable in our data) and also due to the absence of competitor price information.

In conclusion, the results contained in this article provide some indicative estimates of customer profiles and characteristics that are likely to be more sensitive to price movements and can help to inform advertising mail customer pricing strategies. However, as indicated, the estimated elasticities reported are conditional on the sample examined and sub-samples selected. An avenue worthy of further research in this area would be to build on the results contained in this article for retail customers by explicitly taking into account the impact of missing values due to customers switching to access operators and avoiding the impact of any potential bias resulting from the selection of firms belonging to specific sub-sample groups.

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Brand, Product Differentiation and Postal Market Outcomes

Isabelle Carslake, George Houpis, and Ellie Monaghan

1 Introduction

When liberalization was introduced in Europe, a number of papers examined the likely impact of entry on competition and market outcomes, including an assessment of the significance of product differentiation and brand by (Burns, Carslake, & Houpis, 2002). Using a Hotelling model of product differentiation, this paper tried to investigate how entry might struggle to materialize if brand strength or loyalty play a significant role. It showed that the brand value of a postal incumbent and the extent to which the range of current product offerings is so extensive that it 'exhausts' the 'new' products that could be offered can affect entry prospects.

Fifteen years on from that paper, we can observe some market outcomes post-liberalization. Letters markets were opened to full competition by 2011 in most EU countries. Several countries adopted liberalization earlier: 2006 for the UK, 2008 for Germany and 2009 for both Netherlands and Estonia (following similar moves in 1991 and 1993 for Finland and Sweden respectively (ERGP (2014)). At the same time, regulators and policy makers in some countries (e.g. the UK and Estonia) have mandated that the postal incumbent operator provides access to its final delivery network to rivals. As a result, rivals have been able to engage in three distinct types of competition with the incumbent: end-to-end competition (E2E), access-only competition, and a mix bypass model with end-to-end in some regions and access competition in others.

Mailers, at least business mailers, have a choice of delivery operators (with some variations across countries and regions within countries). However, there is mixed evidence on the extent to which they have exercised that choice. As a result, postal incumbents have held relatively high market shares in many jurisdictions. In its 2015

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report on the implementation of the 2008 directive, the European Commission, based on ERGP (2014), notes the relatively low level of competition (as measured by market share).

The broad picture is that after at a number of years of full market opening, customers appear to have been somewhat sticky. The same (EC, 2015) report alludes to possible factors such as declining letter volumes, access regimes and special tariffs, other regulatory features, the cost of setting up a distribution network and the existence of other operators in adjacent markets. This chapter uses a merger simulation tool[1] (based on a differentiated Bertrand economic model) to assess possible factors that affect the development of competition in posts, by capturing the apparent characteristics of different postal markets and assisting policy makers in evaluating policies and assessing the strength of some determinants of market outcomes, such as product differentiation and possibly relative strength of the brand of the incumbent.

Section 3 discusses the product differentiation strategies rivals appear to have taken to enter the letters market in various countries and how the incumbent may have a relative brand advantage compared to newer less well-known operators. Section 5 then discusses how these postal market characteristics can be accounted for based on a differentiated Bertrand model. It also describes the key features of such a tool together with the policy questions it can address. Section 4 presents the results of a modelling exercise to illustrate the insights one can draw from this analytical framework, and Sect. 5 concludes.

2 Competition Strategies: Product Differentiation and Brand

2.1 Product Differentiation

A letters delivery service may come across as having limited scope for differentiation. However, inspecting product offerings of letters delivery operators suggests that a number of such operators compete less head-to-head with the incumbent and instead have chosen product differentiation strategies—by choice or because of market and/or regulatory conditions. We have considered some postal markets and reviewed the product characteristics of a selection of entrants in Europe. Overall, the notable dimensions of differentiation are different product features, change of frequency of delivery and differences in delivery scope.

Regarding variants in product features, in the UK, a postal market characterized by mainly an access-only model, the features of the products of UKMail and Whistl

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[1]As described in EC case decisions for Ireland–Case No COMP/M.6992 HUTCHISON 3G UK/TELEFONICA IRELAND, Germany—CASE M.7018—TELEFÓNICA DEUTSCHLAND/E-PLUS, and Italy—CASE M.7758-HUTCHISON 3G ITALY/WIND.

are close but do not exactly match Royal Mail services. For example, Royal Mail offer a range of speeds of delivery for *all* formats of letters (standard, large and packets). In contrast, UKMail can offer delivery 2 days after the collection day for letters but offer only a slower three-day service for packets and large letters. Whistl commits to a two or three-day delivery service for all mail, with no distinction by format.

Collection from business mailers' premises is another differentiating factor. Collection is an integral part of the service for Whistl (sorted only) and UKMail albeit with (different) minimum annual volume requirements. Royal Mail offer free collection for some services for a certain annual minimum threshold but customers must order collection separately. Both UKMail and Whistl highlight the quality and depth of their reporting to their clients—a feature less apparent in Royal Mail's description of its services.

Frequency of delivery in countries with rivals providing an E2E nationwide coverage is another dimension of differentiation. In the Netherlands, Sandd, the main rival to PostNL, delivers on two specific days, while PostNL provides a 5 day a week service. In France, the firm Adrexo provides a non-priority nationwide delivery service (D+4 to D+6). With regard to geographic coverage, another dimension, in France, a large number of operators remain local and provide delivery in a single region. For example, UrbanPost serves Ile de France and the Alsace regions whereas CourrierPlus delivers in the Nord Pas de Calais region (on a D+2 basis). In Sweden, Bring CityMail (part of the Posten Norge Group in Norway) competes with Posten Sverige and provides an E2E service with a coverage of 64% of households with the intention to reach 80% by 2020.[2]

2.2 Brand

In addition to differences in (observable) product attributes discussed above, if faced with similar postal products, mailers may value the brand of an operator more than other brands. Joona Saluveer, chairman of the management board of Estonia-based Omniva (previously known as Eesti-Post), notes:

> When customers are choosing a delivery provider, we believe the most important considerations are delivery speed and choice, quality and cost, but if all these things are similar between providers, then people are willing to pay extra if it is delivered by a particular brand. At that point, brand has value.[3]

In post, as in many domains, it is not the absolute brand value that matters but the relative strength of the brand when compared to that of rivals. The relative strength

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[2]https://www.bring.se/tjanster/post/.

[3]Postal and Parcel Technology International, March 2018, http://www.ukimediaevents.com/publication/643a6be7/28.

of a new entrant's brand may grow over time. Peter Kane, Chairman of UK Mail Group Plc (2016) explained its need to invest in the UKMail brand to compete.

> As a leader in the UK mail and parcel delivery market, our visual identity needed to evolve for us to remain competitive. Our new brand will align with our growing service offerings and continue to extend the customer experience to the delivery door.[4]

We have reviewed the ranking of the commercial value of postal brands in a country according to Brand Finance.[5] Brand Finance calculates brand value using the Royalty Relief methodology, which determines the value a company would be willing to pay to license its brand if it did not already own it.[6] This approach involves estimating the future revenue attributable to a brand and calculating a royalty rate that would be charged for the use of the brand. It is calculated using a combination of company characteristics, sector specific royalty rates and brand attributable revenue forecasts.

Brand Finance estimates that the postal (incumbent) brands come among the top 30 brands in France, Germany, Netherlands and Italy, and with a rank around 50 or so in the UK and Spain. They appear less valuable in Scandinavian countries, where the postal incumbent does not make the top brands table. Denmark and to a lesser extent Sweden are two markets where digitalization had a severe impact on mail volumes.[7]

Brand rankings can evolve over time. In the UK, Royal Mail brand has declined in the ranking between 2014 and 2017; whereas, the rankings remain at around the same level in both Germany and France over the same period. Country specific factors may be at play and affect brand value. In the UK, Royal Mail was privatized in 2014, possibly affecting the brand evaluation at the time. Since then, Royal Mail has lost retail market share to the access seekers who have 61% (retail) market share of mail delivered (Ofcom, 2017). Recognizing the possible limits of these rankings, this evidence at least indicates that the postal operator brands can and do have some value, which may have been falling, though this is far from universal.

Combining this information with an assessment of the strength of competition based on a recent report for the European Commission,[8] and volume per capita as given by the EC (2018), we have sought to assess if there is any evidence of a negative link between the strength of competition and the value of the brand, taking

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[4]https://www.ukmail.com/news/news-article/2016/04/11/uk-mail-group-plc-launch-new-brand.

[5]Brand Finance is a brand business valuation consultancy firm certified to provide brand valuations that is fully compliant with ISO 10668, the global standard on monetary brand valuations.

[6]http://brandirectory.com/methodology.

[7]Andersson, Bengtsson, and Johanna Eriksson (2018) presented a paper at the 26th conference on Postal and Delivery Economics, finding large and significant differences between Sweden and Denmark.

[8]See Copenhagen Economics (2018), EC Main development in postal markets 2013–2016, preliminary findings. This is a qualitative assessment based on the two reports mentioned earlier—the evaluation should be treated with caution, as there are a number of factors that could affect the intensity of competition that would not be fully reflected in this assessment.

into account also the relative significance of the size of the mail market. This is reported in Table 1 below.

When looking at the rankings in 2017/2018, there is some evidence that where incumbent operators have been ranked relatively high in terms of brand strength, they may be facing less strong competition. Royal Mail, ranked 52 in 2017/2018 and with a falling ranking, has faced significant (access based) competition, with rivals accounting for more than 60% of retail mail volume business. In Sweden, the incumbent does appear in the top 50 brands, and the evidence indicates stronger competition. Not surprisingly, this relation is not apparent in all other cases, as a number of factors will affect the relative success of a new entrant, in addition to the relative brand strength of the incumbent.

Table 1 Top postal incumbent brands ranked by strength of competition

Postal incumbent	Among top brand	2017/ 2018	2016	2014	2013	2012	2011	2016 strength of competition	2016 domestic letter volume per capita
Post Danmark	25	X	X	X	X			Low	NA
Correios de Portugal	25	X	X	X		X	X	Low	50–100
Posten Sverige	50	X	X	X	X			High	200–250
Correos	50	X	X	50		X		Low-medium	50–100
Poste Italiane	50	8[a]	11	X	X			Low-medium	50–100
La poste	50	27	27	25	X			Low	150–200
Deutsche post	30	28	29	31	32	X		Medium-high	150–200
Post NL	50	34	27	35	40	30	X	Medium-high	NA
Royal Mail	50	52[a]	35	25	X	X	X	High[b]	150–200

"X" indicates that the postal company was not among the top brand rankings for the year as reported by Brand Finance. Empty cells indicate that data for the year were not reported by Brand Finance or were not available as part of their paid for offering

Source: Brand Finance, Range for domestic letter volume per capita drawn from presentation given by the European Commission in May 2018; 2016 strength of competition based on our analysis of 2016 EC market developments

[a]For year 2018

[b]Retail

3 Use of a Differentiated Bertrand Model to Assess Regulatory Policy

In light of these differentiated features of postal services, we consider how regulatory policy and market developments could be assessed within a differentiated Bertrand framework. In this framework, each supplier chooses the profit-maximizing prices for its differentiated retail products taking rivals products' prices as given, and at equilibrium each supplier's prices are the "best response" to the prices chosen by all the rivals.

These models have been developed in the literature to support an assessment of the potential price effects of mergers,[9] amongst others, and have been used extensively in practice by competition authorities to inform the assessment of proposed mergers,[10] in terms of likely price changes and possible efficiency gains resulting from the merger.

By assuming a degree of differentiation between the products, producers are able to make some economic rent. The more differentiated the products are, the weaker is the substitution and hence the greater is the market power for the suppliers. In a market with more than two players, a measure of this degree of closeness of competition is given by diversion ratios, which reflect consumers' relative preferences for a second choice of product if they were to stop using their current product due to a price increase. Diversion ratios are widely used in both simple and more complex merger simulations because they can be estimated based on real switching data or even market shares.

An attractive feature of the model is that it is possible to develop a simulation tool of an actual market using information on (a) prices/quantities (b) marginal costs and (c) diversion ratios.[11] These data can be accessed/observed in general, although information on actual marginal costs (and/or margins) can be commercially sensitive. In such cases, it may be possible to use a range of estimates for marginal costs, and/or rely on information/data from other markets to arrive at a range of reasonable estimates for these inputs.

This differentiated Bertrand framework can be used to assess various changes to the market environment and the impact of regulatory policies. One starts by considering the market outcomes observed 'today', which can be assumed to be an 'equilibrium'.[12] Suppliers are assumed to choose profit-maximizing prices for retail

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[9]e.g. Shapiro and Farrell (2010) and Hausman et al. (2011).

[10]See EC case decisions for Ireland—Case No COMP/M.6992 HUTCHISON 3G UK/TELEFONICA IRELAND, Germany—CASE M.7018—TELEFÓNICA DEUTSCHLAND/E-PLUS, and Italy—CASE M.7758-HUTCHISON 3G ITALY/WIND.

[11]This model has been discussed in papers such as Berry and Haile (2016), Froeb and Werden (1994), and Nevo (2000).

[12]This will of course depend on the specific circumstances under consideration; and additional assumptions and parameterizations may be required to capture wider market trends, for example, e-substitution in the case of postal markets.

products taking account of their profits from any other products in the market (including wholesale profits).

Using the existing data on the market: prices, quantities, marginal costs and diversion ratios, the model can be populated to construct the demand curves for all products; this is considered the 'factual' scenario. It is necessary to assume the type of demand system—e.g. assume linear or constant elasticity of demand curves, in order to construct an internally consistent model.[13] An estimate of the optimal reactions of suppliers to changes to 'exogenous' inputs can then be obtained based on the demand curves derived in the factual scenario, allowing the impact of changes to costs, regulatory policy affecting costs, and market structure, etc. to be taken into account and new equilibrium prices (and volumes) determined; the 'counterfactual' scenario.

The model can also be used in a regulatory setting, in a market with differentiated products and a vertically integrated operator with an obligation to allow access to its wholesale products through an access product. In this setting, for example, the model can be used to assess the impact of a reduction in wholesale tariff on competition dynamics and to what extent this feeds through in lower retail prices. It also helps to obtain a deeper understanding of the dynamics of the market in question in a single framework—in combining all features of the market (i.e. the wholesale supply and the retail competition).

4 Application to a Hypothetical Postal Market

We now illustrate how a policy change can be assessed in a differentiated Bertrand model framework through a hypothetical model of the postal market, where we assess the impact of a change in wholesale price on the retail postal market. One of the advantages of this modelling approach in practice is that it is not necessary to have detailed information on the nature of demand for each supplier's products,[14] as this is derived (indirectly) through an initial calibration exercise, where the 'factual' scenario is modelled. The factual scenario depicts market as it operates prior to any change in policy, based on the current prices, volumes, marginal costs, and diversion ratios. Assuming linear demand and profit maximization, we estimate the parameters illustrating the market power and differentiation in the market—the price elasticities

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[13]The assumed shape of the demand curves may have a significant impact on the outcomes when modelling a range of scenarios e.g. mergers. For example, Constant elasticity demand curves tend to have much bigger effects than linear demand curves and may result in more than 100% pass-through of cost changes. Where possible estimating the impact of changes under different demand system assumptions may be desirable.

[14]Although, as noted previously, it is necessary to make assumptions about the shape of the demand curves, and these assumptions can affect the results.

and intercepts which characterize the demand curves for each product, allowing the estimation of best response functions.[15]

Our simple illustration consists of three postal players: a vertically integrated incumbent operator operating nationally ('Incumbent'); one rival operator using a mixed model of access (70%) and end-to-end in some parts of the country (30%) ('AS1') and one rival operator relying in full on access to the incumbent for its nationwide delivery service ('AS2'). Each offers a postal service with some differentiated features.

4.1 Assumptions

As described above, the necessary data input to calibrate the model are diversion ratios, marginal costs, volumes and prices in a 'factual' scenario. When used in practice, data from the actual market in question is used, alongside an assumption about the shape of the demand curves to construct the demand curves for the factual scenario. For our illustrative case, it is necessary to construct a market based on hypothetical values for these inputs.[16] We assume that in the current market the incumbent holds a 74% market share, AS1 16%, and AS2 the remaining 10% of the market. The variation in marginal costs (and hence margins) across these three products seek to capture the relative 'market power' each operator holds. This is reflected by the mark-up of prices over variable (or marginal) costs. With these margins, operators are assumed to then be able to cover their fixed costs.

Each firm bears its own marginal retailing cost. Our assumed marginal costs of delivery are as follows. For the incumbent, it is its marginal cost of delivery, assuming it does not buy access from AS1 or AS2. For AS1, it is a weighted average of the wholesale price charged by the incumbent for the share of the retail volumes of AS1 that it delivers through access (assumed to be 70% of their delivery) plus its own marginal costs of delivery for the E2E share of their delivery (assumed to be the remaining 30%). The E2E margin is higher than the margin based on access. For AS2, it is the wholesale price charged by the incumbent, as it is assumed to perform no end-to-end delivery.

Table 2 below presents the assumptions we have made about the market shares of the incumbent, AS1, AS2; their average revenues and margins; and the assumed access price in the base scenario. These do not represent the situation in any particular country, but the market shares are consistent with liberalization outcomes

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[15]A full mathematical description of the model is available from the authors.

[16]We note that it would also be possible to assume the parameters of the demand curves, i.e. elasticities and constants and from this estimate the optimal prices and quantities. We have chosen to do the reverse as this is consistent with how the demand curves can be estimated in practice (i.e. in merger impact assessments) when the value of these inputs are known.

Table 2 Assumptions for the hypothetical postal market

	Incumbent	AS1 (mix model rival)	AS2 (access only rival)
Market share, %	74%	16%	10%
Av. revenue, cents	0.90	0.75	0.80
Margins, %	72%	33%	29%
Base access price	N/A	0.50	0.50

Table 3 Diversion ratio assumption for the hypothetical postal market—base

	Incumbent	AS1 (mix model rival)	AS2 (access only rival)
Incumbent	0	75%	85%
AS1 (mix model rival)	50%	0	15%
AS2 (access only rival)	50%	25%	0
	100%	100%	100%

observed in Europe, and the revenues/margins information broadly consistent with information on based on our experience with postal cost/revenues models.

The next table shows the assumed diversion ratios. In our hypothetical market, we assume that the diversion ratios are asymmetric. This allows more switching in one direction than the other in order to reflect that customers with a first preference for one product due to specific features (e.g. they place a strong emphasis on quality) may view another product as the next best due to its quality. However, customers who view the second product as their first best option may do so for other reasons and hence view a different product as the next best option. Table 3 contains assumed diversion ratios. Each column tells us when the given supplier gains a customer, what is the likelihood it came from each of the rival operators' products.

These diversion ratios reflect the assumption that customers who switch to the incumbent are equally likely to have come from AS1 or AS2. Customers switching to AS1 in this hypothetical are most likely to have come from the incumbent rather than the other rival; but customers switching to AS2 are even more likely to have come from the incumbent. This could be because as AS2 is access-only, its product resembles the incumbent's product more than AS1's does.

Using these input assumptions, and assuming linear demand curves, we construct the demand system on the basis that the assumed prices are equilibrium prices and operators are profit maximizing. We estimate own and cross price elasticities of demand, constants for the demand curves and hence construct the optimal reaction functions for each firm/product in reaction to 'exogenous' changes.

4.2   Results 1: A 10% Reduction in Access Price

In our 'base' scenario, we assume a reduction in the access price of 10%. This change has a direct impact on all suppliers in the market. The incumbent faces a 10%

reduction in the wholesale revenues it makes from both AS1 and AS2, leading to a 19% reduction in the margin it makes on these products. AS1 faces a 10% reduction in the wholesale price that it faces for 70% of its volumes. Its cost of E2E delivery is unchanged. Its retail costs are unchanged, so the reduction translates into a 7% reduction in weighted average marginal costs. AS2 faces a 10% reduction in the wholesale price that it faces for all of its volumes. Its retail costs are unchanged, so the reduction in total marginal costs is 9%. The result is that the market price falls by 4.7%, with the incumbent reducing its price by 3.9%, and access seekers by 6.8%.

The access seekers pass on some share of their cost reduction to the retail market consistent with profit-maximizing behavior under our linear differentiated Bertrand model. They also react to price changes by all their rivals, to result in the final equilibrium price changes. For the incumbent, the reduced access charge implies that when it loses a retail customer, it recaptures less of this revenue from wholesale profits when the customer switches to access seekers. This gives the incumbent an incentive to reduce price in the retail market. In addition, the incumbent's rivals find it profitable to cut price because of their reduced access cost. The incumbent then responds to price reductions of rivals with a price reduction of its own. Because the regulatory reduction in the access price leads the incumbent to become more 'aggressive' in the retail market, in this simulation, we actually obtain the somewhat 'counter-intuitive' result that the incumbent grows its market share slightly (from 74% to 75%).

We can also consider a scenario where policy reduces the new entrant (variable) costs without affecting wholesale revenues of the incumbent. Without the effect of the incumbent re-optimizing across wholesale and retail, the policy change would lead to a smaller reduction in the incumbent's retail price (−0.9%), and lower pass through of cost changes by rivals. The hypothetical model shows that, in this case, the incumbent would lose 2% market share to rivals and hence both AS1 and AS2 would gain profits at the expense of the incumbent. In this scenario, consumers would gain less, as less of the cost change is passed on to them.

4.3   Results 2: A 10% Reduction in Access Price When AS1 Is 100% E2E

In a second illustration of the model, we consider the impact of the same 10% reduction in wholesale price, however instead of a market with two rivals depending on access (as in the base), we modify the characteristics of AS1, so that it becomes an operator relying solely on its own end-to-end delivery network. Therefore, the only access seeker is AS2 and both AS1 and the incumbent have different reaction functions.

We note that for illustrative purposes to allow comparison with the base we have kept the other input assumptions i.e. initial equilibrium prices, quantities and diversion ratios the same. However, because we estimate the demand curves based on

these input assumptions, this implies that in this sensitivity analysis (and the one below), we assume different parameters for the demand curves relative to the base i.e. elasticities of demand and constants, which lead to different reactions to the access price reduction—i.e. this is a different market to the base market. Therefore, the parameters of demand have first been estimated such that the same equilibrium prices and quantities are found given the different assumptions about AS1 (and hence the different marginal costs that AS1 has). Once the different demand functions are estimated, we assess the impact of the access price reduction. Relative to the base scenario, the wholesale market is less significant to the incumbent (it does not automatically recapture some revenue when it loses a retail customer, as it does not supply both rivals in the wholesale market) and the only operator facing a cost change is AS2.

The price changes in this scenario (compared to the base) are shown in Fig. 1 below. The price changes under this scenario are lower for all suppliers.

The most significant price change is from AS2, as it faces the cost change. AS1's price change is purely a reaction to price changes by AS2 and the incumbent. The incumbent's price change remains a mix of the two effects described in the base scenario, but the effects of both are weaker. Wholesale revenues in this market are already relatively less important to the incumbent, as it only earns them on volumes from AS2. When it loses a customer, it does not automatically recapture some revenue. There is less rebalancing as the incumbent is already more focused on retail. The incumbent also has to react to smaller price changes from its rivals, so its price change is lower for this reason as well.

In this scenario, as illustrated in Fig. 2, the incumbent still gains some market share due to rebalancing, but less than in the base scenario, for the reasons described above. AS2, as the only supplier to face a cost change, passes through less of this cost change, as it does not have a competitor also cutting prices due to a cost change. Despite charging a higher price in this equilibrium compared to our first scenario, AS2 manages to gain a little market share. AS1, who faces no cost change, is in a relatively weaker position and therefore loses market share to both the incumbent and AS2.
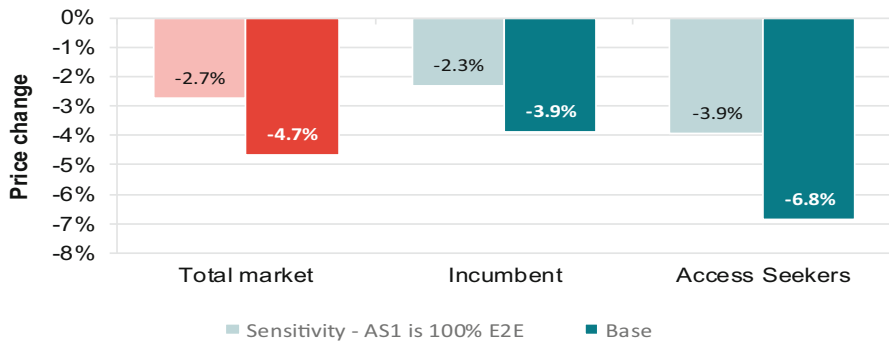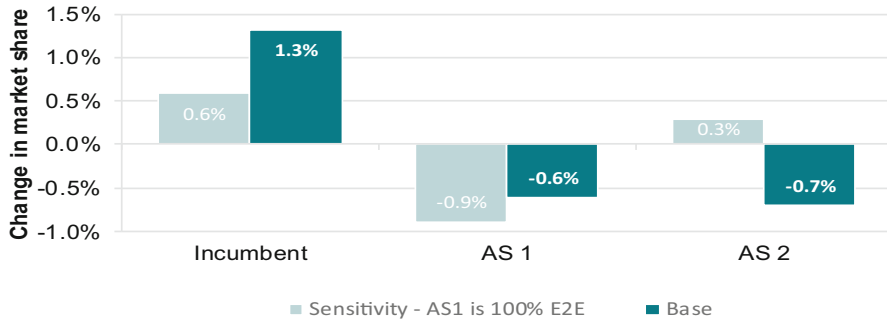

Fig. 1 Price changes when AS1 is 100% E2E compared to the base scenario

Fig. 2 Market share changes when AS1 is 100% E2E compared to the base scenario

With this different market structure, the policy change does benefit the access seeker, and this comes at the cost of the small E2E rival (AS1) as well as the incumbent.

## 4.4 Results 3: A 10% Reduction in Access Price When the Incumbent's Brand Is Stronger

In our third illustration, we revert to the assumption of AS1 as an access seeker and consider the impact of the same 10% reduction in wholesale price, however we assume that the incumbent has a stronger brand relative to the base. We implement this through a change in diversion ratios as shown in Table 4 below. This means when rivals do something to win customers, they are less likely to win them from the incumbent (and more likely to win them from the other access seeker) as the incumbent's customers are more sticky. As in the previous scenario we have kept the other input assumptions i.e. initial equilibrium prices, quantities and marginal costs the same and as such, the demand curves and reaction functions are different to in the base case. We assess the impact of the access price reduction based on this new demand system.

The results show that the incumbent can reduce its price less in response to rivals, as its brand is stronger. The access seekers fight more with each other and find it more difficult to win customers from the incumbent with any given price change, so have to reduce prices more (Fig. 3).

Due to the strength of the incumbent's brand, it gains more market share, as shown in Fig. 4. Customers have a strong preference for the brand of the incumbent and switch in response to lower prices. The access seekers are effectively competing more fiercely with each other for the small share of customers in the market who are less interested in the incumbent's brand, and therefore have to reduce prices more.

Table 4 Diversion ratio assumptions for the hypothetical postal market—after successful product/brand repositioning

	Incumbent	AS1 (mix model rival)	AS2 (access only rival)
Incumbent	0	40% (previously 75%)	40% (previously 85%)
AS1 (mix model rival)	50%	0	60% (previously 15%)
AS2 (access only rival)	50%	60% (previously 25%)	0
	100%	100%	100%
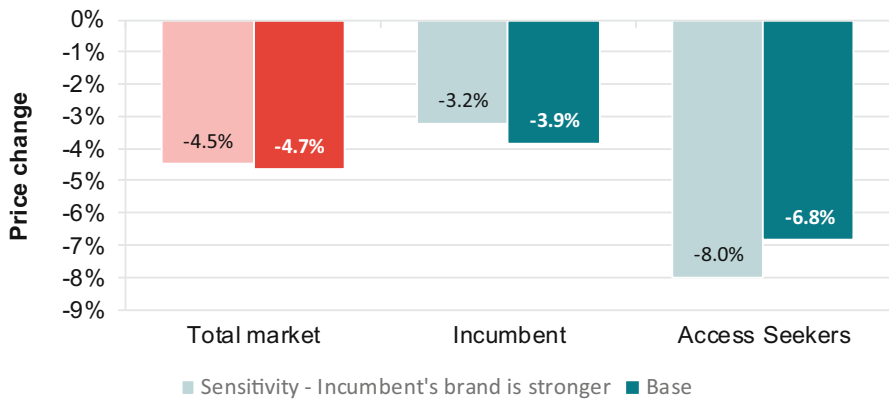
Fig. 3 Price changes when the Incumbent's brand is stronger compared to the base scenario
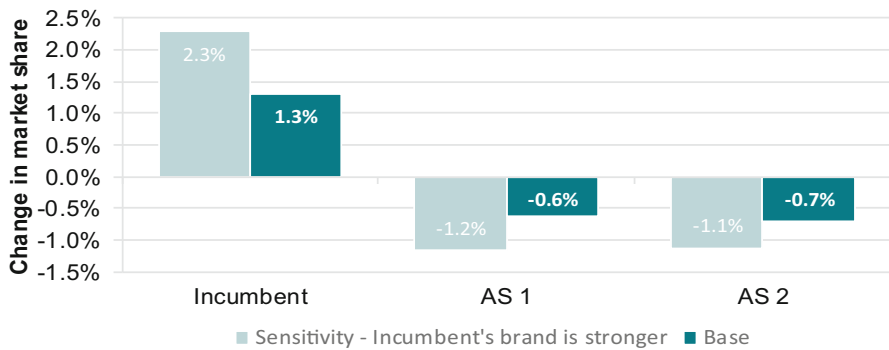
Fig. 4 Market share changes when AS1 is 100% E2E compared to the base scenario

5   Concluding Remarks

In this paper, we considered the use of a differentiated Bertrand model to capture the fact that following letters market opening to competition, postal operators have been offering substitutable but differentiated postal services; and to consider the possibility that incumbents may benefit from a relatively stronger brand than its rivals have. We stress that the results shown in this paper are the result of the specific hypothetical model we have chosen. If the market differs from the base, the impact on consumers, access seekers (or other E2E rivals) and the incumbent, also vary. There are a wide range of other factors, market circumstances and regulatory policies that can be modelled in this framework. With good quality data this framework provides a rich picture of how operators compete and gives insights on consumers' allegiance to a given product/ brand. It reflects responses from *different* operators in a consistent way—not only the one subject to a policy change—and is flexible to adapt to different business models (E2E competition, access only, mix model) to depict the specific features of markets. The exercise highlighted the potential role of the relative position of incumbents/new entrants' brands, and indicates that further research may be warranted, to consider question such as the build-or-buy decision of access seekers, and the dynamics of the postal market including the financial sustainability of operators.

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E-Government: A Curse or an Opportunity for Posts?

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1 Introduction

The expression "e-government" is generally used to describe policies implemented to transform the relationships between administrations, citizens and businesses using information and communication technologies (ICT). A unique definition does not exist since e-government policies reflect diverse government priorities, which are, themselves, evolving. A general view of the term "e-government" adopted here is the use of ICT by government agencies to improve the efficiency and effectiveness of their services, transform their relationships and facilitate communications with citizens and businesses.

E-government involves different interactions: (1) G2C, the direct relationship between government and citizens; (2) G2B, government to business relationships; and (3) G2G, the interactions between administrations (Burhan, 2014). The focus here is on G2C and G2B interactions. Moreover, e-government covers a variety of

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services: from the creation of e-identities, to e-signature, to e-voting process, as defined by Burhan (2014)[1].

Some benchmarks (European Commission e-government benchmark 2017b and United Nations E-Government Survey 2016) help identify certain leader countries in e-government strategies such as Australia, Denmark, France, New Zealand, Norway and United Kingdom.

E-government offers many advantages but also some risks. For example, it improves public administration services and creates economic and social opportunities. Nevertheless, it can also create a digital divide where certain users are excluded from these policies. After analysing the e-government strategies of leader countries, the main factors enabling successful e-government strategies are discussed.

E-governments, in principle, could appear detrimental for postal operators, because these policies often imply digitalization of some administration processes leading agencies to dematerialized communications with citizens and businesses. The example of Post Denmark is famous. Nevertheless, postal operators have also an important role to play to make e-government policies stronger, relying on their physical and intangible assets. Three fields in which some postal operators can actually play a role to support successful e-government implementations have been identified: (1) infrastructure and digital literacy; (2) digital government underlying tools; (3) government ambitions and policies.

The role of postal operators as e-government partners has already been studied by Burhan (2014). This work is different because it focuses on other countries and considers more recent examples than the earlier study.

Section 2 will identify six countries with a well advanced e-government and examine how they implement the three levers of success. Section 3 will show that postal operators are playing an active role in the success of e-government policies by providing services and supporting key enablers for a successful e-government. Section 4 concludes.

2 The Success Factors of E-Government Strategies

2.1 General Benchmark According to Quantitative Analysis

Our analysis is based on different sources: the Digital Economy and Society Index (DESI) of the European Commission (European Commission, 2017a), the

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[1]Buhran categorizes e-government services in outreach (including open data), accessibility, service delivery and e-participation. Where outreach includes: one-stop-shop national online portal, personal online account, digital information for citizens, and open-data. Accessibility includes: electronic signature, mobile phone service delivery. Service delivery includes: online forms and online transactions. E-participation regards: citizens feedback options, e-participation tools.
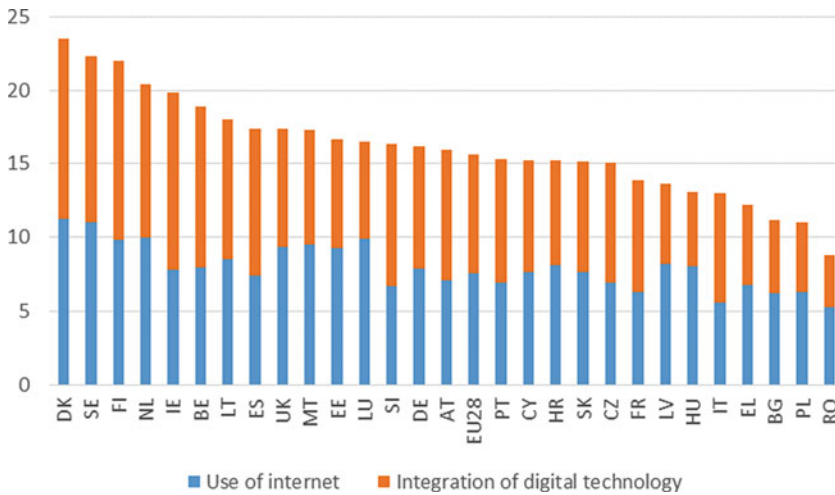
Graph 1 Use of internet and integration of digital technology ranking according to the DESI 2018. Source: DESI 2018

e-government benchmark 2017 of the European Commission[2] and the United Nations e-government survey. The first gives information on the use of ICT by citizens in European countries whereas the two others give inputs on e-government implemented tools. The different benchmarks use different criteria to define e-government and establish their ranking.

To understand how citizens and businesses use ICT, the DESI computed by the European Commission includes two criteria: use of internet by citizens[3] and integration of digital technology in business[4]. The most advanced countries for internet use are Denmark, Sweden, the Netherlands, Luxembourg, Finland, and Malta. For integration of digital technology, the most advanced countries are Denmark, Finland, Ireland, Sweden, Belgium and the Netherlands (Graph 1).

According to the European Commission benchmark, Denmark, Sweden, Estonia, Norway and Malta are the most advanced countries in 2016 for e-government (Graph 2).

Following the UN benchmark, United Kingdom, Australia, New Zealand, Denmark and France are in the top ten e-government leaders in the category "very high EGDI" (E-government Development Index) higher than 0.75[5].

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[2]This benchmark has been published in 2017 but is based on assessments done in 2016.

[3]Use of internet consists of percentage of internet users of news, music, videos and games, videos on demand, video calls, social networks, banking, and shopping.

[4]Integration of digital technology consists of the percentage of enterprises using electronic information sharing, RFID, Social Media, e-Invoices, Cloud, and the percentage of SME selling online, e-Commerce turnover and selling online cross-border.

[5]United Kingdom ranks first, Australia 2nd, New Zealand 8, Denmark 9 and France 10. United Kingdom is first in this benchmark but is ranked slightly below the EU28 average in the European
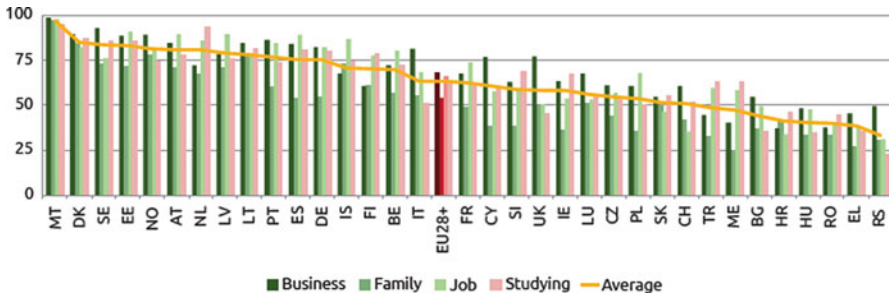
Graph 2 E-government country ranking for 2016 life events (European Commission benchmark 2017b). Business, family, job and studying are the main life events in the benchmark. The average line is the average score of the life events

Based on a combination of these findings, our focus is on six countries where usage of ICT and e-government tools are well developed i.e. Australia, Denmark, France, New Zealand, Norway and United Kingdom.

2.2 Three Main Elements for Successful E-Government Strategies

Even if e-government strategies are various and depend on countries' own particular characteristics and challenges, three factors that influence success of e-government policies appear common to all countries: (1) internet infrastructure and digital literacy of citizens; (2) underlying digital tools; and (3) government ambitions and policies. The six countries identified through the benchmarks have all implemented these different levers leading to e-government success.

Infrastructure and Digital Literacy

E-government success is strictly linked to the ability of citizens and businesses to use ICT; therefore, building a user centric e-government strategy is necessary to avoid the digital divide. Indeed not all the citizens are able to use ICT because: (1) they do not have access to the proper infrastructures (fixed and mobile broadband access); and (2) they do not have the capacity to use it (old people, disabilities...). Therefore,

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Commission benchmark 2017. This difference can be explained by the criteria used by the two benchmarks to measure e-government. The European Commission benchmark assesses on a yearly basis the digital transformation of different public service processes. The UN benchmark is based on the EGDI, which is constructed from three indices: online service index, telecommunication infrastructure index and human capital index.

the main risk for authorities is to design a strategy based only on a supply strategy without measuring effective demand ("build and they will come"—*OECD*, 2003). This can reduce policy effectiveness and can even complicate administration processes.

Infrastructure endowment is a subject linked to the technological choices and investments of countries. In Europe, on average, 87% of European households have access to internet in 2017 (EU 28) but with large disparities between countries (from 98% of households in the Netherlands to 71% in Greece)[6]. In the six countries chosen for this analysis, digital infrastructures are well developed. The telecommunication infrastructure index (TII) used to compute the EGDI in the UN benchmark gives a positive ranking to infrastructure development in the six countries: from 0.8247 (Denmark) to 0.7136 (New-Zealand)[7] compared to an average TII of 0.6438 in Europe and 0.3789 in high income countries[8].

To have efficient e-government, particular policies have to be implemented to include the citizens without the capacities or sufficient knowledge to benefit from on-line government services[9]. In Denmark, the State made it compulsory to receive digital notices from public authorities, but people unable to use the digital post can be exempted and continue to receive letters through traditional postal services. Beyond disabilities, some citizens don't have sufficient digital skills. Governments need to enhance measures towards digital literacy. United Kingdom recently established "Councils for Digital Inclusion," which brings senior leaders from the private and charity sectors together with government officials to deliver programs to help more citizens take advantage of the internet (United Kingdom Government, 2014). Similarly, the Australian Government announced it would launch a national Digital Economy Strategy in 2018[10]. One part of the work plan revolves around "empowering all Australians through digital skills and inclusion" (Australian Government, 2017). Meanwhile in New Zealand, the ICT strategy puts forward that citizens and businesses are at the center of digital services (Cabinet Committee, 2015; Millar, 2004).

Digital Government Underlying Tools

In its benchmark, the European Commission identifies four key digital enablers to boost e-government services: e-ID (electronic identification), digital post (possibility

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[6]Source: Eurostat.

[7]The TIIs for the studied countries are: Denmark: 0.8247; United Kingdom: 0.8177; Australia: 0.7646; France: 0.7502; Norway: 0.7276 and New Zealand: 0.7136.

[8]Countries are divided according to 2015 Gross National Income per capita, calculated using the World Bank Atlas method. The groups are: low income, USD $1045 or less in 2015; lower middle income, USD $1046—$4125 in 2015; upper middle income, USD $4126—$12,735 in 2015; and high income, US $12,736 or more in 2015.

[9]In France, the 2017 annual report of the Rights Defender ("Défenseur des droits") highlights the fact that dematerialization of administration procedures is detrimental for vulnerable people (elderly, people with no internet access).

[10]https://www.industry.gov.au/innovation/Digital-Economy/Pages/default.aspx.

to send and receive digital post), e-documents (possibility to use electronic documents) and authentic sources (online forms pre-filled with data the Government already hold).

E-government strategies embody use of icons and other tools to link citizens and the State. Examples include coherent interfaces or dedicated online portals used with the help of a digital identity to authenticate individuals. This is why most of the time the first step of e-governments is to put in place those tools that constitute the cornerstones of e-governments. In Norway, an electronic ID is used to authenticate Norwegians' identity to use public services on the internet (European Commission, 2016b). Four e-ID solutions are available to citizens, depending on their security requirements (MinID[11], Buypass, BankID and Commfides).

Government Ambitions and Policies

E-government strategies rely on specific actions, in this section we present strategies implemented by leading countries. Some countries have very proactive governments, such as Denmark, which took early and structured actions reaching excellent scores as shown by benchmarks. In Denmark, the first strategic document named "Towards eGovernment: Vision and Strategy for the Public Sector in Denmark" (2001–2004) was aimed at leading Denmark into the digital society, and was followed by a series of other strategic documents, always renewing and adapting the Danish State's strategy (European Commission, 2015, 2016a). All those strategic plans set clear objectives, strongly promoting digital communications and solutions.

In order to support e-government strategies, most countries decided to establish dedicated agencies or task forces to ensure the coordination between the different administrative levels of the State. Indeed, a decentralized e-government strategy can lead to disconnected approaches from other administrative levels of the country and a lack of coordination[12]. In Denmark, the Agency for Digitization was established in 2011 to implement the digital strategy and drive public sector collaboration. Australia appointed in 2015 a "Digital Transformation Agency" whose objective is to lead the government's digital transformation by working with the different government agencies[13].

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[11]MinID allows citizens to access public services that require a medium-high level of security, for example changing a tax return; changing an address in the National Population Register. It is used by 2.6 million Norwegians.

[12]As highlighted by Canadian Digital Service in its 2017 report, horizontal leadership is crucial to allow digital transformation beyond departmental silos. The Treasury Board of Canada Secretariat (TBS) launched in September 2016 an initiative aiming at putting into place a "made-in-Canada approach" to e-government.

[13]https://www.dta.gov.au/what-we-do/.

More and more countries are appointing at State level a data leader like a Chief Data Officer (CDO) to manage data assets of administrations. France created this job function in 2014 and in New Zealand the Government CDO works with the other Data leaders appointed across the State.

Legislative and regulatory changes have to be implemented by central states to establish their e-governments. The government has to create a legal framework to introduce reliable e-government tools and protect data privacy of citizens.

EU Member States benefit from a favorable European legislative framework and early on implemented legislation for electronic signatures, data protection, and public service information[14]. Some countries moved faster than others in some areas and issued their own law; for example, France with its Digital Republic Act in October 2016.

E-government's strategies can also include open data policies for access to public data. They enhance transparency of government actions and promote citizen participation. In this sense, a digital government seems to be a way to deepen democracy and citizen control. It can also help prevent corruption by increasing transparency and reducing contact between corrupt officials and citizens (Andersen, 2009).

Many countries are involved in the Open Government Partnerships[15] to foster local democracy and participation by creating new forms of collaboration and involvement of citizens. Norway has developed a municipality-state-reporting system named "Kostra" to allow municipalities to report electronically to the State data on strategic sectors.

Government data openness is also a way to spur economic activity, innovation and empower citizens to take an active role in society. Open data, beyond promoting government accountability, encourage "collective intelligence," considering that people and start-ups are able to create valuable innovations by reusing available data (O'Reilly, 2017)[16]. In France, open data policies have been strongly promoted since 2011 with the creation of the platform data.gouv.fr, and the mission of Etalab[17] coordinating policies for access and re-use of public data.

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[14]Namely: Directive 95/46/EC on the protection of individuals with regard to the processing of personal data and on the free movement of such data; EU Directive on a Community Framework for Electronic Signatures (1999/93/EC); Directive 2000/31/EC of 8 June 2000 on certain legal aspects of information society services, in particular electronic commerce in the Internal Market; Directive on 'privacy and electronic communications' 2002/58/EC; Directive 2003/98/EC on the re-use of public sector information, etc.

[15]The OGP is a multilateral partnership launched in 2011 which aims at guaranteeing concrete government's engagements towards transparency and fights against corruption, using new technologies.

[16]This virtuous circle is discussed in "Gov 2.0: The Promise Of Innovation", Tim O'Reilly, Forbes, 10 August 2009.

[17]https://www.etalab.gouv.fr/.

3   Postal Operators are Specific Contributors to the Three Successful Drivers of E-Government Policies

Within the top countries identified previously, Postal Operators (POs) are providing different services that contributes to the three success factors presented in Sect. 2. They help develop internet infrastructures and participate in promoting digital literacy; they provide digital government underlying tools and support government ambitions. POs have also some characteristics that explain why they can be a preferred partner of government when it comes to e-government policies. Their role will be more and more significant in the following years giving the digitalization of societies and governments.

3.1   POs Role in Facilitating Access to Internet and Improve Digital Literacy

Success of e-government policies is linked to the capacity of citizens and businesses to have access to internet infrastructure, in particular access to administration portals. Broadband infrastructure remains a major aspect of digital divide such as the one between urban and rural areas. POs have brought practical solutions by implementing internet access network inside some of their post offices. The objective was to enable people to gain access to online postal products and services and more broadly to online public services. A valuable experience from La Poste France ("WIFI 63") is the partnership with the Department Council of Puy-de-Dôme in central France and with Yziact, a start-up that provides an open access Wifi connector solution, implementing a free Wifi open access in some rural villages where no internet access is provided.

Moreover e-government policies need to include citizens who do not have the capacity to use government online service. Indeed, while e-governments policies are progressing in most of European countries, a significant part of the population remains unable to use on-line government services. (In France, this segment is estimated to reach 13 million people, roughly 23% of the French population above 15 years of age.)[18] Here, Posts are playing an active role, relying on their physical assets to help people who needs human interaction. Digitalization of public services creates a disruption and potentially inequality of access. POs can create an ecosystem of digital literacy and digital inclusion designed to make digital transition smoother throughout the whole territory.

In 2017, La Banque Postale (LBP, banking BU of French La Poste) entered into partnership with WeTakeCare (an Emmaüs Connect subsidiary association) to help people develop digital skills and more specifically knowledge to use apps and web

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[18]https://labo.societenumerique.gouv.fr/2017/11/16/vers-strategie-nationale-dinclusion-numerique/.

services provided by LBP. WeTakeCare developed a tool called "Les bons clicks[19]" that provides an evaluation of on-line digital skills. According to the level reached, postal agents are able to recommend ad hoc associations that provide training for digital skills.

The French Postal operator is also addressing the Silver economy, notably contributing to digital inclusion of senior citizens. Indeed, aging can lead to social isolation hence the necessity to better accompany seniors. To reach this objective, the French PO put forward ARDOIZ, a very friendly user digital tablet that enables seniors to get used to basic practices of the internet.

A major PO capacity to provide physical services throughout its service territory remains important in a digital society. Indeed, e-government policies have to take into consideration that a residual portion of the population will never operate online, and foresee particular actions to address the issue. POs have public services access points for people in remote areas for the past decades in many countries. With the acceleration of digitalization, this role grew even more important to accompany people in order to access the service offered by administrations.

Thus, post offices provide government services available online and assist people through the procedure. For example, Royal Mail allows people to access a wide range of services for governmental departments and local councils within its post offices. Also, Australia Post has recently confirmed it will continue to provide passport services across its national post office network for up to six years after signing a new contract with the Department of Foreign Affairs and Trade (DFAT). Similarly, the French inter-ministerial committee on regional equality announced in 2015 the creation of a national partnership between the French government and La Poste, aiming to welcome public service areas into 500 post offices located in rural and mountainous areas called MSAP ("Maisons de Services au Public") providing a host of basic public services (utilities service providers, employment agency, administrative local services, transports etc.). Thus, POs participate to e-government success by providing services that help reduce the digital divide, a result necessary to realize a user-centric e-government strategy. They bring therefore a relevant territorial coverage network that governments can rely on to implement digital public policies.

3.2   POs are Accelerating Public Adoption of E-Government Digital Underlying Tools to Link Citizens and the State

POs are providers of two key enablers of e-government services: digital mail boxes and e-identity. These two tools are necessary to link citizens, businesses and governments in a digital environment and are a major part of e-government strategies.

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[19]http://lesbonsclics.fr/.

POs Role in Securing Online Transfers of Data and Documents, Through Secure Digital Mailboxes

The role of POs in terms of privacy protection has been studied in the postal economic literature (Borsenberger, Klargaard, & Régnard, 2016). The creation of new tools allowing individuals to store, control and share their data and documents is one of the new services now delivered by POs to individuals, leveraging their trusted role and their capacity to manage personal data securely. These tools are used by citizens and businesses in their relation with administrations and government.

Services such as "My Post" (Australia Post), "Connect" (NZ Post), Digipost (Norway Post), "E-boks" (Post Denmark) or "Digiposte" (French Post) are largely used by citizens to communicate with their government. Top of the list are E-boks and Digipost with respectively 4.3 million users in Denmark and 1.6 million users in Norway. These impressive results are clearly linked with e-government ambitious policies implemented in those two countries.

In Norway, digital communication between public authorities and citizens have been made mandatory by law from February 2014. A month later, the Norwegian government, via the Agency for Public Management and eGovernment (Difi), provided an authorization to Digipost, Posten's digital mailbox. The Norwegian State later provided an agreement to E-boks, Postnord's digital mailbox, making it possible for Norwegian citizens to choose between those two mailboxes that are equally secure, and fulfill strict security requirements. In the early months of 2018, more than 500 public bodies were sending documents in Digipost to 1.6 million users[20].

A similar policy was implemented in Denmark in December 2014, making it mandatory for Danes to use digital self-services to access a wide range of government services and be able to receive digital mail from the authorities. There are two ways for citizens to receive secure digital mail from public authorities: together with Government's secure website—borger.dk. Danish public authorities have provided an exclusive agreement to E-boks, the digital mailbox co-created in 2001 by PostDanmark (now Postnord) and Nets, a Danish private company specialized in secure online transactions. This Government recognition and support has turned E-boks into a dominant player in Denmark: at the end of 2017, 4.3 million citizens (89% of the population) were communicating with public authorities through E-Boks. A recent survey among digital post users has shown citizens are highly satisfied with this service, demonstrating the central role played by trusted digital tools in the deployment of successful e-government policies. Among the respondents interviewed, 82% were satisfied or very satisfied with receiving their letters in secure digital mail (up from 81% in 2016). In addition, 81% of respondents felt

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[20]https://www.digipost.no/.

secure with receiving their public letters in Digital Post, which was an increase from 2016 when 77% of respondents felt secure[21].

In Australia, MyPost, the Australian Post's digital mailbox created in 2012, was one of the first of its digital initiatives to have success, and is now being used by nearly 5 million Australians[22]. From 2014, Australia Post partnered with the Australian State to enhance e-government policies, and MyPost was integrated to the government service portal MyGov. The MyGov portal allows Australians to link all information stored there by multiple government agencies to one account that has a single username and password. However, from September 2017, the partnership was ended and the link-up of the two services terminated, MyGov centralizing communication with citizens on administrative issues, while MyPost was turned to more postal-related services. The original digital mailbox concept has now evolved to become the MyPost account, which gives consumers and small businesses online access to Australia Post services. In this case, integration with e-government tools and procedures seems to have been used as a temporary booster more than a strategic partnership.

A Major Key E-Government Enabler Provided by POs: Verified Digital Identities

Recent researchers have specifically addressed the provision of digital identities as a key digital infrastructure to ensure both convenience and privacy protection online in particular when citizens use dedicated online administration portals. Borsenberger, Klargaard, and Régnard (2017) studied the main European and US developments, with operational trusted framework and regulations, demonstrating that postal operators' role in digital identification had become a reality in some European postal markets. Being user-centric, privacy-by-design in their historical role, capable to manage data and identities at a large scale, POs can naturally manage digital identity registration and verification and are already engaged in these frameworks in various ways. The POs' digital identity tool is mainly used today by governments to ease the access to online administration portals. A focus on three of the top ranking countries in e-government studies demonstrates clearly the strategic role of POs: United Kingdom, France and Australia.

The UK government has been among the first to launch a public platform of federated digital identities aiming to cover all identities' verifications through public services. Initiated in October 2014 by the Government Digital Service (GDS), Gov.uk Verify is an open platform facilitating British citizens' ability to log on and access online public services (European Commission, 2016c). Limiting

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[21]The survey was conducted in June 2017 by Epinion for the Danish Agency for Digitisation, there were 13187 respondents of a wide range of ages (http://www.digst.dk).

[22]Australia Post 2017 Annual Report.

its role in setting governance and operating the platform, the government certifies any digital identity provider that respects prescribed rules and technical criteria[23].

In this framework, the role of Posts is significant: both Royal Mail and Post Office Limited are now recognized "certified companies" (digital identity providers) by the British government. Post Office Limited has applied from the beginning of the project in 2014 whereas Royal Mail's service of digital identity has been launched in March 2016, to be ready for the industrialization phase of Gov.uk Verify. Both postal contributors are able to provide citizens with free and secured digital identities.

In France, a similar universal open public platform called France Connect was developed from the end of 2014, experimented in late 2015 with selected public and private identity providers and public service providers and has been finally launched in February 2016. Similarly to Gov.uk Verify, France Connect enables citizens to log on public administration websites to access information and access online public services. About 300 government bodies have integrated France Connect at the end of 2017 and 3.2 million users have connected to the service. La Poste identification systems is one of the identity providers used to connect the platform[24] with a service of digital identity.

In Australia, AusPost launched its digital ID solution in 2017, which allows people to verify their identity information once, so they can then easily prove who they are online. Public authorities already use the solution. Queensland Police Service has been one of the first organizations to adopt the platform. Beyond partnership with Government organizations, it is interesting to note in the Australian case, that AusPost digital ID is also widely used by the private sector (for example by Airtasker, a job outsourcing site, CUA, the Australia's largest credit union, Travelex, the foreign exchange company).

3.3   POs Support Government Ambitions by Participating in Platform Strategies Implemented by States and Sometimes Open Data Initiatives

Today, a large number of European countries have opened data portals (United Kingdom, Germany, Denmark, Spain, etc.). Open data policies are not homogeneous, neither is the opening of postal data sets. Open data policies is one key of e-government strategies and Posts have moved towards supporting open data to improve the virtuous cycle created by this movement.

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[23]Eight certified companies were recognized by the government: Barclays, CitizenSafe, Digidentity, Experian, Post Office, Royal Mail, SecureIdentity and Verizon.

[24]Four identity providers are active: tax department, MobileConnect & Me (Orange), Ameli (French health department of Social Security) and La Poste identification systems.

Indeed, POs handle a huge amount of data, and postal datasets like national address databases can be considered as valuable assets for the society. In France, La Poste joined the open data movement in April 2015 when signing a public innovative convention with Etalab (Etalab is a mission of the General Secretariat for the Modernization of Public Action -SGMAP- in charge of open data policies), the National Geographic and Forest Information Institute and the Open Street Map Association. All these actors agreed to disclose their data related to geocoded address to create a key standard for the economy, society and all public services, which is gradually intended to extend to all actors of the address. The result of this partnership is the release of the National Address Database. Also, La Poste France launched in February 2016 DataNOVA, an online portal that provides access to a collection of datasets for innovators (nine sets of mail-generated data are available, from the list of postal codes to the street mailbox map).

Some POs, however, decided to monetize their datasets like in Great Britain. POs datasets often constitute strategic assets and an open data policy should be weighed against the potential returns databases can generate to finance the universal postal service in a context of renewing business models due to decline in mail volume.

Moreover, it can be observed that best results in terms of transformation into digital societies, widespread use of e-government online services and fruitful cooperation between public authorities and POs are reached where policies are designed following the principle of "Government as a platform". The idea has been developed in 2011 by Tim O'Reilly[25] and considered that public authorities should rely on the same platform principles that made internet giants successful. Government can become open platforms that allow people inside and outside government to innovate[26]. POs interact with public authorities to provide services according to the "Government as a platform" principles (digital identities, digital mailboxes). Then, rather than exclusive partnership, limited in time and scope (see the example of Australia Post MyPost with public portal MyGov), POs are well off by participating in open platforms where they can provide, in a sustainable way, trusted digital solutions, data and assets.

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[25]O'Reilly (2011), "Government as a platform", Innovations: Technology, Governance, Globalization, Vol 6, Issue 1.

[26]This platform strategy relies on three key principles: (1) transparency of governments' information to citizens; (2) co-construction of public services with the private sector; (3) user centricity, i.e. not intend to create solutions or services when they already exist and are successful among consumers.

3.4 POs Advantages in Providing E-Government Tools Compared to the Private Sector

Over past decades, POs have provided a secure, universally accessible platform for physical commerce and communications. Today, the opportunity exists to extend their trusted intermediary role into the digital age and act as a link to facilitate access to the digital world. POs benefit from several assets helpful for e-government strategies that private actors do not have. First, POs have been trusted intermediaries supported by States providing secured communications services. The secrecy of correspondence is a fundamental legal principle enshrined in the Constitutions of many democratic countries. Consequently, respect of confidentiality, data protection and privacy are logically associated to postal brands, which is not always the case for private actors.

Second, POs benefit from a solid "trust capital". POs are generally considered as safe, trusted, reliable institutions. Often, they provide services of general economic interest (SGEI) on behalf of the State; some are still public administration or State-owned companies, increasing the feeling of trust and security as institutions. Thus, they are seen as trusted third parties by citizens.

Finally, many POs benefit from a large physical network of outlets that could become a bridge between the physical and digital worlds. Post offices can become the place where low digital skilled people learn to use, search and communicate with digital tools. In a nutshell they can become a valuable allied in the State's effort to reduce the digital divide.

4 Conclusion

The digital revolution is transforming societies all around the world. The blooming of e-governments is the result of this fundamental change but also the proof that decision makers wish to use technologies as a tool to transform the relationship between the State and its citizens. E-government initiatives are a complex phenomenon that should take into account how digital transformation has empowered individuals and changed the way citizens and consumers interact with authorities and businesses.

Postal operators around the world have a special place in society as still or former State administrations. They have always played a role of trusted third party and access point for people throughout a given territory with their well-developed network. This physical presence everywhere, and even in remote areas is becoming more and more relevant with the digitalisation of the society as postal operators are a physical link between a digital government and the citizens. Aside from their physical assets, postal operators hold intangible assets linked to trust which make them natural partners for the Government wishing to develop its e-government strategies. Besides, Posts are also more and more involved with their own digital transformation, and are credible interlocutors when it comes to digital solutions.

Consequently, it seems that e-government is an opportunity for postal operators, which are not only permitting a smooth transition toward e-government in a given country, but are also constructing with Governments the digital tools and solutions that citizens and businesses will use within a fully inclusive digital State.

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Relating Postal Activity to the Business Cycle by Linear Regression with Integral Equations

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1 Introduction

Econometric demand models for U.S. mail work best when they are fit to time series that include variables for economic activity (Pearsall, 2011 and 2012) or variables that are proxies for business conditions such as the employment rate (USPS, various years since, 2009). Typically, the estimated coefficients for these variables are both positive and significant with high confidence. Recently these kinds of econometric results have been offered to the U.S. Postal Regulatory Commission (PRC) as evidence that postal activity is related to the business cycle.[1]

But the evidence from the econometrics is actually ambivalent. Economic time series have two components—a *trend* component that incorporates the long run movements in the series, and a *cyclical* component that includes the short term variation and noise. The effects of business conditions are mostly limited to the cyclical component. For this paper, we separate time series into their trend and

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[1]In a recent exigent rate case U.S. Postal Service (USPS) witnesses used their econometric demand model to estimate volume and revenue losses due to the great recession. See PRC-LR-R2013-11/1 and 2.

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cyclical components using the Hodrick-Prescott (HP) filter.[2] This division, when successful, allows us to regard the cyclical component as isolated from all other effects.

Therefore, our model relates cyclical components to each other one-on-one. The cyclical components of USPS volumes, real revenues per piece and constant-dollar revenues are regressed on the cyclical component of an indicator of the business cycle. The relationship is represented as a linear integral equation and is fit employing specialized methods. The result is an ordinary least squares (OLS) estimate of the coefficients in the form of a continuous function with familiar statistical properties.

The fits are displayed throughout the paper in graphs and tables. Each fit yields a coefficient function over a time period extending from 18 months before to 18 months after the date of observation of the postal variable. These functions expose the timing of the cyclical relationship between the postal variable and the indicator of the business cycle. The fitted functions are subjected to tests for sign and symmetry. The patterns we discern in these fits constitute our findings.

Overall, we find that USPS volumes respond positively to business conditions. These responses have diverse timings depending upon the component of the mail stream but predominantly lead the business cycle. The response of real revenue per piece to business conditions is mostly negative. Furthermore, the timing appears to have changed in 2007 following passage of the Postal Accountability and Enhancement Act (PAEA). The cyclical behavior of USPS revenue in constant dollars combines the offsetting patterns of volume and real revenue per piece. We find that constant-dollar revenue is only weakly responsive to business conditions over the cycle.

The equation fits indicate that there is not a strong statistical connection between postal activity and the business cycle. On reflection this result is not too surprising. Postal services do not have the attributes of goods that are known to be highly responsive to cyclical conditions. Postal services are not capital goods; they are not luxury goods; postal demands are not driven by credit conditions; they are not linked closely to government finance; and postal expenditures are usually not deferrable. It is thus not surprising that our fitted models do not explain a high percentage of the variation in the cyclical component of any postal time series.[3]

Our model is presented in Sect. 2. The method of estimation is outlined in Sect. 3. Data sources and preparation are the subjects of Sect. 4. The results we obtain by fitting our model to total volume, average real revenue per piece and total constant-dollar revenue are presented and analyzed in Sect. 5. The results are then enlarged

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[2]The HP filter is the most commonly used technique for this purpose. However, it is not without its detractors including, notably, Hamilton (2017). For our purposes the most relevant criticism is that the HP filter may not correctly separate trend and cycle when there are discontinuous changes in the series. Fortunately, our method and findings do not depend critically upon the accuracy of the separations.

[3]An alternative, but unlikely, explanation for these results is that the HP filter has failed to sufficiently separate the trend and cyclical components of our postal time series.

to six aggregate USPS mail classes in Sect. 6 (volumes) and Sect. 7 (real revenue per piece). The sensitivities of our findings to alternative choices are examined in Sect. 8. Section 9 concludes.

2 The Linear Integral Equation Model

Our linear model relates the cyclical component of a postal time series to the cyclical component of a time series representing the business cycle. The model employs an integral equation to describe the functional relationship as continuous in time.[4] The model is the single-variable linear integral equation:

$$y(u) = \int_0^1 X(u,v)\beta(v)dv + e(u).$$

The left-hand side $y(u)$ is the value of the dependent postal variable at the time u. The components of the right-hand side are a two-variable function $X(u,v)$ constituting the leading, lagging and current values of an indicator of the business cycle relative to time u with a lead or lag of v; $\beta(v)$ is a one-variable function of coefficients associated with the leads and lags; and $e(u)$ is a one-variable function describing the error process. $e(u)$ is assumed to be zero-centered, to have a constant variance and to be independent of $X(u,v)$.

For all of the functions the variables u and v are linearly transformed so that $v \in [0, 1]$. v is a time displacement such that $v < 0.5$ for a lag, $v > 0.5$ for a lead and $v = 0.5$ for an observation that is coincident with u. The interval $[0, 1]$ is chosen so that all of the expected leads and lags are within the interval, i.e., $\beta(v) \neq 0$ only if $v \in [0, 1]$.

The linear integral equation model is a natural representation of a causal relationship that is continuous over time. At time u the value of the dependent variable $y(u)$ is a continuous linear function of the values of the independent variable $X(u,v)$ over a time range defined by $v \in [0, 1]$ with u at the center. In our applications this range is an interval of 3 years bracketing a mid-point month. The integral $\int_0^1 X(u,v)\beta(v)dv$ is the continuous equivalent of a multiplication of an independent variable by a coefficient. In this case the independent variable is the two-variable function $X(u,v)$ and the coefficient is the one-variable function $\beta(v)$ which varies continuously over $v \in [0, 1]$ but is the same for all u.

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[4]To account for different possible timings, a conventional single-equation linear model would have to be specified with many explanatory variables defined as leading, concurrent and lagging values of the indicator. However, applying OLS to fit such a model with monthly data does not produce useable estimates of the coefficients because the explanatory variables are nearly co-linear.

The shape of the function $\beta(v)$ describes the relationship of $y(u)$ to $X(u, v)$ over time. If the function is mostly positive, then the two variables move together; if the function is mostly negative then $y(u)$ is counter-cyclical. If the shape of $\beta(v)$ is skewed towards higher values of v then $y(u)$ leads the business cycle. If it is skewed towards lower values, then $y(u)$ lags. If $\beta(v)$ is symmetric about the axis at $v = 0.5$, $y(u)$ is coincident with the business cycle.

3   The Estimation Method[5]

To fit the model, the functions appearing in the model are specified as linear and quadratic forms of a pre-selected column vector function $f(t)$.[6] The elements of $f(t)$ are real-valued one-variable functions of t that are assumed to be linearly independent. It is also required that the elements of $f(t)$ be integrable over $t \in [0, 1]$. The vector function that is used for most of our applications is a powers vector[7]:

$$f(t)' = \begin{bmatrix} 1 & t & t^2 & t^3 & t^4 & t^5 & t^6 \end{bmatrix}.$$

The choice of $f(t)$ is made to provide versatile representations of the functional components of the linear integral equation.

Let us define these components using the vector function $f(t)$ as follows:

$$X(u, v) = f(u)'Xf(v), e(u) = f(u)'e, y(u) = f(u)'y \text{ and } \beta(u) = f(u)'\beta.$$

X is a real symmetric matrix; e, y, and β are real vectors. The model becomes:

$$f(u)'y = \int_0^1 f(u)'Xf(v)f(v)'\beta dv + f(u)'e.$$

We may now perform the integration[8]:

$$f(u)'y = f(u)'XC\beta + f(u)'e.$$

C is a symmetric positive definite matrix whose elements consist of the definite integrals of the squares and cross-products of the elements of the vector function $f(t)$

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[5]This section employs algebraic methods for treating linear integral equations described in greater detail in Pearsall (2018).

[6]The row vector function $f(t)'$ is the transpose of $f(t)$.

[7]One-variable real-valued functions are represented as MacLauren's and Taylor's series using powers vectors. Alternative choices were tested with results described briefly in Sect. 8.

[8]Since the elements of $f(u)$ are independent, the matrix and vectors of the linear integral equation are related by a system of independent linear equations: $XC\beta + e = y$.

taken over [0,1]. Let $f_i(t)$ and $f_j(t)$ be the i-th and j-th elements of $f(t)$, the element c_{ij} (or c_{ji}) of C is the integral $\int_0^1 f_i(t)f_j(t)dt$. The matrix C is predetermined by the choice of $f(t)$.

Our linear regression is an application of OLS to a pair of time series with observations indexed $i = 1,\dots,n$. An individual observation corresponds to a specific point in time, u_i, for which we have a single observed value $y(u_i)$ and a series of discrete observations of $X(u_i, v)$ before, after, and concurrent with u_i. These values are annual rates observed as averages over monthly periods. The observed values of $X(u_i, v)$ correspond to displacements for different values of v. The measurement of time is normalized so that $v \in [0, 1]$ corresponds to the range over which we expect to detect the cyclical relationship, e.g. 36 months. Let us define the following for a single observation i:

$y_i = f(u_i)'y$, a scalar,
$X_i = f(u_i)'X$, a row vector, and
$e_i = f(u_i)'e$, a random variable with zero mean and variance σ^2.

For the observation at time u_i we have:

$$y_i = (X_iC)\beta + e_i.$$

This equation is an ordinary multi-variate linear equation. However, its components also describe the continuous process of the linear integral equation at the time u_i. It obeys the assumptions for a large-sample application of OLS. Specifically, e_i is a random variable independent of X_iC with a zero mean and constant variance.

The scalar y_i corresponds directly to the observed values of the dependent variable of the linear integral equation. However, before we can apply OLS, we must have a practical way to calculate the vector X_iC for each observation. The matrix C is predetermined so this entails finding a way to estimate the vector X_i. We can obtain an estimate of X_i by making a local fit of the observed values of the independent variable to the vector function $f(t)$ in the vicinity of u_i. To make the local fits we use sub-samples consisting of 37 mid-month observations of the independent variable within a 36-month sub-range of the mid-point at u_i.[9]

For each observation of the independent variable we fit an equation by OLS to a vector function $f(t)$ centered on u_i. The equation for these fits is $x = X_if(v - 0.5)$. The "dependent" variable x is an observation of the independent variable falling within the time range of the sub-sample. The "independent" variables are the elements of the vector function $f(v - 0.5)$ evaluated at points determined by the timing of the observation within the sub-sample. The values of v linearly map the observation dates so that $v = 0$ is the date of an observation 18 months prior to u_i, $v = 1$ is

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[9]These sub-ranges correspond to the range $[0, 1]$ of the variable v of the linear integral equation. However, it is possible to make the local fits over ranges that differ from $v \in [0, 1]$.

18 months after and $v = 0.5$ corresponds to u_i. The estimated coefficient vectors from the local fits are the vectors X_i.

It is possible to use the observed values of y_i directly to fit $y_i = (X_iC)\beta + e_i$. However, a better choice is to use centered estimates derived from local fits of the dependent variable. We make the local fit $y = Y_if(v - 0.5)$ as described above to estimate the coefficient vector Y_i and then calculate $y_i = Y_if(0.5)$. Estimated in this way, y_i is a mean forecast with a reduced sampling error.

The OLS estimate of the coefficient vector $\widehat{\beta}$ is:

$$\widehat{\beta} = \left[\sum_{i=1}^{n}(X_iC)'(X_iC)\right]^{-1}\left[\sum_{i=1}^{n}(X_iC)'y_i\right].$$

The estimator is unbiased under the assumed conditions.[10] To show this we substitute $y_i = X_iC\beta + e_i$ in the estimator and take the expected value:

$$E[\widehat{\beta}] = E\left[\left[\sum_{i=1}^{n}(X_iC)'(X_iC)\right]^{-1}\left[\sum_{i=1}^{n}(X_iC)'(X_iC\beta + e_i)\right]\right] = \beta.$$

To derive the variance/covariance matrix for $\widehat{\beta}$ we estimate σ^2 as $\sum_{i=1}^{n}e_i^2/(n-k)$ where k is the number of elements in the vector function $f(u)$. Then:

$$Var(\widehat{\beta}) = E\left[(\widehat{\beta} - \beta)(\widehat{\beta} - \beta)'\right]$$

$$= E\left[\left[\sum_{i=1}^{n}(x_iC)'(x_iC)\right]^{-1}\sum_{i=1}^{n}(x_iC)'e_i^2(x_iC)\left[\sum_{i=1}^{n}(x_iC)'(x_iC)\right]^{-1}\right]$$

$$= \sigma^2\left[\sum_{i=1}^{n}(x_iC)'(x_iC)\right]^{-1}.$$

The estimator for the coefficient function is: $\widehat{\beta}(v) = f(v)'\widehat{\beta}$. The variance/covariance of the estimate of the function is the two-variable function:

$$E\left[(\widehat{\beta}(u) - \beta(u))(\widehat{\beta}(v) - \beta(v))\right] = \sigma^2 f(u)'\left[\sum_{i=1}^{n}(x_iC)'(x_iC)\right]^{-1}f(v) \text{ with } u$$

$$\in [0,1] \text{ and } v \in [0,1].$$

Determining the properties of an estimated coefficient vector $\widehat{\beta}(v)$ can be done with tests performed on integrals taken over sub-ranges of $[0,1]$ in a way that parallels tests of linear hypotheses with the estimated parameters of an ordinary linear regression. The figures in the text exhibit t-statistics that are used in simple t-tests of the sign and symmetry of $\widehat{\beta}(v)$ over sub-ranges $v \in [0.5 - a, 0.5 + a]$, with

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[10]The estimator has the well-known properties of an OLS estimator.

$0 < a \leq 0.5$. To test for symmetry and sign we compute the integrals: $\int_{0.5-a}^{0.5+a} (v - 0.5)\widehat{\beta}(v)dv$, for symmetry and $\int_{0.5-a}^{0.5+a} \widehat{\beta}(v)dv$, for sign. These integrals are computed numerically. The t-statistics for the tests are obtained by dividing the integrals by their standard deviations. The variance of the symmetry statistic is:

$$\sigma^2 \int_{0.5-a}^{0.5+a} \int_{0.5-a}^{0.5+a} (u - .5)f(u)'\left[\sum_{i=1}^{n} (x_iC)'(x_iC)\right]^{-1} f(v)(v - .5)dudv.$$

And the variance of the sign statistic is:

$$\sigma^2 \int_{0.5-a}^{0.5+a} \int_{0.5-a}^{0.5+a} f(u)'\left[\sum_{i=1}^{n} (x_iC)'(x_iC)\right]^{-1} f(v)dudv.$$

The variances are calculated by evaluating the integrals numerically and employing the estimate of σ^2 from the OLS fit.

4 The Data Set

Our data set is composed of two parts. The first part is taken from public sources[11] and consists of seasonally adjusted monthly economic time series that describe the U.S. business cycle. The series include real gross domestic product (Match RGDP), real disposable personal income per capita (A229RX0), the index of industrial production (INDPRO), real manufacturing and trade industry sales (CMRMTSPL), and three indicators of the business cycle compiled by the Economic Cycle Research Institute (ECRI Lead, ECRI Coin and ECRI Lag).

The second part consists of data taken from reports of postal volumes and revenues by USPS to the PRC. This data is only partly available electronically prior to 2009, however, we were able to compile an almost-complete monthly series from USPS Accounting Period Reports (APRs) from the PRC's files back to July 1970.[12] The APRs are not very detailed, consequently, it was only possible to compile monthly observations at a highly aggregated level. It was also necessary to undo the effects of several reclassifications that had altered the categories used in

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[11]The data bank maintained by the Federal Reserve Bank of St. Louis (FRED) is the most important of these sources. Other sources are Macroeconomic Advisors, Stock-Watson and the Economic Cycle Research Institute (ECRI).

[12]Most of the observations were compiled from Same Period Last Year (SPLY) values reported in the APRs for the following year. The only APRs missing from the PRC's files were for FYs 1992, 1993, 2007 and 2008. The observations for FY 1992 are interpolations made from quarterly Revenue, Pieces and Weight (RPW) reports, the data for 1993 were recovered from SPLYs, and the FY 2007 and 2008 reports were supplied by USPS.

the APRs.[13] Ultimately, we were able to compile consistent monthly series for six - broadly-defined classes of U.S. mail: First-Class mail; Priority, Express and Mailgrams (combined); Periodicals; Standard mail; Parcel services; and outbound International mail. These categories roughly correspond to the way mail data were reported to the PRC between 1998 and 2013. For each category we have extracted USPS volume (pieces), revenue and revenue per piece. The revenue series were deflated to 2009 constant dollars using the implicit deflator for real GDP. Prior to FY 2004 USPS used 4-week accounting periods that did not correspond to calendar months. The accounting period volumes and revenues were recompiled to calendar months using the proportions of the 4-week accounting periods falling within each month.

The APR data are unaudited. For this reason, the APR-based monthly series may be noisier than USPS's quarterly RPW reports which are audited for accuracy, and are available at a higher level of detail than the APR data. To eliminate some of the possible noise, a second set of postal series was constructed by combining the monthly APR data and the quarterly RPW data. This was done by distributing RPW volumes and revenues among the months of each quarter according to the distributions found in the APR monthly series.

All of the postal volume and revenue series have been converted to annual rates and seasonally adjusted.[14] Seasonal variation was removed by adjusting each time series using methods developed by the U.S. Bureau of the Census for fitting autoregressive integral moving average models (ARIMA 12).[15] Revenue per piece was calculated from unadjusted volume and revenue, and then seasonally adjusted.

Prior to estimation all variables were converted to logarithms. Next, the cyclical components of both the economic series and the postal series were extracted by applying the HP filter to the monthly time series. The result of this preparation is a trend component which represents the non-transitory effects of pricing, economic conditions, and structural changes on the variable; and a cyclical component that captures the higher frequency effects including those caused by the business cycle and noise in the data. The purpose of seasonally adjusting the time series prior to applying the HP filter is to avoid including seasonal variation in the cyclical component. The cyclical components have a zero mean and are divided by their standard deviations. The standardized cyclical components of the monthly series are the data for our fits.

There are many reasons to suspect that the HP filter will not perfectly separate the trend and seasonal components of the time series that we use.[16] The effect of imperfect filtering is to add noise to the cyclical components that we use in our estimation method. When the noise is added to a postal series appearing as a

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[13]There are two major reallocations needed to obtain series according to consistent definitions. Prior to 1989 Government mail (except Penalty mail) was reallocated to other classes and, more recently, several reclassifications of small packages and parcel services as competitive were undone using quarterly RPWs to estimate the reallocations.

[14]The time series we use to represent business conditions are already seasonally adjusted.

[15]The seasonal adjustments were performed using a Eurostat program called DEMETRA.

[16]See Hamilton (2017).

dependent variable it reduces goodness-of-fit without causing the OLS estimator to be inconsistent. On the other hand, adding noise to the cyclical components of our business cycle indicators has the well-known effect of attenuating OLS estimates. Fortunately, the HP filter has a long record of successful applications to macro-economic time series reflecting business conditions.

5 How It All Works

Our base results were obtained by applying our estimation method at the highest level of aggregation—to total USPS volume, real revenue per piece and total revenue in constant 2009 dollars.[17] We selected a vector function $f(t)$, and a composite coincident measure of the business cycle, ECRI Coin, after testing several alternatives.

Figure 1 shows the result of the local fits for the business cycle indicator. The jagged line is the standardized cyclical component of ECRI Coin. The smoother line is the locus of predicted values obtained by evaluating each fit at the mid-point of the sub-sample. The most notable effect is the elimination of noise. The correlation between the jagged and smoother series is $R^2 = 0.971$. Of the several candidates to represent the U.S. business cycle, ECRI Coin is the least noisy.

The top section of Fig. 2 is a similar graph of the standardized cyclical component of total USPS mail volume derived from the APRs (Vol.APR.Total). The data series is the jagged line and the locus of local fits is the smoother line.[18] Vol.APR.Total is a much noisier time series than ECRI Coin. The correlation between the jagged and smoother lines in Fig. 2 is only $R^2 = 0.482$. The additional line is the locus of local fits for ECRI Coin from Fig. 1.

Fig. 1 ECRI coincident indicator

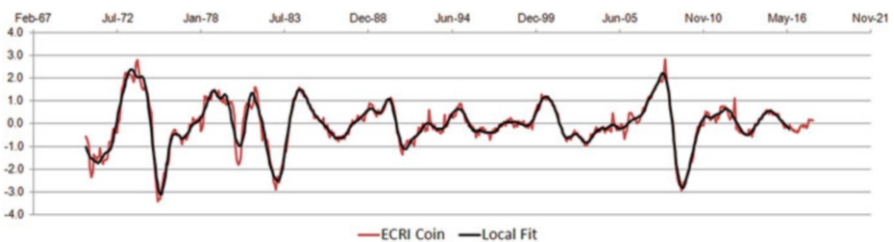[17]To be complete, an econometric model of demand for any category of USPS mail must explain both volume and revenue per piece because both are endogenous. See Pearsall (2011 and 2012) and Bzhilyanskaya, Cigno, and Pearsall (2015).

[18]The prominent "blip" in Vol.APR.Total occurs at the time that USPS transitioned from using 13 4-week accounting periods to 12 monthly accounting periods.
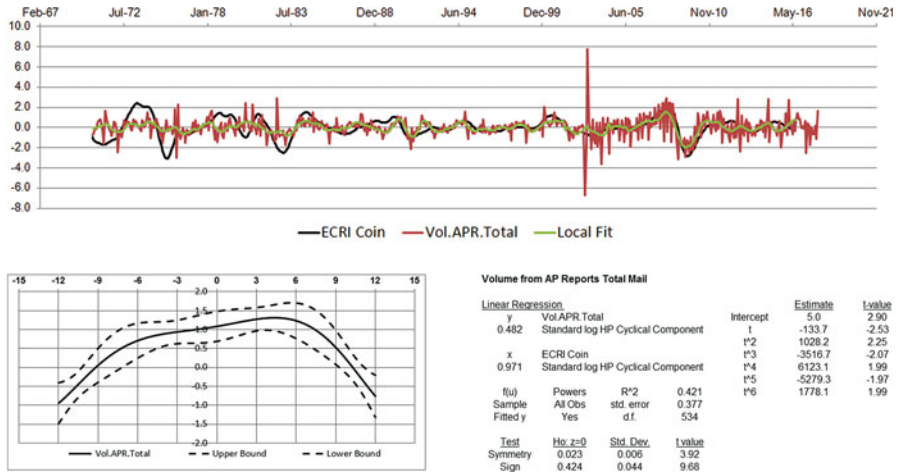
Fig. 2 Total volume

Different components of the mail stream have their own timing relationships to the business cycle. We would expect most mail to be more-or-less coincident with the business cycle because the predominant purpose of the mail is to enable commercial transactions. The fitted coefficient function gives us a summary of these timing relationships with respect to postal volume.

The fitted function $\widehat{\beta}(v)$ is shown in the graph to the left in the lower half of Fig. 2. It is the solid black curve. The variable v, converted to months before and after the midpoint of the month in which Vol.APR.Total is observed, is shown along the top of the graph. The graph has been truncated to omit the first and last 6 months of the 36-month interval used to make the local fits.[19] The fitted function is shown enclosed in its 95% confidence interval. The dashed curves in the graph display the continuous boundaries of the confidence interval.

The graph exhibits how past, present and future business conditions over a range of 2 years impacts the total volume of mail observed at the present time. This impact is overwhelmingly positive as we would expect. The estimate of $\beta(v)$ is continuously positive from 9 months prior to the present to about 10 months after. For most of this span the estimates are statistically significant. The economic explanation for what we see is that the mail is a mix of components that respond in mostly positive ways to cyclical changes as represented by ECRI Coin. However, the timing of these responses varies widely and includes components that lead the cycle by as much as 10 months and components that lag by as much as 9 months. Also note that the graph of $\beta(v)$ is not symmetric. The area beneath the function and above the horizontal axis is larger above month 0 than below. This means that mail volume tends to lead more than lag the business cycle.

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[19]This is done to avoid displaying the endpoints of the estimated function which are poorly supported.

The right-hand section of Fig. 2 displays the values of the parameter estimates, the values for various *t*-tests and several goodness-of-fit statistics. Beneath the identification of the variables are shown correlations between the local fits and the data series for the fit. The estimates of the elements of the vector $\widehat{\beta}$ and corresponding *t*-values are shown on the right. All of these estimates are statistically significant at levels exceeding 95%.

We have obtained these results despite the fact that the model does not fit the sample particularly well. According to the R-square statistic the fitted linear integral equation only explains 42% of the variance of Vol.APR.Total. This percentage would be even lower if we had used observed rather than fitted values for the dependent variable. This confirms what our eye tells us looking at the top half of Fig. 2. The movements in the red and green lines do not track the movements in the black line particularly well.

The table includes statistics and *t*-values for tests of two linear hypotheses regarding the symmetry and sign of $\widehat{\beta}(v)$ over the 2-year interval used to graph the function. To test for symmetry and sign we compute the test statistics described in Sect. 3. The integrals are computed over the 2-year span of the graph. If the graph of $\widehat{\beta}(v)$ is perfectly symmetric, the test statistic for symmetry has a value of zero. If the graph of $\widehat{\beta}(v)$ is symmetric about the horizontal axis, then the sign statistic is zero. *t*-values are calculated for both statistics under the null hypothesis that the statistic is zero. As we see from Fig. 2 both test statistics are positive at high levels of significance. They confirm the inferences we have drawn about $\widehat{\beta}(v)$ from its graph.

The results of applying our estimation methodology to USPS's average real revenue per piece (RRPc.APR.Total) are similarly displayed in Fig. 3. The top half of Fig. 3 suggests that there is little relationship between RRPc.APR.Total and ECRI Coin. The goodness-of-fit statistics for the fit of the model stay the

Revenue per Piece at 2009 Prices from AP Reports Total Mail

Linear Regression

					Estimate	t-value
y	RRPc.APR.Total	Standard log HP Cyclical Component		Intercept	-4.0	-1.17
0.793				t	101.0	0.96
x	ECRI Coin	Standard log HP Cyclical Component		t^2	-962.6	-1.06
0.971				t^3	4020.4	1.19
				t^4	-7981.3	-1.30
f(u)	Powers	R^2	0.118	t^5	7391.8	1.39
Sample	All Obs	std. error	0.750	t^6	-2568.7	-1.45
Fitted y	Yes	d.f.	534			

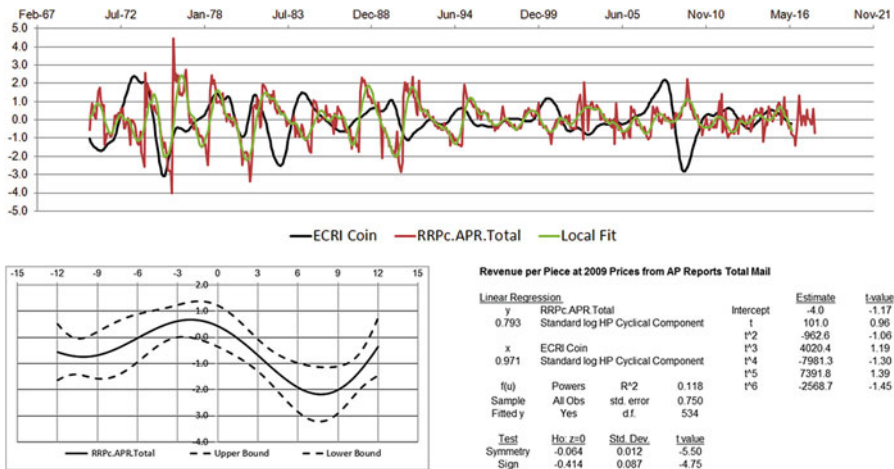| Test	Ho: z=0	Std. Dev.	t value
Symmetry	-0.064	0.012	-5.50
Sign	-0.414	0.087	-4.75

Fig. 3 Real revenue per piece

same. The fitted model explains only about 12% of the variation in the dependent variable. Apparently the business cycle is not an important determinant of postal real revenue per piece.

The graph of $\widehat{\beta}(v)$ lies mostly below zero. Little of the graph is significantly positive. This is confirmed by the sign test. The economics of this result is that real revenue per piece tends to be counter-cyclical. This response can be explained by the system of worksharing discounts found in all US postal tariffs since 1976. The proportion of mail that is workshared to obtain a discount depends on volume. Higher volumes are required to make mailings eligible for higher discounts. And, there are returns to scale that attach to the worksharing activities themselves. Both of these facts will increase the proportion of workshared mail and deepen discounts when volumes are higher over the course of the business cycle. This result accords with previous econometric results (Pearsall, 2011 and 2012) showing that USPS revenues per piece are affected by most of the same causal factors that affect volumes.

The graph of $\widehat{\beta}(v)$ is also conspicuously asymmetric. The deeply negative portions of $\widehat{\beta}(v)$ lie entirely above month 0 with a minimum around month 8. Consequently, the symmetry test rejects the null hypothesis that the graph is symmetric. USPS volumes tend to anticipate the business cycle. The asymmetry may be explained by the composition of USPS mailers. If the anticipating mailers are disproportionately worksharing to obtain discounts, then the negative responses of RRPc.APR.Total will also largely lead movements in ECRI Coin. Finally, in Sect. 8 we shall see that there is evidence that the timing relationship of postal prices to the business cycle changed at the start of 2007. These discoveries are new.

The response of total revenue to the business cycle is a combination of the somewhat divergent responses of volume and revenue per piece. This response is described by the fit of RRv.APR.Total to ECRI Coin shown in Fig. 4. The graph of
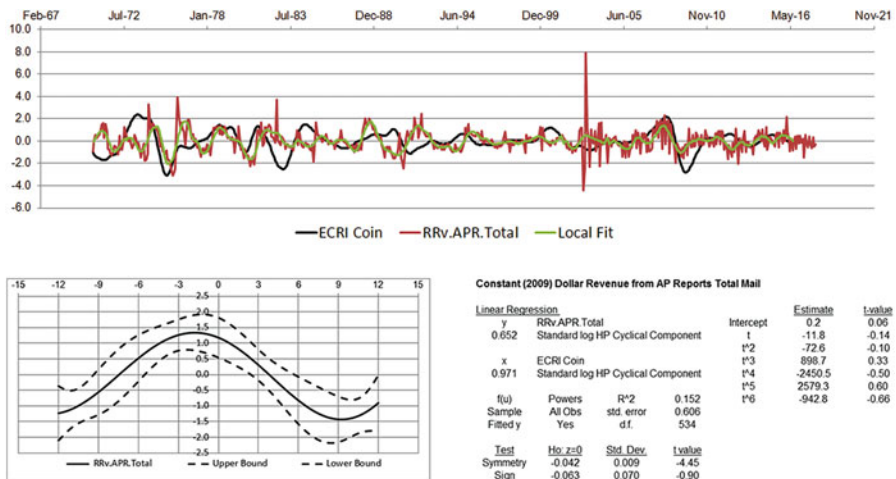

Fig. 4 Total constant-dollar revenue. The large blip in RRv.APR.Total corresponds to a change in USPS accounting. See footnote 19

$\widehat{\beta}(v)$ has features that relate directly to similar features in the graphs for volume and real revenue per piece. The graph for revenue has a significant positive peak at around—2 months that reflects the centered peak of the graph for volume. On the other hand, the graph for revenue displays a significant negative minimum at around 9 months which resembles a similar feature in the graph for real revenue per piece.

Altogether, the response of postal revenue to the business cycle is statistically insignificant. The positive and negative sub-regions of $\widehat{\beta}(v)$ offset each other. The business cycle has almost a neutral overall impact on real postal revenue. The effect of the business cycle on real postal revenue is almost entirely a timing phenomenon. The symmetry test t-value of -4.45 is significant and shows that the graph of $\widehat{\beta}(v)$ in Fig. 4 is skewed to the left. Real postal revenue tends to lag the business cycle.

The fitted model allows us to describe how real postal revenue changes as the economy moves through the recession and then the recovery phase of a typical business cycle. Postal real revenues increase ahead of the recession phase but decline ahead of the recovery phase. These effects are the result of the negative region of $\widehat{\beta}(v)$ which leads the cycle and the positive region which is roughly coincidental. The effects are largely offsetting over time.

Finally, it is important to notice that the model does not fit the time series data very well. Only about 15% of the variation in the cyclical component of RRv.APR. Total can be explained by relating it to ECRI Coin. The remaining 85% of the variation is noise. The poor fit is responsible for the low t values of the estimates of the elements of the vector $\widehat{\beta}$. Yet despite the poor fit the model provides an estimate of the function $\widehat{\beta}(v)$ that is mostly significant over a 2-year region and enables tests that allow us to describe the cyclical behavior of real postal revenue.

6   Volume by Class

We have already seen that Vol.APR.Total gives rise to an aggregate $\widehat{\beta}(v)$ that responds positively and broadly to changes in ECRI Coin suggesting that the timing of mailers' reactions are different and widely distributed. Some of this variety is evident in the results we obtain by applying our model and estimation methods to mail volumes at the class level. These fits are shown in Fig. 5.

As with total mail the graphs also tend to be asymmetric favoring the right-hand side except for Parcel Services. The symmetry test statistics for the classes other than Parcels are positive and significant. Therefore, the cyclical components of volume for these classes all tend to lead the business cycle although the length of the lead seems to vary considerably from class to class. The symmetry test for Parcel Services is inconclusive.
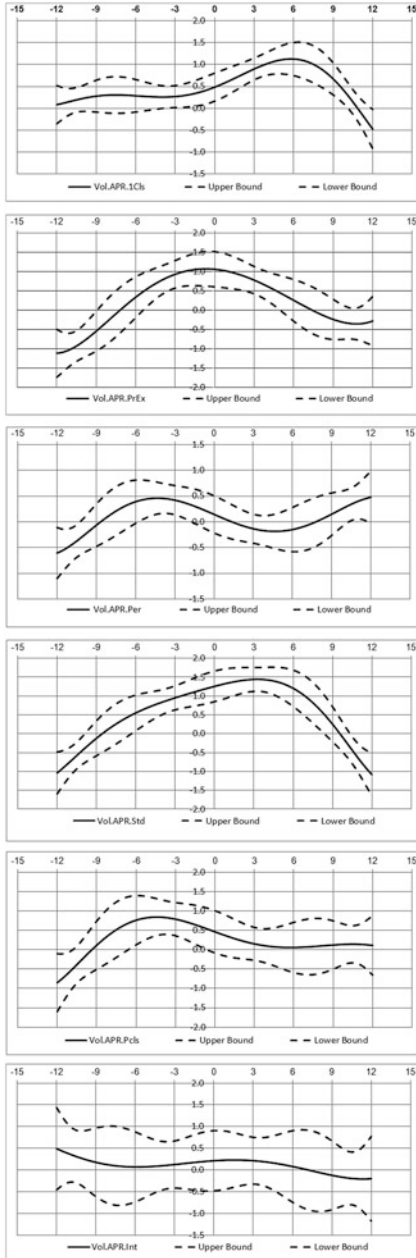
Volume from AP Reports First-Class Mail

Linear Regression					Estimate	t-value
y	Vol.APR.1Cls			Intercept	3.6	2.57
0.373	Standard log HP Cyclical Component			t	-74.9	-1.76
				t^2	592.9	1.61
x	ECRI Coin			t^3	-2207.4	-1.61
0.971	Standard log HP Cyclical Component			t^4	4166.2	1.68
				t^5	-3814.4	-1.77
f(u)	Powers	R^2	0.340	t^6	1337.3	1.86
Sample	All Obs	std. error	0.304			
Fitted y	Yes	d.f.	534			

Test	Ho: z=0	Std. Dev.	t value
Symmetry	0.019	0.005	3.93
Sign	0.327	0.035	9.26

Volume from AP Reports Priority, Express and Mailgrams

Linear Regression					Estimate	t-value
y	Vol.APR.PrEx			Intercept	4.9	2.47
0.491	Standard log HP Cyclical Component			t	-97.1	-1.59
				t^2	549.7	1.04
x	ECRI Coin			t^3	-1360.6	-0.69
0.971	Standard log HP Cyclical Component			t^4	1742.4	0.49
				t^5	-1184.0	-0.38
f(u)	Powers	R^2	0.199	t^6	349.1	0.34
Sample	All Obs	std. error	0.434			
Fitted y	Yes	d.f.	534			

Test	Ho: z=0	Std. Dev.	t value
Symmetry	0.015	0.007	2.24
Sign	0.152	0.050	3.02

Volume from AP Reports Periodicals

Linear Regression					Estimate	t-value
y	Vol.APR.Per			Intercept	3.7	2.38
0.333	Standard log HP Cyclical Component			t	-79.8	-1.65
				t^2	507.3	1.21
x	ECRI Coin			t^3	-1378.2	-0.89
0.971	Standard log HP Cyclical Component			t^4	1775.6	0.63
				t^5	-1038.9	-0.42
f(u)	Powers	R^2	0.069	t^6	208.3	0.26
Sample	All Obs	std. error	0.345			
Fitted y	Yes	d.f.	534			

Test	Ho: z=0	Std. Dev.	t value
Symmetry	0.008	0.005	1.41
Sign	0.058	0.040	1.45

Volume from AP Reports Standard Mail

Linear Regression					Estimate	t-value
y	Vol.APR.Std			Intercept	2.4	1.39
0.528	Standard log HP Cyclical Component			t	-88.7	-1.63
				t^2	719.0	1.53
x	ECRI Coin			t^3	-2527.3	-1.45
0.971	Standard log HP Cyclical Component			t^4	4555.8	1.44
				t^5	-4092.6	-1.49
f(u)	Powers	R^2	0.492	t^6	1437.0	1.57
Sample	All Obs	std. error	0.387			
Fitted y	Yes	d.f.	534			

Test	Ho: z=0	Std. Dev.	t value
Symmetry	0.020	0.006	3.36
Sign	0.380	0.045	8.45

Volume from AP Reports Parcel Services

Linear Regression					Estimate	t-value
y	Vol.APR.Pcls			Intercept	4.2	1.78
0.549	Standard log HP Cyclical Component			t	-109.0	-1.49
				t^2	780.5	1.23
x	ECRI Coin			t^3	-2387.0	-1.02
0.971	Standard log HP Cyclical Component			t^4	3590.4	0.84
				t^5	-2628.8	-0.71
f(u)	Powers	R^2	0.072	t^6	749.5	0.61
Sample	All Obs	std. error	0.521			
Fitted y	Yes	d.f.	534			

Test	Ho: z=0	Std. Dev.	t value
Symmetry	-0.002	0.008	-0.23
Sign	0.179	0.060	2.96

Volume from AP Reports International Mail

Linear Regression					Estimate	t-value
y	Vol.APR.Int			Intercept	0.8	0.27
0.692	Standard log HP Cyclical Component			t	6.4	0.07
				t^2	-96.8	-0.12
x	ECRI Coin			t^3	366.6	0.12
0.971	Standard log HP Cyclical Component			t^4	-589.5	-0.11
				t^5	416.8	0.09
f(u)	Powers	R^2	0.047	t^6	-103.0	-0.07
Sample	All Obs	std. error	0.662			
Fitted y	Yes	d.f.	534			

Test	Ho: z=0	Std. Dev.	t value
Symmetry	-0.015	0.010	-1.43
Sign	0.073	0.077	0.96

Fig. 5 Volume by class

There is little that can be inferred about Periodicals (Vol.APR.Per) and even less that can be said about International mail (Vol.APR.Int) from our fits. The estimated $\widehat{\beta}(v)$ is mostly insignificant for Periodicals and entirely so for International mail. Neither the sign nor the symmetry test produces a significant result for either class.

In the aggregate we have seen that our model only explains 42% of the variation in the cyclical component of USPS volume. This mediocre performance also characterizes the fits by class. The fit for Standard mail (Vol.APR.Std) has a semi-respectable R-square of 0.492, the highest of the classes.

7   Real Revenue per Piece by Class

The class-level fits of real average revenue per piece to ECRI Coin also roughly reproduced the results analyzed in Sect. 5. These fits are shown in Fig. 6.

The functions $\widehat{\beta}(v)$ are mostly negative-valued for First-Class mail (RRPc. APR.1Cls), Priority mail etc. (RRPc.APR.PrEx), Standard mail (RRPc.APR.Std), Parcels (RRPc.APR.Pcls) and International mail (RRPc.APR.Int). The sign test statistic for all of these classes is negative and significant. As explained in Sect. 5 these negative responses to cyclical changes are the logical result of the system of worksharing discounts found in the postal tariff. Only for Periodicals (RRPc.APR. Per) is $\widehat{\beta}(v)$ mostly positive. However, the sign statistic for this class in not significantly different from zero.

The functions for First-Class mail, Priority mail etc., Standard mail and Parcels are all roughly similar in shape to that for RRPc.APR.Total over the time span shown in the graphs. Each exhibits a contiguous and roughly centered range over which the estimates of $\widehat{\beta}(v)$ are positive and statistically significant. The predominant negative regions of $\widehat{\beta}(v)$ are found towards the borders of the graphs. The conclusion to be drawn from this observation is that the relationships of real revenue per piece to ECRI Coin are complex. The typical overall response combines a positive coincident response with negative responses that both lead and lag.

The symmetry test statistics for the fits are all statistically significant but differ in sign. Those for First-Class, Periodicals, Standard mail and Parcel services are negative indicating that the graphs for these classes are skewed to the left; while the graphs for Priority etc. and International mail are skewed to the right.

The fits are all poor as statistical explanations of the cyclical variation of real revenue per piece. The highest R-square, 0.273 for Periodicals, does not evidence a very strong relationship to ECRI Coin.
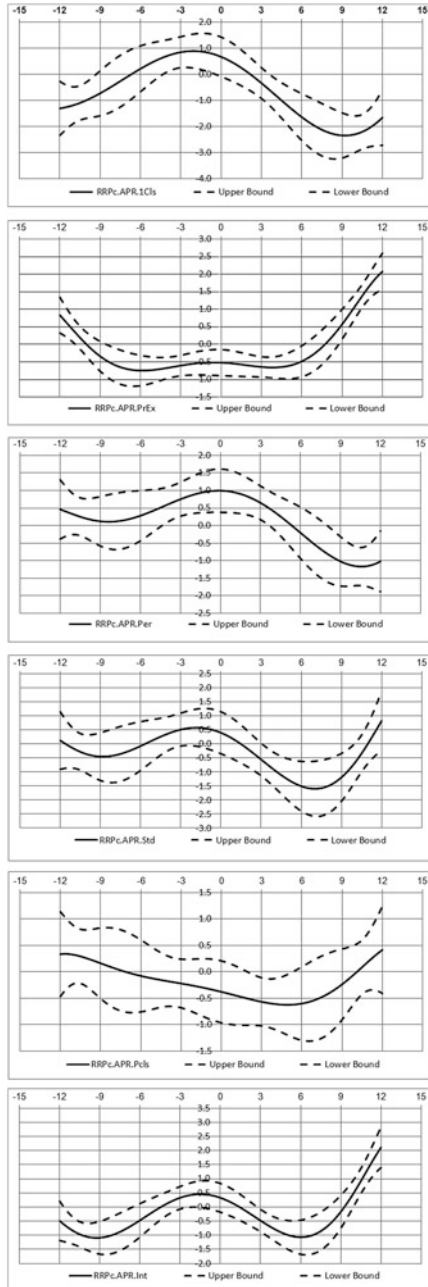
Revenue per Piece at 2009 Prices from AP Reports First-Class Mail

Linear Regression				Estimate	t-value
y	RRPc.APR.1Cls		Intercept	-1.7	-0.52
0.800	Standard log HP Cyclical Component		t	18.4	0.18
			t^2	-257.5	-0.29
x	ECRI Coin		t^3	1424.7	0.44
0.971	Standard log HP Cyclical Component		t^4	-3218.9	-0.55
			t^5	3123.5	0.61
f(u)	Powers	R^2	0.201	t^6	-1086.6	-0.64
Sample	All Obs	std. error	0.720		
Fitted y	Yes	d.f.	534		

Test	Ho: z=0	Std. Dev	t value
Symmetry	-0.076	0.011	-6.85
Sign	-0.417	0.083	-5.00

Revenue per Piece at 2009 Prices from AP Reports Priority, Express and Mailgrams

Linear Regression				Estimate	t-value
y	RRPc.APR.PrEx		Intercept	-5.5	-3.41
0.437	Standard log HP Cyclical Component		t	162.5	3.26
			t^2	-1357.2	-3.14
x	ECRI Coin		t^3	4968.9	3.10
0.971	Standard log HP Cyclical Component		t^4	-9091.6	-3.13
			t^5	8139.6	3.23
f(u)	Powers	R^2	0.273	t^6	-2829.4	-3.37
Sample	All Obs	std. error	0.356		
Fitted y	Yes	d.f.	534		

Test	Ho: z=0	Std. Dev	t value
Symmetry	0.041	0.006	7.41
Sign	-0.115	0.041	-2.78

Revenue per Piece at 2009 Prices from AP Reports Periodicals

Linear Regression				Estimate	t-value
y	RRPc.APR.Per		Intercept	-3.4	-1.26
0.616	Standard log HP Cyclical Component		t	88.1	1.07
			t^2	-703.6	-0.99
x	ECRI Coin		t^3	2500.8	0.94
0.971	Standard log HP Cyclical Component		t^4	-4293.0	-0.89
			t^5	3468.0	0.83
f(u)	Powers	R^2	0.126	t^6	-1054.5	-0.76
Sample	All Obs	std. error	0.588		
Fitted y	Yes	d.f.	534		

Test	Ho: z=0	Std. Dev	t value
Symmetry	-0.053	0.009	-5.81
Sign	0.098	0.068	1.44

Revenue per Piece at 2009 Prices from AP Reports Standard Mail

Linear Regression				Estimate	t-value
y	RRPc.APR.Std		Intercept	-4.5	-1.40
0.726	Standard log HP Cyclical Component		t	135.4	1.35
			t^2	-1247.4	-1.44
x	ECRI Coin		t^3	4991.5	1.55
0.971	Standard log HP Cyclical Component		t^4	-9642.8	-1.66
			t^5	8816.7	1.74
f(u)	Powers	R^2	0.044	t^6	-3054.2	-1.81
Sample	All Obs	std. error	0.713		
Fitted y	Yes	d.f.	534		

Test	Ho: z=0	Std. Dev	t value
Symmetry	-0.036	0.011	-3.27
Sign	-0.220	0.083	-2.66

Revenue per Piece at 2009 Prices from AP Reports Parcel Services

Linear Regression				Estimate	t-value
y	RRPc.APR.Pcls		Intercept	-5.6	-2.18
0.580	Standard log HP Cyclical Component		t	102.5	1.31
			t^2	-676.5	-1.00
x	ECRI Coin		t^3	2176.8	0.86
0.971	Standard log HP Cyclical Component		t^4	-3704.1	-0.81
			t^5	3174.9	0.80
f(u)	Powers	R^2	0.082	t^6	-1072.0	-0.81
Sample	All Obs	std. error	0.560		
Fitted y	Yes	d.f.	534		

Test	Ho: z=0	Std. Dev	t value
Symmetry	-0.018	0.009	-2.11
Sign	-0.130	0.065	-2.00

Revenue per Piece at 2009 Prices from AP Reports International Mail

Linear Regression				Estimate	t-value
y	RRPc.APR.Int		Intercept	-2.5	-1.14
0.529	Standard log HP Cyclical Component		t	105.1	1.54
			t^2	-1154.5	-1.96
x	ECRI Coin		t^3	5036.5	2.30
0.971	Standard log HP Cyclical Component		t^4	-10254.6	-2.59
			t^5	9759.9	2.83
f(u)	Powers	R^2	0.115	t^6	-3502.0	-3.05
Sample	All Obs	std. error	0.486		
Fitted y	Yes	d.f.	534		

Test	Ho: z=0	Std. Dev	t value
Symmetry	0.040	0.008	5.37
Sign	-0.169	0.056	-3.00

Fig. 6 Real revenue per piece by class

8   Alternative Models and Data

Our general findings are mostly robust in that they are not materially affected by our specific selections of variables, sample periods or certain technical details of our estimation method. In this section we report summaries of cases designed to exhibit the effects on the estimates of various alternative choices.[20]

Business Cycle Variables: Vol.APR.Total has been fit to each of the five general economic time series listed in Sect. 4. All of the graphs of $\widehat{\beta}(v)$ are roughly similar to the graph using ECRI Coin. They all exhibit a broad central range of significant positive coefficients.

ECRI Indicators: Fits have been made with a leading indicator (ECRI Lead) and a lagging indicator (ECRI Lag). The shapes of the graphs of $\widehat{\beta}(v)$ change in exactly the way we would expect. The leading indicator produces a positive bulge on the left hand of the graph and a significantly negative symmetry test statistic. The bulge moves to the right-hand side of the graph for the lagging indicator and the symmetry statistic is significantly positive.

Postal RPW Data: Estimates were made that mirror those of Sect. 5 but use the derived RPW series described in Sect. 4. The fits were usually slightly poorer.

Observed y: The functions $\widehat{\beta}(v)$ change hardly at all when we use the actual observations of the postal variables y_i rather than the values derived from the midpoints of their local fits. These results show that the local fits mostly eliminate noise and not cyclical variation from the time series.

The Vector Function: We have explored several alternatives to the powers vector $f(t)$ used to obtain the base results. Adding terms to the powers vector allows the estimator to refine the shape of $\widehat{\beta}(v)$. However, this comes at a cost in statistical accuracy. As we add terms the confidence bounds around $\widehat{\beta}(v)$ expand markedly. A vector of sines and cosines produced a wavier estimate of $\widehat{\beta}(v)$ but would not lead us to alter any of the findings regarding the shape of $\widehat{\beta}(v)$. A vector composed of normal densities spaced one sigma apart produced somewhat more robust estimates than the powers vector and would be a good choice for future applications.

Before and After PAEA: Prior to PAEA postal rates were set by the PRC following a process that depended on forecasts that looked ahead 1–2 years. PAEA replaced this with a process based upon observations of inflation during the preceding year. Fits were made to partitions of the data to explore the possibility that PAEA altered the responses of USPS total volume and real revenue per piece to the business cycle. The fits of $\widehat{\beta}(v)$ for the volume partitions resemble each other. But the fits of $\widehat{\beta}(v)$ for revenue per piece before and after PAEA show that the timing of the response changes dramatically. Pre-PAEA the symmetry test statistic is negative and significant; post-PAEA it is positive and significant. Pre-PAEA postal real revenue per piece tended to mostly lag business conditions. Post-PAEA revenue

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[20]The tables and graphs for these cases and others are available on request from one of the authors at espearsall@verizon.net.

per piece leads business conditions. Since we do not see this pattern in volumes it is likely to be caused by the changes PAEA made in the pricing process.

Recession versus Growth: The recession and growth phases of past U.S. business cycles have been used to separate the time series into sub-samples. The fits for the sub-samples for total volume indicate that the cyclical behavior of postal volume is roughly similar in both phases of the business cycle.

9 Conclusion

Our method for fitting linear integral equations has been applied to obtain robust estimates of the relationships of many USPS time series to the business cycle. The estimates take the form of continuous coefficient functions relating the cyclical components of a USPS series to the cyclical component of a coincident index of economic activity over a bracket period of 36 months.

We have found that USPS volumes are positively related to cyclical conditions and are diverse in timing. Conversely, USPS real revenues per piece are most often negatively related to cyclical conditions and have changed in timing due to PAEA. Our results for USPS constant-dollar revenues are a combination of these counteracting effects that leave revenues only weakly related to the business cycle.

None of our regressions exhibit goodness-of-fit statistics to indicate that our fitted equations explain even half the variance in the cyclical component of the dependent postal variable. If U.S. postal activity had been heavily influenced by the business cycle, our fits would have been much better. A general explanation for the poor fits is that postal services do not typically have the properties of goods that are highly sensitive to cyclical conditions.

As a consequence, it may not be sound practice to adjust postal rates to offset the perceived effects of the business cycle on USPS volumes and revenues.

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To What Extent Has E-Substitution Impacted the Demand for Letters and Which Factors Are Constraining Its Advance

Catherine Cazals, Thierry Magnac, Frank Rodriguez, and Soterios Soteri

1 Introduction

The demand for letters has been in decline for several years because of electronic (e)-substitution. Some communication that would have taken place previously through letter mail has been replaced by electronic media, much of this process being associated with the expansion and growing use of the Internet. However, there is limited published information across countries on the detail and extent to which the cumulative impact of e-substitution has reduced letter volumes. The main exceptions appear to be Finland, the UK and the US. In various papers, Nikali has examined the path of e-substitution in Finland in total and by high level sender-recipient profile (see, for example, Nikali (2014)). Cigno, Clendenin, and Pearsall (2014) report estimates of the impact of Internet penetration in the US on postal volumes by mail class/category. For the UK, Rodriguez, Soteri, and Tobias (2016, 2017) explored trends in e-substitution for business or transactional mail up to 2012 and examined longer term prospects for the volume of such mail. Rodriguez and Soteri (2018) extended the analysis of e-substitution trends by another 4 years to cover the period up to 2016. However, the declines in letter volumes that have

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occurred in developed economies cannot be explained adequately by the negative effects of e-substitution alone. In the UK, at least, other variables that historically have influenced volumes, such as GDP, appear to remain in place (Jarosik, Nankervis, Pope, Soteri, and Veruete-McKay, 2013; Rodriguez et al., 2016).

The results reported in Rodriguez et al. (2016, 2017) and Rodriguez and Soteri (2018) emphasized that the speed and distribution of the effects of e-substitution on business to consumer (B2C) business mail, which accounts for about three quarters of all business mail in the UK, have not been uniform across different segments of traffic. These papers disaggregated e-substitution trends by content type (e.g. bills, financial statements and business letters), sender group (e.g. banks, government and utilities) and age group of the recipients of B2C business mail. This chapter provides further insight to these empirical results by assessing the relative importance of these factors in the advance of e-substitution. Analysis of variance techniques are used which, to the best of our knowledge, breaks new ground in the postal economics literature.

The chapter is structured as follows. Section 2 reports estimates of key trends in the e-substitution of business mail in the UK. Section 3 uses analysis of variance modelling to assess the relative importance of letter content type, sender group and age group of recipient as factors underpinning the advance of e-substitution. Section 4 undertakes a further examination of e-substitution in the light of the analysis of variance results, and Sect. 5 concludes.

2 E-Substitution Trends in the UK

The extent of e-substitution is measured using an index, E_t, defined as (1—proportionate loss of mail to e-substitution) where $(0 < E_t \leq 1)$ and $E_t = 1$ represents a year t when there has been no overall net impact on mail volumes from e-substitution, as set out in Rodriguez et al. (2017, p. 36). For example, a value of $E_t = 0.6$ in year t indicates that mail volumes were only 60% of the level they would have reached in that year if there had been no impact on volumes from e-substitution.

Estimates of E_t are based on results from an updated version of the econometric model developed in Veruete-McKay, Soteri, Nankervis, and Rodriguez (2011) reported in Rodriguez et al. (2016, p. 4), which used annual data from 1980 to 2012 for the UK from Royal Mail and includes an equation for the volume of commercial mail which is explained as a function of GDP, demographics, prices and "unexplained" time trends which are included to account for the impact of e-substitution.[1] As outlined in Rodriguez et al. (2016, 2017) and Rodriguez and

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[1]An alternative approach would have been to have identified variables that can be directly associated with e-substitution. However, as noted by Jarosik et al. (2013, p. 203), models including time trends tended to contain better properties and diagnostic test statistics than those including Internet and broadband penetration rates. This may be because the dynamic impact of technology related letter substitution is unlikely to be reflected within the properties of a single direct variable and time trends may be a better proxy for the net impact of numerous and overlapping technology effects. Further discussion on this issue is contained in Rodriguez et al. (2016).

Soteri (2018), information from the two linear time trend terms (and also the relatively small impact from prices) in that equation have been used to derive estimates of E_t for business mail overall.[2] The first, T_1, begins in 2002 and equals $-3\frac{1}{2}\%$ pa. It is added to by a second time trend, T_2, commencing in 2010 ($-5\frac{1}{2}\%$ pa) so that both of these effects apply jointly from 2010 (at -9% pa). In computing E_t in each year since 2001 the impact of price effects is also included so that the overall expression is given by:

$$E_t = (1 + T_1)^{n1t}.(1 + T_2)^{n2t}. \prod_{t=2002}^{t} (1 + x_t) \tag{1}$$

where $n1t$ is the number of years in year t since 2001; $n2t$ is the number of years in year t since 2009; T_1 and T_2 enter as proportions; x_t is the estimated effect of real prices on commercial mail volumes (applied here for B2C business mail) in year t expressed as a proportion and introduced as a product calculated over the years to year t from $t = 2002$.

The time path of E_t, as reported in Rodriguez and Soteri (2018) and which extended Rodriguez et al. (2017) results to 2016, is shown by the "Overall" series in each panel of Fig. 1 and accelerates after 2009. By 2016 E_t is estimated to have declined to 0.39, which implies that business mail volumes were only about 39% of the level they would have reached in that year in the absence of e-substitution.[3] Although not equal to unity in many years, over the period 2002–2016 as a whole the product of the terms in x_t in (1) is close to 1, signifying that the negative impact of real prices on B2C business mail volumes is estimated to have been relatively small.[4] Note that the overall decline in business mail volumes since 2001 has been considerably less for, as the econometric model indicates, there have been continuing upward impacts on volumes from GDP and demographics that have contrasted and partially offset the negative effects of e-substitution.[5]

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[2]Although the equation estimated was for the volume of commercial mail and the traffic measure included relatively small amounts of publishing material and lightweight packets, it is considered a good proxy for both total and overall B2C business mail volumes.

[3]This value is towards the upper end of the range of the values in the two hypothetical scenarios for the rate of advance of e-substitution presented in Rodriguez et al. (2017, p. 46) of 0.42 in the "low rate of advance scenario" and 0.33 in the "high rate of advance scenario".

[4]The estimated cumulative impact of price on E_t by 2016 was to reduce it from 0.42 to 0.39. The main reason for this relatively small difference is that the two letter price elasticities used to inform our analysis were low, as informed by Rodriguez et al. (2016, Table 1, p. 4). In particular, the analysis assumed a real letter own-price elasticity of -0.13 and a real telecommunication price elasticity (acting as a substitute price effect) of 0.18. Therefore only a small proportion of the change in real letter and telecommunication prices, which themselves tend to be low, are estimated to impact letter volumes.

[5]For example, in 2016 business mail volumes in the UK were around 60% of their level in 2001.
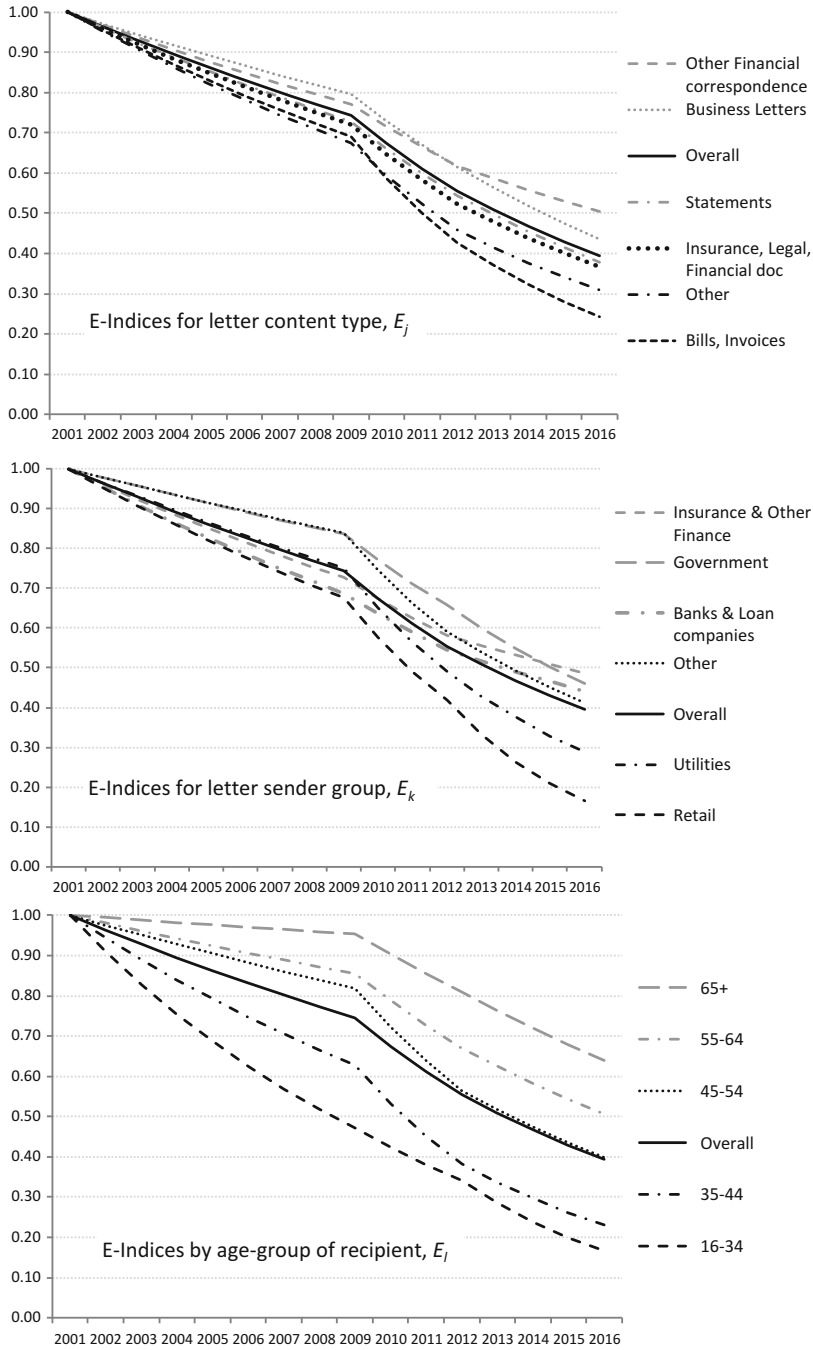
Fig. 1 Estimates of E-substitution indices, E_t, for UK business mail to 2016 (2001 = 1). E_t equals (1—proportionate loss of mail to e-substitution) where $E_t = 1$ implies no e-substitution (last such year estimated as 2001) and $E_t = 0$ implies complete loss of all mail. Source: Royal Mail Group and author calculations

The main focus of interest of this chapter is on analysis of the advance of e-substitution at a disaggregated level. Three disaggregations of B2C business mail traffic are considered. The first is by content type, j ($j = 1, \ldots 6$: Bills, Invoices; Business Letters; Insurance, Legal, Financial Documents; Financial Statements; Other Financial Correspondence; and All Other Content Types). The second is by sender group, k ($k = 1, \ldots 6$: Banks and Loan Companies; Government (including Health and Education); Insurance and Other Finance; Retail; Utilities; and All Other Sender Groups). The third is by age group of recipients of B2C business mail, l ($l = 1, \ldots 5$: 16–34, 35–44, 45–54, 55–64, 65+).

Some of the data used in this analysis were taken from a continuing survey of mail sent and received by households in the UK.[6] These data, along with other information, were used to allocate the overall estimate of the e-substitution of B2C business mail determined by the econometric model across the various segmentations of traffic (Rodriguez and Soteri, 2018). At the level of total traffic, the total volume of B2C business mail in year t can be expressed in a stylized form of the variables in the econometric model as its volume in year $t = 0$ (2001) multiplied by three factors reflecting the impacts of e-substitution (including price effects[7]), GDP and population[8] on overall volumes since year $t = 0$:

$$Q_t = Q_{t=0}.E_t.(1 + g.G_t).(1 + p.P_t) \tag{2}$$

where Q_t is an estimate of the total volume of B2C business mail received by individuals in year t; $Q_{t=0}$ is an estimate of that volume in year $t = 0$ (2001); E_t is the overall e-substitution index; g and p are the elasticities of total B2C business

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[6]Respondents in the survey completed a detailed diary each day and recorded information on the number of items of mail sent and received, the content of the mail (by content type) and its origin (by sender group). Information was also recorded on the characteristics of the respondent including their age group. The survey is operated by an outside market research company and was given to a panel sample of about 1500 households, with 1200 reporting each month and weighted to reflect population characteristics. The business mail outputs of the survey are periodically checked against Royal Mail customer and product data information for consistency and are deemed by business experts to be broadly representative. However, as these data are from a survey, they are subject to sampling error and noise and the results reported in the current paper are best viewed as indicative of main trends.

[7]As the estimated impact of the effect of price changes on letter volumes was estimated to be relatively small (see footnote 4) the analysis was simplified by including this effect within E_t.

[8]Consistent with Veruete-McKay et al. (2011), population enters (2) separately in order to reflect the impact of delivery point growth on demand while the impact of population on total economic activity is embodied in the GDP term. The demographic variable in Veruete-McKay et al. to capture delivery point growth is the number of households and population is used in the current chapter as a proxy, given the lack of published disaggregated annual data in the UK on the number of households.

mail volume with respect to GDP and population; and G_t and P_t are the cumulated proportionate changes in GDP and population by year t from year $t = 0$.[9]

For any segment of B2C business mail s ($s = j$, k, l or any pairwise or three-way combination of categories of which, for the latter, in total there are ($6 \times 6 \times 5 = 180$)), the formulation at (2) can be applied such that:

$$a_{st}.Q_t = a_{s,t=0}.Q_{t=0}.E_{st}.(1 + g_s.G_{st}).(1 + p_s.P_{st}) \tag{3}$$

where a_{st} is the share of segment s as a proportion of the total volume of B2C business mail in year t derived from the household survey data; $\sum_s a_{st} = 1$ for a particular segmentation across all B2C business mail such as sender groups, k. The corresponding share in year $t = 0$ is $a_{s,t=0}$. The subscripts s on other variables in (3) denote their correspondence to segment s. Some rearrangement and equating (2) and (3) yields E_{st}, the index of e-substitution for segment s in year t, as:

$$E_{st} = E_t.\left(\frac{a_{st}}{a_{s,t=0}}\right).\left(\frac{1 + g.G_t}{1 + g_s.G_{st}}\right).\left(\frac{1 + p.P_t}{1 + p_s.P_{st}}\right) \tag{4}$$

The e-substitution index for a particular segment of traffic in year t then is equal to the e-substitution index across all B2C business mail for that year, E_t, as estimated by the econometric model, multiplied by three factors: the ratio of the volume share of segment s in year t to its share in year $t = 0$; and the ratios of the impact of GDP (respectively population) on overall B2C business mail in year t to the impact of GDP (respectively population) on segment s in that year.[10] The index E_{st} is lower (respectively higher) relative to the overall index E_t (implying more e-substitution of segment s than overall B2C business mail) where the share of segment s traffic has fallen (respectively increased) since year $t = 0$ and where the impact of GDP or population on segment s is greater than the impact of these variables on B2C business mail overall. Further detail on the data used to populate the elements of E_{st} for each segment of traffic is reported in Rodriguez and Soteri (2018). In particular, with regard to the elasticities g and p, and lacking disaggregated estimates of these parameters, the method in Rodriguez et al. (2016) is followed which sets all segment elasticities to the values at the total traffic level from the econometric results reported there such that $g_s = g = 0.9$ and $p_s = p = 1$.

Section 3 analyses the development of e-substitution at the three-way or 180 level of segmentation but it is insightful first to summarize this at a higher level of

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[9]In order to ease the analysis and simplify the expressions used later in the chapter we adopted expression (2) which is an approximation to the expression $Q_t = Q_{t=0}. E_t (1 + G_t)^g (1 + P_t)^p$ that is consistent with the econometric model reported in Rodriguez et al. (2016).

[10]If we had adopted the expression referred to in footnote 9, expression (4) would have taken the form $E_{st} = E_t.\left(\frac{a_{st}}{a_{s,t=0}}\right).\left(\frac{(1+G_t)^g}{(1+G_{st})^{g_s}}\right).\left(\frac{(1+P_t)^p}{(1+P_{st})^{p_s}}\right)$ and estimates for E_{st} would be marginally different. A range of estimates found the differences to E_{st} to move the third decimal point or in most cases the fourth or fifth.

aggregation. Figure 1 reports the time paths for estimates of e-substitution at the level of the six content types, six sender groups and five age groups of recipients used in the analysis based on detailed analysis of 3 years: 2009, 2012 and 2016. By content type, e-substitution is estimated to have advanced furthest for Bills, Invoices where communication is more routine in nature, and least for the categories of Other Financial Correspondence and Business Letters where communication is generally *ad hoc* and less suited to standardization. By sender group, Retail and Utilities sectors are those where e-substitution is estimated to have developed most while the differences between the other sender groups were relatively small and had narrowed substantially by 2016 compared with divergence between them in earlier years.

The largest differences in the development of e-substitution are estimated to be those by age group of recipient highlighting the importance of considering this process from not only the perspective of senders but also that of recipients (Nikali, 2008).[11] Differences in trends in mail received by age of recipient are evident also in the US over the period 2001 to 2016. Declines in both US First Class correspondence (for example, business letters) and, particularly, transactional mail (for example, bills and statements) received by younger individuals have been larger than for older recipients (Office of Inspector General (OIG), United States Postal Service, 2018a, 2018b).[12]

Rodriguez et al. (2017) showed that the very high rates of e-substitution of mail received by younger age groups compared with older groups are due only partially to differences in access to the Internet. The differences in e-substitution between age groups are substantially greater than in such access. This point was reaffirmed in Rodriguez and Soteri (2018) using data up to 2016. It is likely then that, where recipients have choice, older age groups have a lower willingness to accept an e-communication in place of letter mail than younger groups.

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[11]As noted, these estimates of e-substitution by age group of recipient were derived using population data. Broadly similar results were obtained using instead more limited household data as the demographic measure in expression (3). In particular, estimates using household data from the decennial censuses of 2001 and 2011 (the only source of data in the UK on the number of households at the level of disaggregation required for these estimates) were within ± 0.03 of those contained in Fig. 1 for each age group in 2011.

[12]Definitions of mail as reported by OIG. For example, between 2001 and 2016 the percentage change in transactional mail received by households with a head aged 25–34 was -58%; -49%, aged 35–44; -41%, aged 45–54; -36%, aged 55–64; and only -25% for those aged 65+ (OIG, 2018b, p. 8).

3 ANOVA Methodology and Results

Analysis of variance (ANOVA) is a robust and widely used statistical method that decomposes the variance of a particular variable into components attributable to different sources of variation. This method is appropriately suited to assessing the relative extent to which e-substitution can be accounted for by letter content type, sender group, and recipient age group. An ANOVA analysis is undertaken at the three dimensional E-Index level E_{jkl} consisting of 180 segments. This method is equivalent to a regression setting in which dummies for all segments are covariates.

3.1 ANOVA Methodology

ANOVA models consider the variation of a quantitative dependent variable to be a function of some categorical variables (or factors) and provide a framework to evaluate the relative importance and significance of the effects of each factor and their interactions. For example, if the dependent variable y_i is considered to be a function of three factors (j, k, l), the standard ANOVA model denotes y_{ijkl} to be the value of the dependent variable defined by the combination of the three factors, with $i = 1, \ldots, n_{jkl}$ and $j = 1, \ldots, J, k = 1, \ldots, K$ and $l = 1, \ldots L$ (where J, K and L are the numbers of categories for each factor, and n_{jkl} is the number of observations for the cell (j, k, l)). In the specific empirical application of this chapter, the number of observations n_{jkl} is equal to 1 and thus index i is dropped henceforth.

To test the significance of the effects of each factor and their interactions on the quantitative variable, the variance for y_{jkl} can be decomposed using the standard ANOVA equation and assessed using the Fisher statistics relative to each factor and their interaction terms. This analysis commences with the following identity:

$$
\begin{aligned}
y_{jkl} - \bar{y}_{...} &= \left(\bar{y}_{j..} - \bar{y}_{...}\right) + \left(\bar{y}_{.k.} - \bar{y}_{...}\right) + \left(\bar{y}_{..l} - \bar{y}_{...}\right) \\
&+ \left(\bar{y}_{jk.} - \bar{y}_{j..} - \bar{y}_{.k.} + \bar{y}_{...}\right) + \left(\bar{y}_{j.l} - \bar{y}_{j..} - \bar{y}_{..l} + \bar{y}_{...}\right) + \left(\bar{y}_{.kl} - \bar{y}_{.k.} - \bar{y}_{..l} + \bar{y}_{...}\right) \\
&+ \left(y_{jkl} - \bar{y}_{.kl} - \bar{y}_{j.l} - \bar{y}_{jk.} + \bar{y}_{..l} + \bar{y}_{.k.} + \bar{y}_{j..} - \bar{y}_{...}\right) \quad (5)
\end{aligned}
$$

(where $\bar{y}_{...} = \dfrac{1}{JKL} \displaystyle\sum_{j=1}^{J} \sum_{k=1}^{K} \sum_{l=1}^{L} y_{jkl}$; $\bar{y}_{j..} = \dfrac{1}{KL} \displaystyle\sum_{k=1}^{K} \sum_{l=1}^{L} y_{jkl}$; $\ldots$ and the other means

being defined in a similar way. The ANOVA equation is obtained by decomposing the total sum of squares (TSS) of the dependent variable as a sum of the sum of squares (SS) associated to each of the three factors (SS1, SS2 and SS3), their interactions of order 2 (SS12, SS13, SS23) and of order 3 (SS123), which can be written as:

$$TSS = SS1 + SS2 + SS3 + SS12 + SS13 + SS23 + SS123 \qquad (6)$$

In this study for e-substitution, as there is just one observation for the e-substitution index y_{jkl} for each cell (j, k, l), then the interaction of order 3 (SS123) should be replaced in (6) by the residual component (Sum of Squared Residuals, denoted SSR).[13]

The significance of each effect (principal effects and interactions) can then be tested by using Fisher statistics. For example, to test the significance of the principal effect of factor 2 (with K categories), this statistic is defined as the ratio:

$$F_2 = \frac{SS2/df_2}{SSR/df_R} \qquad (7)$$

where $df_2 = K - 1$ and $df_R = (J - 1)(K - 1)(L - 1)$, are the corresponding degrees of freedom.

The precision of the e-substitution index estimates may vary across cells. To account for this, the ANOVA estimation for decomposing the variance is weighted by the inverse of the variance of e-substitution indices, as in weighted least squares or more exactly Asymptotic Least Squares (Gourieroux, Monfort, and Trognon, 1985). This amounts to minimizing the sum of weighted squares of residuals. The mail volume shares are used as weights that are highly likely to be related to the precision of the E-indices. This modifies the ANOVA equation for the decomposition of variance ((5) and (6)), since the factors and their interactions are no longer orthogonal in the usual least squares sense. However it does not change the interpretation of the estimated F-statistics and their relative importance as measured by their corresponding p-values.

3.2   ANOVA Results

Table 1 contains the ANOVA results applied to the 180 E-indices, E_{jkl}, pertaining to 2009, 2012 and 2016. In this table, the value of "partial sum of squares" for a particular term represents the contribution of this term to a model including all the other terms. More precisely, the effect of each term is equivalent to it being evaluated after all other terms have been accounted for (that is, equal to the sum of squares as if each term were entered last into the model). The ANOVA results applied to the 180 E-indices pertaining to the 3 years examined show that all the models have a high degree of explanatory power with the adjusted R^2 values lying in the range 0.87 to 0.98.

To evaluate the relative significance of factors or the interactions between factors, the p-values associated with the hypotheses of the absence of an effect of a factor or

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[13]For details about ANOVA models see for example Cameron and Trivedi (2010).

Table 1 ANOVA results for business mail letter e-substitution by content-type, sender group and recipient age-group, E_{jkl} in 2009, 2012 and 2016

	Partial sum of squares	Degrees of freedom	Mean square (SS/df)	F-statistic	P-value (prob > F stat)
2016 model	7.0498	79	0.0892	46.29	1.16E-54
Age, *l*	1.8008	4	0.4502	233.53	8.62E-50
Sender, *k*	0.2180	5	0.0436	22.61	4.11E-15
Content, *j*	0.1993	5	0.0399	20.67	3.97E-14
Age and sender, *lk*	0.0919	20	0.0046	2.38	2.51E-03
Age and content, *lj*	0.0669	20	0.0033	1.74	3.96E-02
Content and sender, *jk*	1.1707	25	0.0468	24.29	5.71E-32
Residual	0.1928	100	0.0019		
Total variance	7.2426	179	0.0405	Adjusted R^2: 0.9524	
2012 model	6.4616	79	0.0818	121.69	5.10E-75
Age, *l*	2.9096	4	0.7274	1082.25	2.41E-81
Sender, *k*	0.1177	5	0.0235	35.02	1.51E-20
Content, *j*	0.3162	5	0.0632	94.08	3.22E-36
Age and sender, *lk*	0.0508	20	0.0025	3.78	4.94E-06
Age and content, *lj*	0.0488	20	0.0024	3.63	9.55E-06
Content and sender, *jk*	0.8898	25	0.0356	52.96	8.92E-47
Residual	0.0672	100	0.0007		
Total variance	6.5289	179	0.0365	Adjusted R^2: 0.9816	
2009 model	5.3570	79	0.0678	16.27	8.85E-34
Age, *l*	2.6830	4	0.6707	160.9	1.20E-42
Sender, *k*	0.3663	5	0.0733	17.57	1.86E-12
Content, *j*	0.0786	5	0.0157	3.77	3.61E-03
Age and sender, *lk*	0.1591	20	0.0080	1.91	1.95E-02
Age and content, *lj*	0.1215	20	0.0061	1.46	1.14E-01
Content and sender, *jk*	0.5676	25	0.0227	5.45	4.44E-10
Residual	0.4169	100	0.0042		
Total variance	5.7738	179	0.0323	Adjusted R^2: 0.8708	

an interaction term on e-substitution can be examined. The value of these p-values is the probability of rejecting incorrectly the hypothesis that a factor or an interaction term has no influence on e-substitution. The p-values reported in Table 1 indicate that all factors (principal and interactions) are significant at a 5% level of significance in explaining the variation in the E-indices for the 3 years examined and most are significant at the 1% level for all years except for the interaction between Age and Content.

The factor Age is estimated to be the most important factor that explains the variation in E-indices because its p-value is by far the smallest of all factors or interaction terms in all the years examined. The second most important term, moving

ahead of the individual factor Sender after 2009, is the interaction of Content and Sender groups followed, some way behind, by the remaining Age interaction terms which, while statistically significant, have consistently been the relatively less important.

It is also worth mentioning that the explanatory power of the model was lower in 2009, with a value for the adjusted R^2 equal to 0.87 and the variance of the E-indices have increased over time (as denoted by the increasing sum of squares in Table 1), indicating that the three factors and their interactions are accounting for a somewhat higher proportion of the total variance in 2012 and 2016 compared to 2009.

4 A Further Examination of E-Substitution by Content Type, Sender Group and Age Group of Recipient

The ANOVA models show that amongst the factors examined to account for differences in B2C business mail e-substitution, the age of recipients is by far the most important factor and the interaction of content-sender factors has become more important over time. This section examines E-index estimates for these categories in more detail.

Figure 2 reports estimates of sender-age group E-indices. The individual curves all slope upwards and indicate that the E-indices tend to increase (that is, e-substitution declines) by age group of recipients for all sender groups. It is noticeable that Retail business senders tend to have the lowest and shallowest curve, which indicates that in addition to possessing the highest rate of e-substitution, this sender group also exhibits the least variation by age groups. In contrast, the Utilities sender group, which is estimated to have the second highest overall level of e-substitution (see Fig. 1), exhibits a steeply rising curve in Fig. 2, similar to all the other sender groups. This pattern suggests that characteristics related to recipients' age are more important than sender specific factors for all of these sectors.[14] These results may also suggest that factors driving e-substitution in the retail sector may be more independent of the demand for letter mail by recipients than in other sectors, especially those in more regulated areas such as finance and utilities.

Figure 3 plots E-indices for letter content types by sender group, where the x-axis is ordered by the content type with the lowest to highest E-index value in 2016 as shown in Fig. 1 (that is, for content types from most to least e-substitution). This shows no clear upward sloping relationship between the magnitude of the Retail sender E-indices and those for letter content types and suggests that factors related to the latter are unlikely to be a major driver of e-substitution in the retail sector.
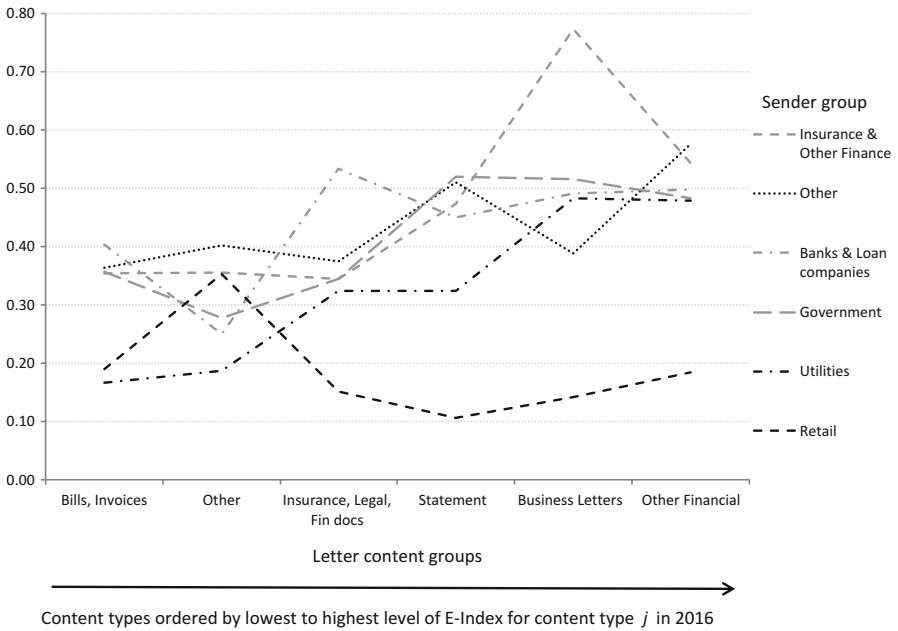
In contrast, the profile for the Utilities sender group slopes upwards which indicates that sender group-content type E-indices tend to increase together. In

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[14]A similar conclusion can be drawn when examining the age-content equivalent of Fig. 2.
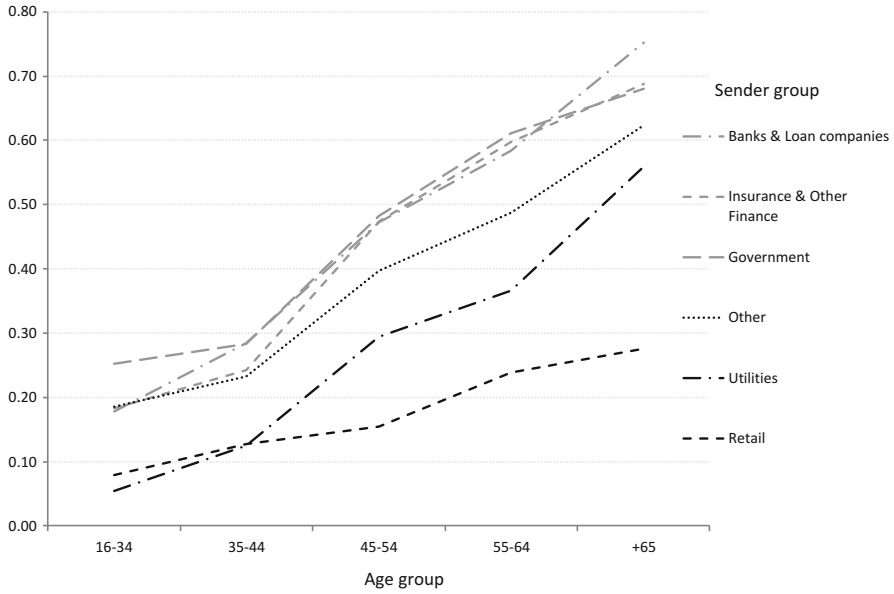
Fig. 2 Business mail 2016 age-sender E-indices, E_{lk2016}

Content types ordered by lowest to highest level of E-Index for content type j in 2016

Fig. 3 Business mail 2016 content type-sender group E-indices, E_{jk2016}

addition to age, therefore, the interaction of both content and sender factors are also likely to be contributing materially to the relatively high level of overall e-substitution for Utilities. With respect to the remaining sender groups there tends to be some, although less strong evidence, of an upward sloping relationship with regard to content types in Fig. 3. This implies that the interaction of sender-content factors is likely to be relatively weaker for these segments.

The high E-index (low level of e-substitution rate) for Business Letters sent by the Insurance and Other Finance is somewhat of an outlier with respect to other points in Fig. 3 and suggests that sender-recipient aspects for this segment of traffic are relatively more important than for others.

5   Conclusions

This chapter provides estimates of the degree to which e-substitution has reduced the demand for B2C business letter mail in the UK overall and by content type, sender group and age group of recipient. As highlighted in Sect. 2, volumes for B2C business mail overall in 2016 are estimated to have been only about 40% of the level they would have reached if there had been no e-substitution of such letter mail. The overall decline has been considerably less as the negative effects of e-substitution have been partially offset by continuing upward impacts on volumes from GDP and demographics.

Further, the extent to which e-substitution has taken place has been highly uneven across different segments of business mail. With regard to letter content type it is estimated that, up to 2016, e-substitution has advanced furthest for Bills and Invoices and least for Business Letters and elements of financial correspondence. The large category of Statements has moved approximately in line with the trend for e-substitution of B2C business mail overall. Among sender groups, the impact of e-substitution appears to have reduced mail traffic most extensively in the retail and utilities sectors and least for senders from government and insurance sectors.

The most pronounced differences seem to be by age of recipient, a result that also that appears to hold in the US (Office of Inspector General, United States Postal Service, 2018a, 2018b). Unsurprisingly, e-substitution appears to have advanced most among younger age groups (aged under 45) while for older groups (65 and over) e-substitution is estimated to have commenced later and developed much less. By 2016, the volume of B2C business mail in the UK received by those aged 16–34 is estimated to have been less than a fifth of the level it would have reached in the absence of e-substitution while among those aged 65+ the corresponding estimate is over 60%.

The rather distant second most important factor in 2016 was estimated to be the interaction of content type and sender group factors, which has also tended to increase in importance over time. The individual sender and content factors, although highly statistically significant, were estimated to be relatively less important in explaining the variation in e-substitution across different segments, while the

interaction terms with age group of recipient were estimated to be the least important.

The very significant extent to which the importance of recipient age far outweighs that of any other factor or interaction of factors suggests that the ability and willingness of senders to replace letter mail by electronic communication are constrained by recipient behavior. With very high accessibility to Internet related technology for nearly all age groups in recent years, it appears that the unwillingness of recipients to accept, where they have a choice, the substitution of e-communications for letter mail is likely to be a key element in limiting the advance of e-substitution; the age group of the recipient of mail captures this effect most strongly. Consumer preferences and choices with respect to the form of the recipient of business communications appear then to be playing a powerful role in determining the rate of decline in B2C business mail letter volumes and the level that these could reach over the medium to long term.

These developments are consistent with a framework first developed by Nikali (2008) for examining trends and prospects for business mail which emphasizes the ability and willingness of recipients to accept communication by electronic means as well as the ability and willingness of senders in wishing to reduce their use of letter mail. To the extent that willingness is likely to change over time as individuals become more familiar with different types of electronic devices and as internet enabled applications become easier to use, it would be very useful to extend the ANOVA estimates to try and capture such effects, possibly by simultaneously estimating all years together and including a fourth factor such as a time trend or other variable.

It is important that postal operators, consumer bodies and policy makers actively support the range of choices available with respect to how recipients of business communications themselves wish to be contacted by companies and other organizations such as government agencies. Evidence from a comparison of the rates and reasons for the decline in mail volumes in Denmark and Sweden (Andersson, Bengtsson, and Eriksson, 2018) has reinforced the significance of this point. In terms of targeting possible activities, the analysis undertaken in Sects. 3 and 4 suggests these could focus on all sender groups, with the possible exception of the retail sector, and try to support letter volumes for low e-substitution (high E-index) content types, such as business letters, other financial mail and possibly statements.

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The Danish Problem: Soon Everybody's? A Comparative Analysis of Digitalization Effects on Letter Volumes

Peter Andersson, Sofia Bengtsson, and Johanna Eriksson

1 Introduction

Letter volumes are falling in most industrialized countries. However, the rate of decline varies between countries. In Scandinavia, there is a unique opportunity to compare two neighboring countries with the same universal service provider, Postnord, since the national incumbent postal operators in Denmark and Sweden merged in 2009. Letter volumes in Denmark have dropped more than in any other country: with 75% between 2000 and 2016, whereas Sweden had a relatively more modest decline of 34% in the same period. The Danish situation may be explained by a law implemented 1 July 2012 that requires all citizens to have a digital mailbox to communicate with public authorities, and state provision of a common mailbox, Digital Post. In Sweden, the digital mailbox market has been fragmented.

It is important to explore forces behind the different development in the two countries. The rapid digitalization in Denmark compared to Sweden resulted in reduced services and large price increases for postal consumers. Postnord is losing money in Denmark but remains profitable in Sweden. When Postnord in 2017 asked its owners, the Danish and Swedish states, for additional funding to cover losses in Denmark, the responsible Swedish Minister responded that "This is a Danish

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problem."[1] It remains to see whether he was right or if Denmark is just a few years ahead of other countries in the process where digital communication replaces messages sent by letter mail.

Our aim is to understand the different rates of decline in letter volumes in Denmark and Sweden by analyzing the effects of digitalization of the market for messages on the generalized (that is, implicit and explicit) costs for senders and receivers of messages and the strategies to meet this development. We provide an explanation for differences in digitalization between the two Scandinavian countries. We show the role of the postal market conditions and how the strategies from the incumbent postal operator contribute to differences in the digitalization process. In addition, we discuss the impact of policy and market mechanisms on the future effects of digitalization on letter volume.

The generalized cost consists of the price for the services and the transaction costs, which in turn can be divided into a fixed and a variable component. We apply a model with generalized costs for physical and digital mail that helps explain the rate of change from the former to the latter. Our model extends other demand models for letters, e.g. Nikali (2010) by introducing transactions costs for senders and receivers. The generalized cost (GC) is the sum of the monetary price (the postage) and transaction costs, consisting of all other monetary and non-monetary sacrifices that are required in order to communicate messages. The transaction costs may be fixed, e.g. getting a mailbox or establishing an address register, and variable, e.g. writing, printing, and enveloping a letter for the sender, or when the receiver picks up a letter at its place of delivery.

Digital communication changes the traditional role of the sender and receiver of messages. Once the fixed transaction cost of opening a digital mailbox is taken, the receiver may choose to get mail from the sender, such as invoices or messages from the public authorities, by post or to its digital mailbox depending on the variable generalized cost. The sender also has to consider the generalized cost for both alternatives. Monetary incentives, nudges or regulation may affect these decisions. The Danish law from 2012 is an example of regulation and senders' imposing a fee for sending a message on paper a monetary incentive.

Section 2 presents the letter market and Sect. 3 the digital market for communication in Denmark and Sweden. In Sect. 4 we make the comparative analysis of the two countries and in Sect. 5, we draw our conclusions.

2 The Market for Postal Messages

As in most industrialized countries, letter volumes in the studied countries peaked around the year 2000 and have since started to decline (WIK, 2013). Figure 1 shows the universal provider Postnord's letter volume per capita in Sweden and Denmark.

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[1]Minister for Innovation and Enterprise Mikael Damberg, in Lucas (2017).
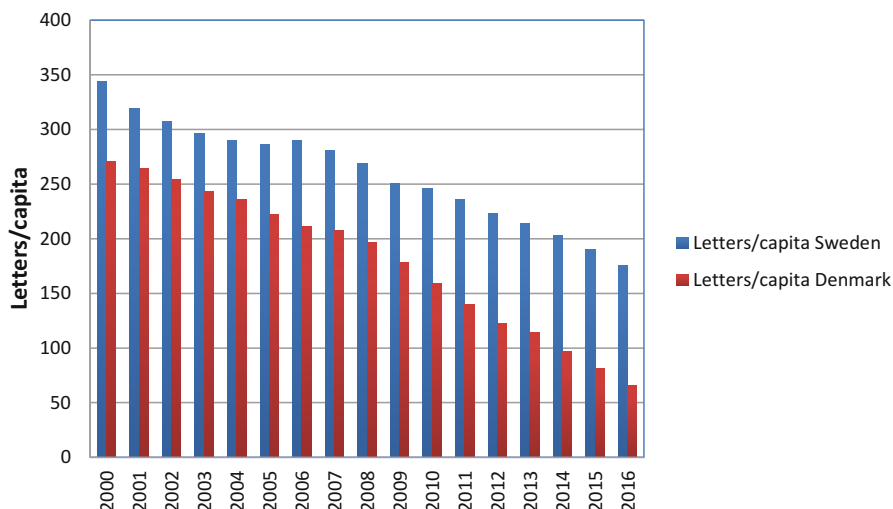
Fig. 1 Postnord's letter volumes per capita in Sweden and Denmark 2000–2016. Source: Eurostat (2017) and Postnord (2017)

It highlights not only the fall in the number of letters, but also the large and growing difference in volume per capita between the two countries. Already in the year 2000, Postnord (then Sweden Post) in Sweden had just over 30% more letters per capita than (then) Denmark Post, whereas in 2016, the difference had grown to over 60%. In Sweden there are competitors to Postnord with a growing market share, which makes the total volume difference even larger.

2.1 Postnord

Sweden and Denmark Post merged in 2009 and subsequently established the name Postnord. Postnord is owned to 60% by the Swedish state and to 40% by the Danish. In 2017, Sweden accounted for 62% and Denmark for 24% of the net turnover (Postnord, 2018a). Despite falling letter volumes, the Swedish part of the company has been profitable and its letter business is making a reasonable return (SOU 2016:54). In 2017, the overall operating profit was −13 million euro; the Swedish part showed however a profit of 53 million euro but the Danish part had a result of −68 million euro.[2] (Postnord, 2018a).

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[2]All amounts given in EUR are transferred with the average exchange rate for 2017: 9.63 SEK/EUR and 7.44 DKK/EUR (The Riksbank, 2018).
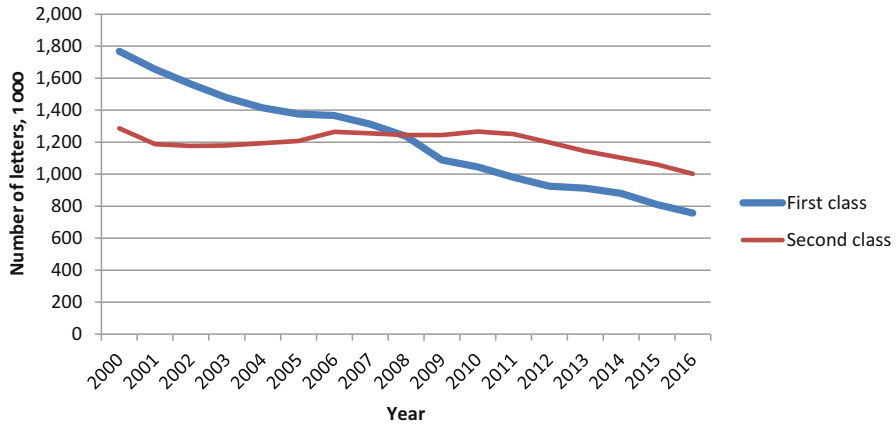
Fig. 2 Postnord's letter volumes in Sweden 2000–2016. Source: Postnord (2017)
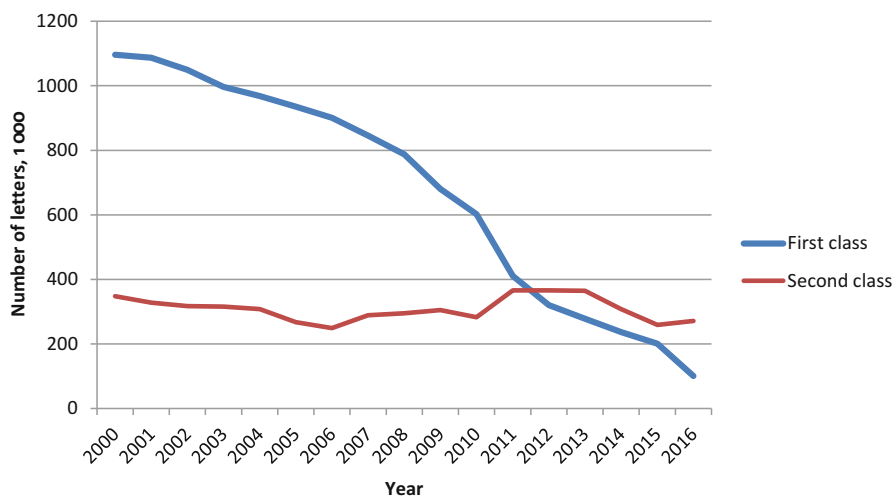
2.2 Volumes

In Sweden, the letter monopoly was abolished in 1993. Postnord has not only faced competition from digitalization, but has also lost market shares to competitors. By 2017, Postnord had 79% of all letters representing 87% of the market turnover. Whereas Postnord's volume declined 46.6% between 2000 and 2017, the total volume decline in Sweden was only 35.7% (PTS, 2018). Its competitors are almost entirely active in the second-class mail segment.

Figure 2 shows Postnord's volume of first and second-class mail in Sweden between the years 2000 and 2016. The fall in volume mainly concerns first-class mail; second-class mail was relatively stable until around 2011. However, adding the roughly 400 million items delivered by other firms in 2016, the total volume of second class mail in Sweden was relatively constant over this period.

Compared to Sweden, the fall in volumes in Denmark is more dramatic, also almost entirely concerning first class mail. Since the year 2000, over 90% of first-class mail has disappeared. A significant difference is that in the year 2000, first class mail in Denmark was 215% more than second-class mail, whereas in Sweden first class mail was only 37% more. Thus, the fall in first-class mail has had a much stronger impact on the Danish market than on the Swedish. Figure 3 shows the volume of first and second class mail for Postnord in Denmark.

2.3 Prices

The fall in volumes and revenues has made Postnord respond to digitialization, but very differently in Sweden than in Denmark. It is difficult to compare prices for sending letters because of different products, and, particularly in Sweden, frequent

Fig. 3 Postnord's letter volumes in Denmark 2000–2016. Source: Postnord (2017)

discounts to senders of large shipments of mail ('bulk mail'). Official statistics shows only letter postage in price lists.

Sweden has applied a price-cap for single letters up to 500 g. Until 2017, the cap was related to changes in consumer price index, which means that the real price has been nearly constant. After postal reform legislation, the Swedish Post and Telecom Authority (PTS) has the authority to allow price adjustments by Postnord, depending on how its average cost is affected by lost volumes. Also, the required reliability for a first-class letter was changed in 2018, from overnight delivery with at least 85% on time to two-day delivery with 95% on time. Postnord has however stated that most first-class mail, initially at least 80%, will still be delivered overnight (SOU 2016:54).

The price in 2018 for a stamp for a first-class letter up to 50 g is 0.93 EUR; a rise from the previous 0.67 EUR for a 20 g letter.[3] However, less than 6% of all letters are paid with a stamp and less than 10% are sent via a letter box. Businesses sending single piece first class mail can pre-pay the first-class postage with the price of 0.54 EUR (PTS, 2018).

Second-class mail, which represents 73% of all letters, has different prices for unsorted and sorted mail, for different shipment sizes, and it is often offered at a discount from the price list. PTS (2018) includes case studies of prices for bulk mail. The lowest price it found for a large shipment of sorted second-class mail from Postnord was 0.178 EUR, and from a competitor, 0.144 EUR. For a similar small

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[3]The single-piece letter postage in Sweden is not perfectly comparable over time. In 2014, the lowest weight limit was changed from 20 to 50 g and the postage was allowed to increase from 6.00 to 7.00 SEK. When VAT was removed from the postage in 2016, it was lowered to 6.50 SEK and in 2018 allowing for lower volumes, the postage changed to 9.00 SEK.

shipment, Postnord offered 0.241 EUR and two of its competitors 0.242 and 0.217 EUR respectively. Thus, the common mass-produced second-class letter has a price of around 20–25% of a first-class letter with a stamp.

Denmark has not applied a similar price-cap. Between 2006 and 2016, the postage has risen with 182%, compared to Sweden where the (nominal) increase was 20%. The first sharp increase in Denmark, of 25% came in 2011. From 2012-2015 there was an annual increase of 7–9%, but in 2016 postage increased another 86% (Denmark Statistics, 2017a). Today, the standard letter is no longer first-class, but a product with delivery within 5 days, for a price of 1.21 EUR. There is an overnight service *(Quickbrev)* offered at 3.63 EUR (Postnord, 2018b). The authors have not been able to obtain information about any discounts in Denmark for senders of large quantities of bulk mail.

3 The Digital Market for Messages

3.1 Use of Digital Communication in General

Both Denmark and Sweden are in the front when it comes to both access to and use of digital communication. Table 1 shows an international comparison, where both countries lie clearly above the average in the EU. Denmark is ahead of Sweden, being the most digitalized country within the EU in many of the compared factors, but the differences to Sweden are small.

3.2 Digital Communication of Messages

In Denmark, public authorities have long worked in order to create a common digital infrastructure. A first strategy for a gradual digitalization of the public sector, including how citizens could communicate with public authorities, had been adopted already in 2001. The Agency for Digitisation (Digitaliseringsstyrelsen) was,

Table 1 The use of digital communication in Denmark, Sweden and the EU 2016

	Percentage of population		
	Denmark	Sweden	EU28
Access to internet and broadband at home	94	94	85
Using the internet daily	89	85	71
Using e-mail	93	86	71
Using net banking	88	83	49
Using digital communication with public authorities	88	78	48
Shopping on the internet	82	76	55

Source: Denmark Statistics (2017b)

established in 2011, and has created a common log-in facility, NemID, for electronic identification on the internet for public and private services. Moreover, it has launched a website for communication with the citizens (borger.dk) with 34 million visits in 2017, and a facility, NEMKonto for payments. In 2017 this account had 5.4 million subscribers and 90.4 million payments were made. In 2018, public communication was complemented with NemSMS, an option for the public sector to send SMS to the citizens.

In July 2012, Denmark enacted a law requiring all citizens over 15 years of age and all firms to have a digital mailbox that can receive mail from public authorities. Digital messages from public authorities have the same judicial status as physical letters and it is the obligation for citizens to regularly take part of such messages. It has been possible to obtain an exception from the obligation. In 2018, 4.366 million Danish citizens, out of a population in Denmark of 5.7 million (Denmark Statistics, 2018), had such a digital mailbox and 454,000 had an exemption. (Digitaliseringsstyrelsen, 2018). There is a single public digital mailbox, Digital Post, which is free for the citizens to connect to. It is used for communication with public authorities and it is possible to reply to messages. Log in is safe via the NemID-system.

Digital Post is currently provided by the company E-boks, and is co-owned by Postnord A/S and Nets A/S. It does not allow advertising. (Digitaliseringsstyrelsen, 2017). E-boks was established in 2001 as an alternative to physical mail. By 2013, just after the law was passed, it reached 3 million users; by 2015 the number passed 5 million. In 2017, over 30,000 businesses used this box for sending information and 442 million documents were sent (E-boks, 2018).

In Sweden, there are five alternatives: one public digital mailbox, three private ones and one public mailbox that collects digital mail from the other four ones. The Swedish National Audit Office has criticized the government for lacking a policy for digitalization. In 2017, an ongoing Government Inquiry noted that Sweden lags behind Denmark's digitalization of the public sector because it has been up to each public authority to implement its own strategies, and proposed a centralized strategy for the future (SOU 2016:89; SOU 2017:23).

All five digital mailboxes in Sweden are free and a safe log in is made via a BankID provided by the major banks. The public digital mailbox Min Myndighetspost started in 2012 for public authorities and municipalities to communicate with households and businesses. The mailbox is operated by a few of the biggest public authorities. The mailbox Mina Meddelanden collects digital mail from Min Myndighetspost and the three private ones. To connect to this service, a person or household must first have an account on one of the other mailboxes.

The biggest private operator is Kivra, which started in 2012. In 2017 near 1000 businesses and authorities were connected as senders, among them the Swedish Tax Authority, and reached near one million accounts for receiving digital mail. Kivra can also be used for paying invoices over the internet (Kivra, 2017). The second biggest private mailbox is *Digimail* that is owned by Bring Citymail, Postnord's major competitor for physical mail. It delivers digital mail from connected businesses, municipalities and authorities but can also deliver mail from all senders

Table 2 Number of connected receivers to digital mailboxes in Denmark and Sweden, as percentage of the total population

	Denmark	Sweden				
	Digibox	*Min Myndighetspost*	*Kivra*	*Digimail*	*E-boks*	Total
March 2017	75.6	3.3	9.6	0.3	0	13.1
April 2018	76.6	3.9	22.4	0.4	0.1	26.9

Source: PTS (2017), Digitaliseringsstyrelsen (2017, 2018), Digibox (2018), Mina Meddelanden (2018)

connected to the common mailbox Mina Meddelanden (Digimail, 2017). The third private actor on the market in Sweden is E-boks, introduced in Sweden in 2015. It delivers digital mail from public authorities and businesses to citizens and is, as mentioned, half owned by the Danish subsidiary of Postnord (E-boks, 2017). The population in 2017 was 10.1 million (SCB, 2018).

Table 2 shows the number of connected receivers to digital mailboxes in Denmark and Sweden as percentage of the total population.

Over 75% of all Danish citizens are connected to a digital mailbox; 90% of those over 15 years of age. As most Danes are already connected, the market is mature and its growth has ceased. In Sweden, the percentage of the population connected to the common facility *Mina Meddelanden* is 25%. However, this figure more than doubled last year. The Swedish Tax Authority announced that the year's tax refunds would be paid back earlier to those who had a digital mailbox. The private operator *Kivra* is gaining market share with a 133% increase in subscribers in one year; only after the nudge from the Tax Authority it got half a million new subscribers. In 2016, a total of 1.6 million messages were sent to a digital mailbox, just over one message per receiver and year, which means that the boxes were not at this time used frequently by the Swedes (PTS, 2017). In 2017, 1.4 million messages were sent from the public sector via *Min Myndighetspost* (Mina Meddelanden, 2018), less than 4% of the 442 million in Denmark. It is equal to 0.06% of all letter mail in Sweden. The private operator *Kivra* delivered just over 30 million messages in 2017 (Kivra, 2018), equal to 1.3% of all letter mail.

4   Analysis

We have showed that demand for letters has fallen in both Denmark and Sweden, but that the decline is almost entirely in first class mail, and about double in Denmark. This has caused adjustment problems and reduced revenues for Postnord, particularly in Denmark. In this analysis, we will try to explain the differences between the two countries.

Three factors can be ruled out as important explanations. The large difference in demand decline cannot be explained by income or general digitalization. GDP per capita in both countries is nearly equal; in 2017 it was 0.9% higher in Denmark

(OECD, 2018). Both Denmark and Sweden are among the most digitalized countries in the EU; even if Denmark is somewhat ahead of Sweden the difference is small, as showed in Table 1. Higher costs for postal services in Denmark can hardly be explained by a larger financial burden of the universal service obligation. If there is such a burden, it ought to be higher in Sweden with a population of 23 inhabitants per square kilometer compared to Denmark's 134 per square kilometer (Denmark Statistics, 2018; SCB, 2018).

4.1 Explanations to the Differences Between Denmark and Sweden

With digital communication the receivers' demand decisions become important. If receivers do not invest in a digital mailbox this alternative is not available. Demand for postal services remains the senders' decision, only considering their GC for sending mail. In Denmark, the government has forced all firms and households to connect to a digital mailbox and the state is providing the common mailbox Digital Post. In Sweden, the digital mailbox market is fragmented and confusing and even if Sweden is becoming more digitalized, it remains a big difference in the degree of connectivity and the amount of traffic.

We conclude that the fixed generalized cost (GC) for the receivers in Denmark is lower than in Sweden. Even if there is no monetary cost for households to connect to a digital mailbox in either country, it has been simple in Denmark because the search and information costs are lower as there is only one, well-established such mailbox. The strategy for digitalization adopted in 2001 encouraged early adopters to connect to the *E-boks* that was established the same year. The relative success of this digital mailbox paved way for implementing the law in 2012 that made late adopters connect.

In Sweden, as in most other countries, 15 years later there was no simple alternative as the market for digital mailboxes was undeveloped. It has been complicated to obtain information about the different alternative mailboxes, the difference between them and the value of having one. Public authorities have not been coordinated in their communication policies and private businesses have developed other alternatives such as e-mail or electronic invoices direct to the receivers' bank accounts.

Once the receiver has a digital mailbox, variable GC determines whether the receiver prefers a message physically or a digitally. As the receivers normally do not pay, they compare the transaction costs of receiving messages in a digital or a physical mailbox. However, it is typically the senders' GC that determines whether to send to the physical or digital mailbox, not taking the receivers variable transaction costs into account. Both physical and digital mail has transaction costs for the sender, including producing messages and keeping address registers etc. The GC for physical mail in Denmark has been markedly higher than in Sweden because first

class mail has been standard and the postage much higher. We conclude that the incentives for senders to shift to digital communication have been stronger in Denmark, as the GC for mail is higher and the GC for communication to digital mailboxes is lower than in Sweden for most types of messages.

Over time, falling mail volumes in Denmark from an already lower level than in Sweden, resulted in higher costs, lower quality and further price increases. Danish physical mail prices increased further compared to Sweden. There, price regulation limited price increases for first class mail, and competition for second class mail made postal services more competitive.

The fall in postal volumes in Denmark started already in 2001, but the law requiring people to get mail from public authorities came in 2012. Mail from public authorities is important but the major part of letters comes from private senders. The establishment of *E-boks* in 2001 substantially explains more early and rapid substitution to digital mail in Denmark. Postal volumes had already fallen by near 60% in 2012 when the law was implemented; the law enhanced the additional 45% fall in volumes since then. However, the subsequent fall is also enhanced by more than doubling prices and reducing service for first class mail. As first-class mail was dominating in Denmark, the postal market was more vulnerable to substitution of digital mail.

The law in Denmark is a result of government promotion of digitalization. Unlike Sweden, where no digital mailboxes existed in 2011, the established *E-boks* with over half of the population already connected facilitated the use of digital mailbox for communication with public authorities required by the law. The importance of a digital mailbox for private senders of mail is also visible in Sweden with the more rapid growth for *Kivra* than for the public one.

In Denmark, first-class mail has been the dominating means of sending letters, whereas in Sweden second-class is more common. This is a result of the competitive situation on the Swedish market for second class letters since 1993. The generalized cost for the sender of such mail is very low: the price is low, particularly for large shipments, and the transaction costs are also lower than for single-piece mail. Thus, physical mail has remained more competitive in Sweden.

This, in turn, can explain why neither the public nor the private sector in Sweden has felt such strong demand for developing digital solutions to communication as in Denmark. The digital communication market did not grow in Sweden and the lack of public policy made the market fragmented and confusing. Stronger public engagement may not have had the same strong effect in Sweden as in Denmark, however, perhaps because the demand for digital solutions has been insufficient.

4.2   Responses to Decline in Demand

It is beyond the scope of this paper to fully explain why it has been more difficult to adjust costs to falling demand in Denmark than in Sweden. Among other things, contracts for employees in Denmark make it difficult to adjust the size of the labour

force. In Sweden, adjustments of the logistical network have taken place too fast, resulting in lower reliability with less mail on time and increasing complaints from customers regarding lost letters (PTS, 2018; SOU 2016:54).

Rapidly falling demand with relatively high fixed costs have made Postnord in Denmark adopt at strategy of raising prices significantly. Unlike in Sweden, no price cap has limited price increases. With high prices and a five-day delivery as standard, the fall in demand has been spurred. In Sweden, the real price has been nearly constant and total letter volume has fallen with 35% since the year 2000. As volume in Denmark fell with 75% in the same period, the remaining 40% points could be explained by price increases, if all other factors were the same between the countries. As the price in Denmark increased by 183%, that would imply a relatively low price elasticity of −0.16. With such a low price elasticity, a postal operator would find it profitable to raise prices. The demand to send those letters in Denmark, not already displaced by digital communication, thus appears to have low price elasticity. If the price is a small part of the senders' generalized cost, changes in the price also become less important.

5 Conclusion

For Denmark, the market for digital communication is already mature and most substitution may already have taken place. If Sweden and other countries are able to adopt a centralized strategy for communication with public authorities, this will enhance the challenge to postal services. Alternatively, a private operator like *Kivra* in Sweden is able to gain market shares and fills the role for making the market less fragmented. If there are scale and network economies, a private operator may monopolize this market. The bulk of mail is however not from public authorities, so the major threat to postal services comes from the digitalization of B2H-communication.

Policy plays an important role for the development. Liberalization and subsequent competition for second-class mail, and the price-cap for single-piece first-class mail in Sweden have made postal services more competitive, limiting the rise in GC for mail. Future policy needs to adjust to the new situation and relax some obligations for the universal services provider. When mail becomes less time-sensitive and two-day delivery is allowed, 2.5 deliveries per week may be the next step in order to relax regulatory requirements. The lack of strategy for digitalization, nudges or monetary incentives have also postponed the substitution process in other countries compared to Denmark. However, we want to underline that the law in Denmark is not the sole explanation for the fall in postal volumes; equally important explanations is the possibility to send private communication through one single digital mailbox established long before the law, and the dominance of and high price for first class mail. We conclude that the different development in Denmark compared to Sweden and other countries is that the GC for digital communication in Denmark has been relatively lower and GC for postal communication relatively higher.

Postnord's different strategies are also relevant. As Postnord has attempted to adjust costs to falling postal volumes, it has established itself in the digital communication market through *E-boks* with a monopoly in Denmark. This diversification has not improved the company's results; on the contrary the losses in Denmark have caused Swedish taxpayers to lose revenue that would otherwise have entered the government's budget. To maintain profit, it is crucial for Postnord to adjust costs to falling volumes without enhancing substitution by increasing prices and reducing service. The competitiveness of postal services in the future in both Denmark and Sweden is in time-insensitive second-class mail, where digital substitution is less challenging.

For Sweden, and other countries in earlier stages of digital communication, it remains to be seen how much demand for postal services continue to decline and how postal operators are able to reduce costs without deteriorating service, and raising prices to the extent that demand decreases even more. For countries like Sweden with relatively large postal volumes, low prices owing to competition, a well-functioning market for second-class mail and ability to adjust costs, the "Danish problem" may be less significant, while still presenting an ongoing challenge to the postal market.

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Parcel Lockers, an Answer to the Pressure on the Last Mile Delivery?

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1 Introduction

Over the last decade, e-commerce has spurred the growth in parcel lockers. By "parcel locker", the authors refer to automated parcel machines where users can send and/or receive parcels. This relatively new phenomenon has the potential to alter the traditional postal delivery model significantly. Section 2 of this chapter describes the range of parcel locker types. Many distinctions are possible, such as by provider, location, collection point and mobility. The chapter continues with a consumer perspective on parcel lockers in Sect. 3. In general, users find parcel lockers user-friendly. Access to parcels at every hour of the day is especially well-received. Sometimes, e-retailers or postal operators encourage the use of parcel lockers through a price reduction.

Next, in Sect. 4, the chapter looks more deeply into the parcel locker landscape of five nations. Germany was chosen because of its pioneering role in deploying parcel lockers. Spain also has a rather mature parcel locker market. Sweden was picked because of its use of community mail boxes in some rural regions, which could improve the perception and acceptance of parcel lockers. Estonia is a European frontrunner in digitalization. Belgium was a logical choice due to the nationality of the authors. The chapter continues with the cost efficiency and sustainability of parcel lockers in Sect. 5. Section 6 touches upon the regulatory challenges of parcel lockers, while Sect. 7 concludes with a look into the future of parcel lockers.

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2   Different Types of Parcel Lockers

The term 'parcel locker' encompasses a wide range. In what follows, we touch upon some possible parcel locker types.

2.1   Public vs. Private Parcel Lockers

Parcel lockers can be installed in either public or private spaces. For an installation in a public space, the local administration - in most cases this will be the municipality - must approve the placement. When placed in a public space, the scarcity of space might become an important issue. Most parcel lockers, however, are located in private locations. Examples include parking sites of supermarkets or gas stations, entry halls of workplaces or outside private enterprises located in the city center. Private parcel lockers can consist of just one cabinet and be located at a home just like an ordinary letter box.

Another public vs. private distinction is between publicly accessible parcel lockers and parcel lockers with restricted access to an individual or a certain group of individuals. In this paper, when talking about public parcels, the authors refer to publicly accessible parcel lockers.

2.2   Electronic vs Mechanic Parcel Lockers

Two main parcel locker types have emerged in the market. First is electronic parcel lockers. They can be connected to the Internet and send a notice of delivery to the receiver while at the same time generating a proof of delivery, both useful to the postal operator and e-retailer.

Second is mechanical parcel lockers. These mechanical parcel lockers can come with a soft-drop compartment in the bottom part of the locker, guaranteeing a waterproof and safe environment for the parcel until the customer collects it. Mechanical parcel lockers can be equipped with PIN code protection. A mailman, who is notified of the parcel locker PIN code, has access to the secured parcel locker.

2.3   Stationary vs Mobile Parcel Lockers

Although most parcel lockers are stationary, mobile parcel lockers may emerge in the near future (Joerss, Schröder, Neuhaus, Klink, & Mann, 2016). After locating the customer, the parcel delivery vehicle drives to the customer's desired location. When

the truck stops at a certain point, the customer can access the secure package compartments by using a smartphone or entering a PIN code.

Different enterprises are developing mobile parcel lockers, making use of the technology of self-driving cars. Google, for example, has been granted a US patent for the development of a self-driving parcel delivery truck, which it named 'autonomous delivery platform'.[1] Ford's CEO stated that by 2021, parcel delivery can, next to ride-hailing, be one of the key commercial applications for the first fleet of fully autonomous vehicles.[2]

3 Consumer Preferences Regarding Parcel Lockers

According to an IPC study, 11% of all parcels are delivered to a parcel locker while 9% of returned parcels pass through a parcel locker as well. Parcel lockers are most popular in Finland (43%), Denmark (41%) and China (33%).[3] Furthermore, ability to select the delivery location is assessed with a score of 47%, ranking it seventh (International Post Corporation, 2018).[4] According to a study of the Maritime University of Szszecin, 70% of the respondents to a survey conducted in 2015 rated the use of parcel lockers in the Szszecin with a grade of 8 or higher on a 10-point scale (Iwan, Kinga, & Justyna, 2016).

A Polish study examining the young adults' perception towards parcel lockers, revealed that young adults like parcel lockers for different reasons (Moroz & Polkowski, 2016).[5] Their preferences are, however, not fueled by ecological reasons—only 1% of youngsters choose parcel lockers because of environmental considerations. 24/7 availability (55%) and lower delivery cost (32%) top the table.[6]

In Sweden, a master's thesis at Lund University (Bengtsson & Vikingson, 2015) found that 93% of the respondents did not know what a package vending machine was. However, all participants thought that the processes to retrieve and return a package were easy to perform. The authors believe that there is a significant lack of

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[1]Patent named 'autonomous delivery platform' with patent number 9.256.852 B1 granted on 09/02/2016.

[2]https://postandparcel.info/74935/news/ford-ceo-sees-parcel-delivery-as-important-application-for-fully-autonomous-vehicles/.

[3]Here, the popularity was measured by the question 'Considering your online shopping experiences of the past 12 months, where have you had your parcels delivered to?'.

[4]A total of 20 innovations with regard to shopping online was presented to the respondents, such as clear information about delivery charges before purchase, a simple and reliable return process, full visibility on the delivery process and the possibility to select the delivery speed.

[5]With young adults within the age group of 15–35.

[6]Young adults were asked what the reason was for which they made use of a parcel locker. Possible answers were: lower delivery cost, 24/7 availability, delivery speed, environmental considerations and brand confidence.

knowledge about what customers think of parcel lockers, but they appear to remain positive about using them.

In Belgium, a BIPT qualitative consumer study of 2016 revealed that parcel lockers are relatively unknown to Belgian postal end users (BIPT, 2017). The study reported a lack of parcel locker visibiltiy and acquaintamce with their use.[7] Postal end users who did use parcel lockers seemed content. In its annual report of 2014,[8] bpost, the Belgian postal incumbent, said that a survey of bpost parcel locker users found 72% of them thought the lockers useful. Many stated that they would be willing to use these lockers in future.

A PostNL pilot carried out in 2014 also indicated that consumers familiar with a system of parcel lockers is satisfied with it. 89% were very or extremely satisfied with the system, and 95% would use the system of parcel lockers again.[9] Nonetheless, PostNL shifted its focus from train stations, with a pilot covering 9 locations in train stations at the end of 2014, to residential neighborhoods.[10] It currently has over 50 parcel locker locations in the Netherlands.

4 An Overview of the Operators' Parcel Locker Landscape

4.1 Germany

The German incumbent Deutsche Post DHL Group (hereafter: 'DP/DHL') launched a pilot project for "Packstations" in 2001. Packstations, using Radio Frequency IDentification technology,[11] are large public parcel lockers where end-users are able to send and receive parcels and oversize letters. Since its launch in 2001, the Packstation network has quickly expanded. In 2014, DP/DHL stated that it had 2650 Packstations in Germany with approximately 250,000 compartments, serving over 5 million registered users.[12] In its annual report of 2017, DP/DHL said that it operated 3200 Packstations in Germany.

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[7]BIPT launched in 2017 the www.postalpoint.be website displaying the postal access points (including parcel lockers) of all active operators in the Belgian postal market.

[8]http://corporate.bpost.be/~/media/Files/B/Bpost/annual-reports/ar-2014.PDF.

[9]PostNL press release of 29 October 2014: https://www.postnl.nl/over-postnl/pers-nieuws/persberichten/2014/oktober/postnl-start-installatie-pakketautomaten-op-grote-ns-stations-en-op-schiphol.html.

[10]https://www.postnl.nl/en/about-postnl/press-news/news/2017/postnl-continues-trial-with-innovative-parcel-and-letter-machine-in-limburg.html.

[11]Radio-Frequency Identification (RFID) is the use of radio waves to read and capture information stored on a tag attached to an object. A tag can be read from up to several feet away and does not need to be within direct line-of-sight of the reader to be tracked (Source: EPC-RFID Info).

[12]http://www.dpdhl.com/en/media_relations/press_releases/2014/dhl_packstation_success_story_continues.html.

Furthermore, DP/DHL currently has around 800 Paketboxes, which are publicly accessible parcel lockers, similar to curbside collection letterboxes, only usable for sending parcels.[13] In addition to these public parcel lockers, DP/DHL also provides private parcel lockers named Paketkasten.[14] These private parcel lockers can be used for sending and receiving parcels at your premises. Although DP/DHL has an extensive postal parcel network, with 90% of the people in Germany living within 10 min of a DHL Packstation,[15] it does not offer wholesale access to these parcel lockers.

Competitors DPD, GLS and Hermes are currently working out an alternative for the DP/DHL Packstations, named ParcelLock.[16] The ParcelLock system, which is designed as an open access system for all postal providers will offer public parcel lockers (Paketstation) as well as private parcel lockers (Paketkasten), both for sending and receiving parcels. According to the website, the first Paketstations will soon be installed in Hamburg. In 2016, Amazon has launched a pilot project in cooperation with Shell oil company. Amazon will install its Amazon Lockers in 10 Shell petrol stations in Munich.[17]

4.2   Spain

Correos, currently undergoing a digital transformation process has offeed since 2015 parcel locker services in cooperation with KEBA.[18] The company provides two types of KePol lockers, named HomePaq and CityPaq. The pilot started with around 500 lockers in the Madrid area and then steadily expanded to more areas across Spain. HomePaq lockers are private lockers that are installed in local community areas such as apartment entrance halls. The CityPaq lockers, however, are parcel lockers placed in public spaces such as train stations and supermarkets. Correos now services over 3200 of these CityPaq lockers.

As of 2017, Amazon is also active on the Spanish automatic parcel locker market with over 200 of its own Amazon Lockers.[19] These lockers will be located in 30 cities in 26 provinces. For their placement, Amazon works together with several business establishments such as supermarket chains, gas stations, shopping centers and restaurants.

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[13]Worldwide, DP/DHL has around 7000 Paketboxes.

[14]https://www.dhl.de/de/privatkunden/pakete-empfangen/pakete-zuhause-empfangen/paketkasten.html.

[15]2014 data. See footnote supra.

[16]https://www.parcellock.de/.

[17]https://ecommercenews.eu/amazon-tests-amazon-locker-shell-stations-germany/.

[18]http://www.ejecutivos.es/2018/05/03/correos-recibe-el-galardon-a-la-transformacion-digital-en-la-i-edicion-de-los-premios-ejecutivos-exttremadura/.

[19]https://www.amazon.es/gp/help/customer/display.html?nodeId=201910660.

4.3   Sweden

In 2014, the Swedish incumbent PostNord launched a pilot project of 10 parcel lockers across Sweden, Norway and Finland, with each parcel locker having approximately 40 compartments. These parcel lockers were set up at public transport nodes. PostNord no longer provides parcel locker services due to a lack of demand.[20] It aims, however, to reenter the Swedish parcel locker market in the near future.[21]

Unlike PostNord, some of its competitors in the parcel market provide parcel locker services. Bring, a subsidiary of Norwegian postal operator Posten Norge, has partnered with the Stockholm public transport company SL in order to expand its network of automated parcel lockers in the Swedish Capital. In June 2016, Bring possessed, after less than 1 year since the start of the project, 11 locker locations.[22] With parcel lockers at public transport stations, Bring aims to make it easier for commuters to pick up or drop off their packages on the go.

Another player on the Swedish parcel locker market is DP/DHL. It has partnered with Danish firm Swipbox to install 60 automated parcel lockers at various locations throughout Sweden. Customers who have registered to use the parcel locker service will receive a text message from DHL Express as soon as the item is ready for collection. This will contain a security code that customers simply need to enter at the designated station in order to receive their parcel.

4.4   Estonia

The Estonian incumbent, Omniva, manages the largest Estonian parcel locker network, with approximately 130 parcel lockers. Customers can pick up parcels from a locker after receiving an email or short message service (SMS) with a six digit code. Addressees may be required to show their ID and to pay a fee (by bankcard) before collection. To send a parcel, customers have to register for the Omniva parcel service, complete the details for their package, make payment and print out an address card (either at home or at the locker), scan the bar code on the address card, and then place the parcel into the opened locker. Omniva has announced that it aims to extend this service by expanding its parcel locker network.[23]

Parcel lockers are also offered by a number of other postal providers including DPD (32 parcel lockers) and Itella SmartPOST (100 parcel lockers).[24,25]

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[20] http://scandinavianretail.se/postnords-parcel-locker-no-immediate-success/.

[21] https://www.svd.se/dags-gora-om-postladan-till-paketbox.

[22] https://ecommercenews.eu/nordic-company-bring-invests-more-parcel-lockers/.

[23] https://www.omniva.ee/index.php?article_id=686&article_token=news&page=888&action= article&.

[24] https://www.dpd.com/ee_en/home/pickup_network/pickup_point_locations.

[25] http://uus.smartpost.ee/en/parcel-terminal-locations.

4.5   Belgium

In Belgium, bpost, the postal incumbent, started commercializing parcel lockers in 2014.[26] By the end of that year, it had 125 locker locations near well-attended places, such as train stations, grocery stores and large postal offices, which were accessible at any time, day or night. During the following years this network grew to 150 units.

In 2016, bpost took a majority interest in De Buren, a Dutch network of independent parcel lockers. After that, the bpost lockers were rebranded to 'Cubee', with an aim to have more than 450 parcel lockers in Belgium by the end of 2018.[27] It is now an open network of lockers, which is also being used by other operators like GLS, UPS and DPD.[28] DHL Express also offers two locations with parcel lockers in the Antwerp province. These lockers can be used only for sending parcels.

5   Sustainability and Cost Efficiency of Parcel Lockers

5.1   Friction Between Consumer Needs and Spatial Planning

In 1950 approximately one-third of the world population lived in urban areas, and this figure is expected to rise to two thirds by 2050 (United Nations, 2014). This population concentration, with the total number of e-purchases, creates a major challenge for last mile delivery. The preference of most consumers for home delivery, from a city logistics point of view, is a major concern. The growth in e-commerce, together with the preference of home delivery, has led to a fragmentation of shipments in the 'last mile' (Morganti, Seidel, Blanquaert, Dablanc, & Lenz, 2014).

At the same time, consumers have become more time-sensitive regarding delivery. This creates pressure on the supply chain management and requires complex forecasting models. Consumers also wish their purchases to be delivered when they are actually at home, meaning they want it mostly in evenings or on weekends. Evening delivery, however, falls during rush hours, creating an extra challenge for on-time delivery.

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[26]Bpost year report 2014: http://corporate.bpost.be/~/media/Files/B/Bpost/annual-reports/ar-2014. PDF.

[27]Bpost press release (4 October 2017): http://corporate.bpost.be/media/press-releases/2017/04-10-2017?sc_lang=en.

[28]https://cubee.be/become-partner/.

5.2 Sustainability of Parcel Lockers

24/7 availability of (most) parcel lockers offers a strategic environmental advantage when compared to traditional postal delivery. Delivering and collecting parcel lockers at any time can have a significant impact on urban environmental pollution due to traffic congestion. Night collections or collections outside rush hours might reduce this congestion. According to InPost statistics, around 58% of parcel locker collections occur between 6 PM and 8 AM (Moroz & Polkowski, 2016).[29] Consumers could also be nudged towards night collections through financial incentives such as a price reduction.

A higher emphasis on night deliveries to parcel lockers could decrease environmental pollution from traffic congestion. Proper cost calculations for traditional parcel delivery in urban areas, should incorporate the externalities such as time loss (through traffic congestion), noise pollution (creating cardiovascular effects) and environmental pollution (intensifying respiratory illnesses).

A study of the University of Krakow calculated, for the city of Szczecin, compared CO_2 emissions for a parcel delivered to a parcel locker to those for a parcel delivered at home (Moroz & Polkowski, 2016). The study revealed that a parcel delivered at home creates over 20 times as much CO_2 as a parcel delivered in a parcel locker (300 g vs 14 g). This figure does not, however, incorporate the impact of the consumer-induced CO_2 emitted when collecting the parcel. The study also conducted a poll to explore consumer parcel collection. It turns out that 44% of Polish respondents collect the parcel on foot, while 50% collects their parcel by car, on the way to another location. A mere 6% of respondents takes the car to collect their parcel where the destination was the parcel locker itself.

5.3 Cost Efficiency of Parcel Lockers Owned by Postal Operators

The advantages of parcel lockers over traditional home delivery from an operator's point of view, are a near 100% hit rate and shared delivery costs when multiple parcels can be dropped off at the same time and the same location.[30] 24/7 availability also eliminates the need for operators to deal with delivery time restrictions like the opening hours of parcel shops. And, compared to a parcel shop, no fee needs to be paid to a shop owner. Large objects like a television, however, can't be delivered through most parcel lockers.

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[29]InPost is a Polish postal operator with an extensive network of nearly 5000 parcel lockers in over 20 countries (with among them UK, Italy, Canada, Russia).

[30]Fully occupied parcel lockers and oversized parcels are two examples of what can negatively impact the hit rate.

Gevaers, Van de Voorde, and Vanelslander (2014) calculated the last mile cost of home delivery, with on average a 75% delivery rate, versus delivery at a collection point, having a 100% hit rate. The cost savings they computed on the basis of the average Belgian population density were significant. Home delivery would cost €3.87 and delivery in a collection point only €2.91, with delivery of just one parcel. If on average 2.5 parcels are dropped off at the same collection point, the last mile cost per parcel drops to just €1.16. If we compare these cost savings to the installation cost of one parcel locker location, this enables us to calculate the pay-back period of the investment.

With regard to cost, in 2014, bpost, the Belgian postal incumbent, stated that one parcel locker location, with about 70 lockers or cabinets, required an investment of between 40,000 and 50,000 euros. Given that the depreciation period normally used for machines is 10 years, this should imply that the cost savings would ideally be above 4000–5000 euros per year to make sense from an investor's point of view.

For reasons of simplicity, we will therefore assume that the delivery cost of €1.16 per unit, when delivering on average 2.5 parcels at the same location, is the lowest unit delivery cost possible. This would imply that compared to home delivery with a 75% hit rate, a delivery at a parcel locker location could save up to €2.71 in delivery costs per delivered parcel, being €3.87 minus €1.16. To recover an investment of 5000 euros per year needed for one parcel locker location, at least 1845 parcels that would otherwise have been delivered at home, need to be dropped off at that locker location—the equivalent of around 5 parcels per day.

To put that number into perspective, bpost stated in its annual report of 2017,[31] that it handled 190,000 parcels on average per day.[32] This implies that less than 1% of all parcels (5 parcels per day for 150 parcel locker locations versus a daily total of 190,000 parcels) need to be dropped off at a specific parcel locker location before this parcel locker investment would be financially sound.[33] This seems reasonable for an operator like bpost, with a national market share in terms of parcel volume between 25 and 30% (KPMG, 2017).[34]

For smaller operators with a minor market share and inferior volumes, a substantial investment in a parcel locker network will carry a higher financial risk since a higher percentage of consumers that opt for parcel locker delivery would be needed in order to make the investment viable.

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[31]http://corporate.bpost.be/investors/year-in-review?sc_lang=en.

[32]This daily amount also includes B2B deliveries, which will not be delivered in a parcel locker.

[33]$(5 \times 150)/190,000 = 0.4\%$.

[34]http://www.bipt.be/en/operators/postal/universal-and-non-universal-postal-services/communication-by-the-bipt-council-of-18-may-2017-regarding-the-results-of-the-study-on-the-belgian-market-for-parcel-delivery-in-the-context-of-e-commerce-activities.

5.4   Cost Savings of Parcel Lockers Owned by Operators Passed on to Consumers

Some operators offer a reduced tariff for collection point delivery to encourage customers to opt for it and avoid more expensive home delivery. Cost savings achieved by collection point delivery are partially passed on from the operator to the consumer (sender). In Belgium, bpost offers an online reduction (C2X) for delivery in one of their postal offices, shops or lockers.[35] Shipping a domestic 2 kg parcel can be bought online for €5.5 for a delivery address of choice or €4.5 for delivery to a collection point, a €1 saving for the consumer. This amounts to more than one third of the maximum cost saving of €2.71, achieved by parcel locker delivery as compared to traditional home delivery.

6   Potential Regulatory Challenges

6.1   No Legislation, but General Legal Rules

We found no specific legislation concerning parcel lockers of the countries analyzed in Sect. 5. This may be due to the spontaneous character of the provision of this service or that parcel lockers market is still in its infancy. As a consequence, it is impossible, at this point, to compare their legal frameworks in order to identify elements likely to contribute to the development of this new market.

The lack of specific legislation does not prevent more general legal rules from appling to parcel lockers, such as general rules of competition law. That was the basis on which SmartPost, in Estonia, lodged a complaint with the National Competition Authority against Omniva concerning the provision of parcel lockers, using arguments related to predatory and discriminatory pricing, as well as suspected cross-subsidisation. However, the National Competition Authority ruled that Omniva did not have a dominant position in the parcel lockers market, and thus there was no basis for sanctions against Omniva.[36]

The Spanish postal regulator (CNMC) recently responded to the concerns of certain operators regarding parcel lockers. It stated that the parcel locker service provided by Correos should not be considered part of a universal service obligation. Questions concerning possible competitive advantages arising from the provision of parcel lockers remain open. Installation costs of this type of equipment were not so high as to make it impossible or unreasonably difficult for a competitor to provide this type of service (Cullen International, 2016).[37]

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[35]C2X consists of both C2C (Consumer-to-Consumer) and C2B (Consumer-to-Business) parcels.

[36]http://www.konkurentsiamet.ee/index.php?id=23391.

[37]The CNMC-position remains, however, questionable seen the physical and technological investments which are necessary to develop a parcel lockers network (see Sect. 5.4).

6.2 Anticipations

Current Market State

The current state of the market for parcel lockers does not seem to require intervention from the national competition authorities or regulatory authorities at this time. This might change in the near future as the market evolves. Changes could result from parcel locker delivery becoming a basic service, similar to home delivery, or by political decisions aiming at encouraging the use of parcel lockers for environmental reasons and decongestion of urban areas. Besides ecological reasons, the search for a solution to prevent or minimize possible net costs related to the last mile of the delivery could also play a role in the political authorities' desire to foster the use of parcel lockers, just like the use of community letter boxes.[38] After the parcel locker market reaches a certain maturity level, a regulatory intervention might become necessary.

Competition Law

A first approach consists in applying the general rules of competition law to the parcel lockers market. This approach leaves it up to competition authorities to assess the existence of possible market entry barriers, resulting from forbidden agreements between competitors or possible abuse of dominant position by one or more market players.[39]

Certain characteristics specific to the parcel lockers market could justify intervention by competition authorities, such as a dominant player that acquires a very wide network of parcel lockers, which might be very difficult or impossible to replicate by a small or medium-sized company, as noted above (see Sect. 5.4). The tendency to enter into exclusivity agreements with the main providers of strategic locations (particularly all the favored passage places: supermarkets, train stations, etc.) may also lead to intervention by competition authorities.

Regulatory Approaches

If competition authorities' interventions do not create conditions for effective competition in the parcel lockers market, ex ante regulation tools might then be considered. A first (radical) approach could consist in entrusting the management of parcel

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[38]Parcel lockers have the potential to significantly reduce delivery costs since parcels can be bundled and the hit rate is much higher as compared to traditional home delivery.

[39]It is noteworthy that, before assessing competition aspects, first one has to define the relevant market. One needs to determine if parcel lockers represent as such a separate market or a simple convenience in complement to the provision of a more general delivery and collection service of postal items.

lockers to a single player, making these lockers interoperable and available to every provider or service postal user. The Swedish postal regulator, PTS, believes that *"different operators establish parallel facilities to meet consumer needs is unlikely to be sustainable."* and that *"this topic needs to be further analyzed, for example with regard to the possibility of establishing operator-neutral parcel lockers."* (PTS, 2017).

A second option concerns access to parcel lockers, including transparent, non-discriminatory and proportional operational and tariff conditions, perhaps combined with a cost orientation principle. One should first ask if such a regulatory initiative is possible within the framework of the Postal Directive currently in force. Given the wording of Article 11a of the Postal Services Directive (hereafter: 'PSD'), this implies addressing whether a parcel locker a service provided within the framework of the universal service or an element of postal infrastructure and, if not, is it an element of the postal network? A reading of Article 11a could suggest that parcel lockers are an element of postal infrastructure, because post office boxes and delivery boxes are listed as elements of postal infrastructure.

The issue is whether a parcel locker could be regarded as a delivery box. As to whether a parcel locker is a service provided within the framework of the universal service, one could answer negatively as the CNMC did in 2016 when it considered whether Correos' HomePaq service is a specific element of the operator's network, aiming to provide a value-added service. Another analysis might consider parcel lockers as alternatives to post offices for transit management of parcels. Because parcel lockers both receive and send parcels, they perform a function traditionally entrusted to post offices.

The PSD clearly gives Member States some flexibility concerning the assessment of the notion of element of postal infrastructure. Recital 34 of Directive 2008/6/EC, amending Directive 97/67/EC with regard to the full accomplishment of the internal market of Community postal services, specifies, concerning the elements of postal infrastructure, that "As the legal and market situation of these elements or services is different among the Member States it is appropriate to only require Member States to adopt an informed decision on the need, extent and choice of the regulatory instrument, including where appropriate on cost sharing."

In other words, the range of relevant legal and economic situations in the different Member States justifies a not too rigid approach of the notion of elements of postal infrastructure. Still open is whether this geographical flexibility also influences the definition of postal infrastructure and justifies an evolutionary interpretation, taking into account, among other things, technological developments. Furthermore, this interpretation may not be supported by the mere illustrative nature of the notion of element of postal infrastructure as defined in Article 11a. Finally, it should be assessed whether a parcel locker might constitute an element of the postal network, on which Article 11a allows Member States to offer access. It will be interesting to observe the jurisprudential developments in this area.

7　The Future of Parcel Lockers

There are many ways in which the parcel locker market might evolve. Parcel lockers will have, in the next decade, a growing impact on the traditional postal delivery model. Many factors will have an upward pressure on this growth. Continued urbanization will create traffic congestion and (local) environmental pollution. It will be important for legislators to internalize these externalities into the price of mobility (such as the transport and delivery of a parcel).

The development of self-driving cars might change the dynamics of the postal delivery chain. At the moment one can already witness a growing friction between traditional postal operators and large e-retailers or e-commerce platform companies such as Amazon, which might extend its service to the parcel locker or the front door of the customer. Autonomous vehicle providers or tech platforms such as Uber might enter the parcel delivery market as well.

Finally, the financial sustainability of the postal universal service suffers under growing pressure from letter volume decline. One of the possibilities of downsizing the postal universal service might be the partial limitation of the postal universal service network to optimally placed parcel lockers. The last mile burden would be transferred to the postal end-users or, if home delivery is requested, to local postal couriers specializing in last mile solutions.

Disclaimer　The views expressed in this paper are personal and do not necessarily represent the position of the institution to which the authors belong.

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The Transformation of Postal Services in Light of Technological Developments and Users' Needs

Luigi Scorca

1 Introduction

The market mix for postal services is changing quickly, with a decrease in letter volumes and a concurrent increase in parcels. This trend implies changes in postal users' preferences and needs over the last few years. Studies recently carried out at national level were presented in an ERGP document (2016). Although in that paper it is not possible to observe specific trends, it appears that users are shifting their focus from the delivery of mail to parcel items. Furthermore, parcels require more flexible delivery times to customer premises and greater flexibility in the opening hours of access points.

New players are using internet-based applications, artificial intelligence and robotics to provide new services. One notable outcome is the integration between e-commerce platforms and delivery services. E-commerce platforms have started to place their network of warehouses according to predictive algorithms. Storage is optimized and items are located as near as possible to the place where consumers want them. By crowdsourcing local couriers by using algorithms, geolocation and connectivity, e-commerce platforms are starting to develop their own delivery services. With similar crowdsourced operations, it is possible to manage last-mile express delivery services, where virtual platforms connect sellers to local couriers delivering small items or food.

The postal market is also witnessing the appearance of providers focusing on one or more parts of the production chain. This is especially true in the segment for clearance and/or delivery, where automatic parcel lockers and platforms for the management of proximity points are gaining ground.

Given the forthcoming revision of the Postal Service Directive, it is important to evaluate how the postal market is changing. It is essential to assess both shifting

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313

users' needs and technological developments, such as the virtualization of operations and crowdsourced networks. Previous studies focused on the "uberization" of activities (Borsenberger et al., 2016; Borsenberger, 2017). The approach undertaken here outlines two concurrent trends: the vertical integration between the retail and delivery business, and the rise of an ecosystem wherein some providers are focusing on one or more sections of the production chain. This chapter analyses new service providers in the postal market. To begin with, it focuses on e-commerce platforms that internalize delivery services. Subsequently, it also takes into account virtual platforms that manage automatic parcel lockers and proximity points. Last-mile express services are also considered here, thereby concluding that they do not differ from other delivery services conducted through crowdsourced operations. Finally, this study compares the operative model performed by virtual providers to those of traditional postal operators, in order to discuss if they might eventually be considered postal activities according to the current definitions.

The structure of this chapter is the following: Section 2 describes the EU jurisprudence on postal services and the postal production chain. Section 3 states the changes in the preferences and needs of postal users. Section 4 describes how technology is changing the postal services production chain. Finally, Sect. 5 provides conclusions.

2 The Postal Industry and Its Production Chain

Directive 2008/6/CE, which amended Directive 97/67/CE with regard to the internal market for Community postal services, defines postal service with reference to both activities that are undertaken as well as to the type of items dispatched. Article 2, p. 1, defines the activities that are typical of postal services: "*services involving the clearance, sorting, transport and distribution of postal items*"; notably, transport is not considered as a parcel delivery service in and of itself. Article 2, p. 6, defines a postal item as "*an item addressed in the final form in which it is to be carried by a postal service provider. In addition to items of correspondence, such items also include for instance books, catalogues, newspapers, periodicals and postal parcels containing merchandise with or without commercial value*".

EU jurisprudence has been reshaping the product definition of postal services over the years, thereby indicating the activities to be performed, and tracing the boundaries between the postal and transportation sector. According to ECJ case C-148/10, postal services may even consist of only one of the activities quoted in the Directive, so it is not necessary that they are performed cumulatively.[1] The only exception to the rule regards transportation, which should be undertaken concurrently with at least one of the aforementioned activities. In addition, Decision C

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[1] DHL International NV, formerly Express Line NV vs Belgisch Instituut voor Postdiensten en Telecommunicatie.
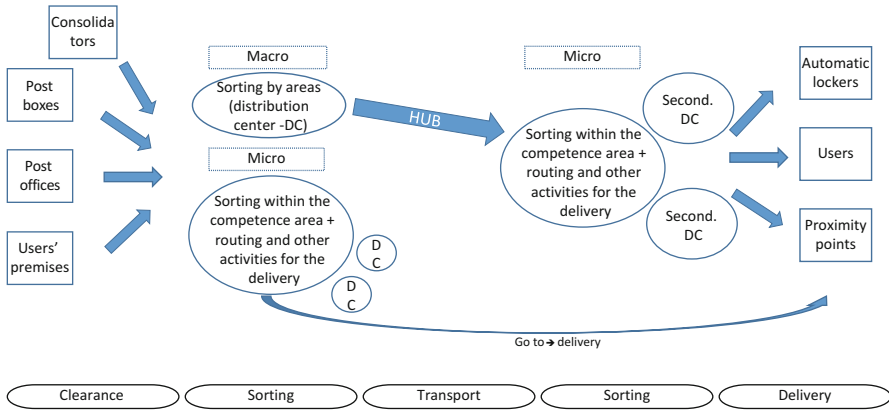
Fig. 1 The postal service production chain

(2013) 431 drew a further distinction between the postal and transportation ("freight") sectors, by setting the weight limits of postal package items between 2 and 31.5 kg.[2]

The EC Notice on the application of the competition rules to the postal sector (98/C 39/02) clarified that courier express parcel (CEP) services represent postal products with additional value-added features, including tracking and tracing, the delivery by a specific day and time, as well as the refund in case the delivery does not occur in due time.[3] Recently, the ECJ case C-259/16 and 260/16 confirmed that CEPs are postal parcels.[4]

EU regulation (n. 2018/644[5]) on cross-border parcels published this year further clarified criteria that define postal parcels and parcel delivery service. Postal parcels have definite size and weight features. As just noted, their weight cannot exceed 31.5 kg. Clearance, sorting, transport and delivery—including when they are provided by courier service providers—should be considered parcel delivery service activities. It is not necessary that activities are managed together in order to be considered parcel delivery service, except for transportation. Finally, the regulation also deals with providers using alternative business models or e-commerce platforms, in case they provide at least one of the activities in the postal production chain.

Although it is necessary to bear in mind that operators might apply different operating models, we can briefly represent the postal production chain (WIK, 2013). As shown Fig. 1, this chain essentially consists of the following activities: clearance,

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[2]http://ec.europa.eu/competition/mergers/cases/decisions/m6570_20130130_20610_4241141_EN.pdf.

[3]The same conclusion was reached in different EC decisions, the last one being n. 2002/M.2908.

[4]CONFETRA and others vs Autorità per le Garanzie nelle Comunicazioni.

[5]https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32018R0644&from=FR.

the methods used to collect postal items. The method will depend customer type and postal product. The items are then carried to a local distribution center, where sorting takes place. Postal items are homogeneously grouped (according to product, format and destination), and then transported to the logistic distribution center of the area of destination. At this point, postal items are sorted once again by destination, then routed and delivered to the customers by different modalities.

3   Changing Users' Needs and the Shift Towards the Delivery of Physical Goods

Postal item volume data show a decrease in letter items and a concurrent increase in the volume of parcel items (ERGP, 2017). Owing to e-substitution, there is less demand for letter mail items, while the volume of direct mail (both addressed and unaddressed), is quite stable overall (Intergraf, 2016). E-substitution, however, cannot replace the delivery of physical goods. Thus, the development of e-commerce is fostering the growth of parcel delivery, express and non-express.

As ERGP (2016) and McKinsey (2016) indicate, several studies have analyzed postal users' needs, but their results are not the same because their methodologies and purposes differ. To some extent, however, those studies identify a few tendencies. For all users, reliability of the postal service is becoming more important. In addition, although for most users price remains a key criterion in the choice of a delivery service, there is a wider willingness to pay for express services or for deliveries with value-added features.

The postal market is developing in two opposite directions. Some users are willing to pay more for a premium delivery, while others are keen to accept longer transit times to spend less. Regarding the delivery of physical goods, the market is leaning towards products with value-added features. Consumers' needs and preferences are changing also with regard to other features of the postal service. Users prefer delivery to their premises rather than delivery to an external location, even if the latter would result in lower prices. Users require greater flexibility in the operating hours of access points as well, for the collection and/or delivery of postal items as well as more flexible delivery times for parcels.

4   Technological Developments in the Postal Sector

The evolution of the postal market is limited not just to products, because production processes are changing too. As in other industries, new operators have entered the market and focused on single parts of the production process. As a result, vertically integrated companies providing all-in services now coexist with operators supplying one or a few production chain activities.

Furthermore, technologies based on artificial intelligence, automation, geo-location and connectivity, empower the disintermediation of the postal value chain, the integration of different operational processes and the development of new business models, as in the case of the management of postal services by virtual platforms. The possibility of entering the market without the need to manage a vertically integrated infrastructure or to operate through a physical infrastructure is lowering costs, reshaping network effects and disrupting the business model of traditional postal operators. Technology also offers the opportunity to manage separately activities that were traditionally bundled. Consequently, the postal services market is witnessing a strong push towards the segmentation of the postal production chain. At the same time, it also allows the vertical integration strategy followed by e-commerce retailers such as eBay and Amazon, companies that are developing their own delivery network.

Technology is lowering entry barriers for new operators, reducing transaction costs by iterative optimization and offering an opportunity for established businesses to enter new industries (lateral competition). The digitalization and the virtualization of industries also improves the flexibility of operations, which allows scalability with negligible costs and makes the cost structure highly variable. Finally, through crowdsourced operations, digitalization and virtualization allows the provision of services based on use rather than ownership of instruments (e.g. vehicles, equipment, etc.) (IPC, 2018).

Competitors resorting to crowdsourcing operations represent both a threat and an opportunity for traditional providers. To succeed, traditional postal operators must develop their ability to modify quickly their capacity, equip their workers with connected tools allowing real-time route optimization, and develop their skills learning from an environment where preferences and needs of consumers might differ. Traditional operators must also invest in alternative forms of delivery, in order to offer wider choices to consumers.

A recent ECJ ruling on Case C-434/15 has important implications for crowdsourcing services.[6] The Court was asked whether the service provided by UBER represented an electronic intermediation between drivers and users or a transportation service. The ECJ concluded that the platform organizes and make accessible a service that would not exist otherwise—meaning UBER's service is more than merely intermediation (Marasà, 2018). According to the ECJ, the company influences decisively the conditions under which the service is provided. UBER sets the fares, processes the payments, and exercises even direct control over the quality of the service provided. Therefore, the Court decided that the "*intermediation service must thus be regarded as forming an integral part of an overall service whose main component is a transport service*".[7] Such a judgment is important for the analysis of the services provided by some virtual platforms, as we

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[6]Asociación Profesional Élite Taxi v Uber Systems Spain SL. Link to http://curia.europa.eu/juris/liste.jsf?num=C-434/15.

[7]Para 39–40.

discuss below. Following the ECJ ruling, those services may be described as postal services, rather than merely electronic intermediation.

4.1   The Integration of E-Commerce Platforms and Delivery Services

E-commerce platforms are two-sided markets, wherein two distinct groups of users enter into a transaction thanks to the platform itself. The customers of this virtual ecosystem are the users shopping on the infrastructure, as well as the sellers of the items on sale. The larger size of the group one each side creates a positive (network) externality for the group on the other.

The rise of e-commerce platforms is increasing B2C parcel volumes. The postal production and value chain is affected as well. The business model by which anybody can sell anything on-line is developing through different modalities. Sellers might use e-commerce platforms as a showcase and providing delivery directly to customers. In some cases, such as eBay (by Shutl[8]) and Amazon (by Amazon Logistics[9]), the intermediary function operated by such platforms has developed further. To create their business model, these companies may combine multiple operations by different modalities, physical or virtual (as the *de facto* sorting activities described later in the text). Therefore, the analysis provided in this document is by no means exhaustive.

To provide additional services to sellers, e-commerce platforms might become intermediaries between sellers and postal operators. In this case, the platform negotiates better rates with postal operators and assistance to sellers such as package preparation and shipment. Other platforms have developed their own network of hubs and depots. In this case, when sellers send their products to one of the platform's warehouses, predictive algorithms based on potential demand are used to sort and then store items as near as possible to the destination point (i.e., where buyers will require them) (Stone, 2013). When customers place purchase orders, the articles are then distributed to the postal operators, chosen for delivery according to the evaluation undertaken by the e-commerce platform (Fig. 2).

When the amount of purchase orders become considerable, e-commerce platforms have an incentive, especially in major cities, to enter in the (off-line) delivery business. In such cases the platform, through its own subsidiary, delivers in areas covered by its service. It hands off other parcels to the traditional postal operators. Once the purchase order is placed, the item is packed, labelled with the name and the address of destination (thereby resembling a traditional postal parcel), it is handed either to its subsidiary or to an external (postal) provider for final delivery. Platforms internalize delivery within dense urban areas, pushing competition in the most

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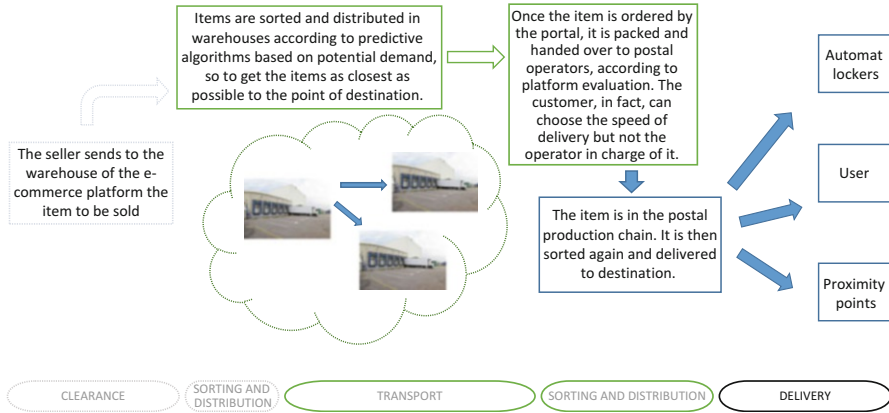[8]https://shutl.com/uk/.

[9]https://www.amazon.com/gp/help/customer/display.html?nodeId=201821690.

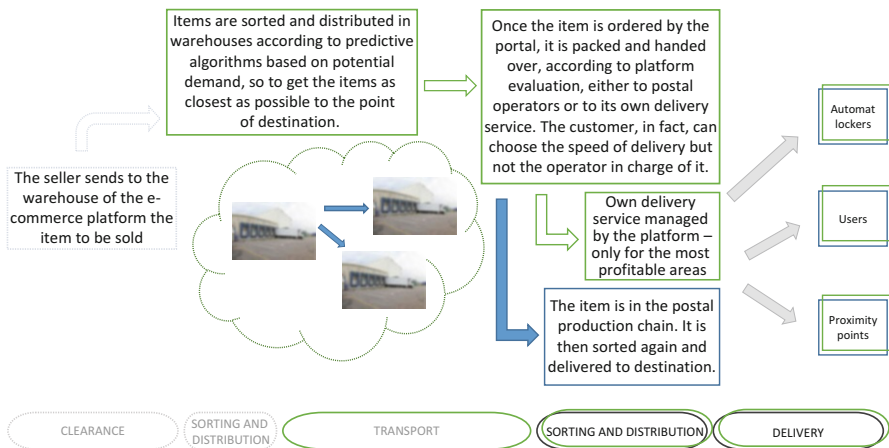**Fig. 2** E-commerce platforms' production chain with outsourced delivery

Fig. 3 E-commerce platforms' production chain with integrated delivery

profitable part and leaving traditional postal operators with deliveries with lower profits (in small towns or rural areas).

One platform delivery strategy is to operate a crowdsourcing platform of local couriers (Rougès, 2014; Slabinac, 2015; Bradley et al., 2018), over which the control of the e-commerce platform is pervasive (see also Sect. 4.3). In similar cases, local crowdsourced couriers are paid by the e-commerce platforms, receive specific training, and are provided with geolocation tools with whom they manage routing and delivery (Arslan, 2016).

The operations by which items are sorted according to the provider in charge of their delivery, as well as the organization of the routing activity, represent a *de facto*

substitute for the sorting activities undertaken by traditional postal operators. Through control over the delivery, by its own subsidiary or a crowdsourced network of local couriers, e-commerce platforms are involved in those activities (Accenture, 2015; Milt, 2016). Some on-line platforms might be operating in the sorting and delivery segments of the postal chain (see Fig. 3).

E-commerce platforms might also find it efficient to integrate their infrastructure with a system of physical urban stores. The case of Amazon and Whole Foods[10] shows that a network with few hubs located in the suburbs might not be enough to compete in a market where the main feature is to cater quickly to consumers' demands. Since products might be moved around hubs and located in proximity stores without being packed and labelled, they may shorten or even skip the postal production chain as we know it today.

Traditional postal operators are reacting by offering integrated solutions in addition to core postal services, e.g., Royal Mail e-commerce engine or warehousing service. The disruption ensuing from the competition between established postal operators and e-commerce platforms is also affecting prices. Some e-commerce platforms have started to offer their clients a subscription to an unlimited delivery service (e.g. Amazon Prime). Bundling the retail business and delivery service increases the power of e-commerce platforms. Platforms also have knowledge about users' preferences not available to both off-line retail shops and postal operators. By vertically integrating different operations, e-commerce platforms might leverage customer information to price discriminate and to fend off competitors (Khan, 2017). Given the massive volumes of their deliveries, such platforms might then acquire a strong advantage against traditional postal operators. Under these conditions, e-commerce platforms can bargain for lower delivery prices, depriving postal operators of part of their profits and pushing them to offer similar conditions to their clients.[11]

4.2 Automatic Parcel Lockers (APLs) and Delivery Proximity Points

As mentioned in Sect. 3, consumers increasingly require longer opening hours of access points for items' collection and/or delivery, particularly for parcels. At the same time, e-commerce platforms demand lower prices for delivery services. Optimization of costs is crucial; delivery costs may account up to 70% of total costs.

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[10]https://www-bloomberg-com.cdn.ampproject.org/c/s/www.bloomberg.com/amp/news/articles/2018-03-22/amazon-seeks-larger-whole-foods-stores-to-support-delivery-plans.
https://www.theatlantic.com/technology/archive/2017/06/when-exactly-does-amazon-become-a-monopoly/530616/.

[11]https://www-lesechos-fr.cdn.ampproject.org/c/s/www.lesechos.fr/amp/74/2164174.php.

The growth of B2C parcel items is creating new services on the delivery section of the postal chain such as automatic parcel lockers (APLs) and delivery proximity points' platforms.

APLs generate savings on operational costs and produce efficiencies that may not be easily attainable through traditional delivery services, such as lower distribution costs and an increase in items delivered. APLs may be used to collect or deliver postal items up to a certain weight, usually goods ordered on e-commerce platforms, as described in Sect. 4.1. Such lockers are often located in public areas, such as malls or service stations, where they are accessible all day. To send or receive their items, users need to register to the service, either by the authentication system of the e-commerce platform or separately. When items are delivered by a courier, users receive a message, after which they can access the locker through a recognition system such as a QR code.

Another opportunity offered by technology are platforms that manage proximity points such as newsstands or cafés, such as Indabox.[12] Like APLs, these platforms act as intermediaries between physical locations aiming to provide this service and users (e-commerce platforms costumers). Shop owners might earn fees paid by the operator because e-commerce costumers might be keen on receiving their items at locations that are close to their premises and have longer opening hours than traditional post offices. When users place their orders, they state their favorite delivery point (according to distance or opening hours, for instance). The items are subsequently delivered to the proximity point by the courier in charge (e.g. a postal operator, a subsidiary of the e-commerce platform or a local courier managed by crowdsourced operations). Users then receive a message by the proximity points' operator, after which they can collect their items at the designated place.

Given the operational features described above, both APLs and proximity points' platforms presumably operate in the delivery section of the postal production chain—and, in some cases, may manage clearance. Both APLs and proximity point platforms might be provided in three different ways: as an optional integrated service offered by traditional postal operators; as part of operations of an e-commerce platform (e.g., Amazon Lockers[13]); or as an independent operator with a service of points of collection or delivery of postal items.

4.3   Last-Mile Express Services

Algorithms, geolocation and connectivity are paving the way for a new class of service providers, focused on the last-mile section of the postal delivery chain,

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[12]https://www.indabox.it/.

[13]https://amp-businessinsider-com.cdn.ampproject.org/c/s/amp.businessinsider.com/amazon-hub-receives-packages-at-apartments-2018-6.

including Glovo,[14] Ponyzero[15] and others. Just like UBER, these players are virtual platforms connecting sellers to non-professional couriers. As in the case of deliveries provided by e-commerce platforms, these new providers create a potentially cost-effective logistics network by crowdsourcing local couriers and using technologies like geolocation and apps. In contrast to e-commerce platforms, however, last-mile operators do not restrict their deliveries to items bought via their virtual ecosystem. On the contrary, anything might be delivered within their coverage area.

Couriers (called "riders") are paid through the operator, are randomly placed across a limited area (e.g., a city), and use a proprietary geolocation application to manage operations. The platform uses its algorithms to organize and manage its deliveries. When an order is placed, it is automatically forwarded to the rider who is closest to the location where the item awaits. The rider can decline the task, but this might affect negatively his or her performance in the eyes of the platform, as the latter might decide to bar the rider from its network. Both pickup and delivery can be on-demand or scheduled for a specific time window. While the rider is approaching the place of clearance, the item is packed, labelled, and then handed over to the rider, who uses his or her own vehicle to finally deliver the product.

Last-mile express services do not differ from other delivery services conducted through crowdsourced operations. These operators are acting as a substitute for the sorting process, just as happens with e-commerce platforms that provide delivery through a crowdsourced network of local couriers (see Sect. 4.1). Such virtual platforms choose the best option to manage delivery, allocate tasks and suggest the most efficient routes to manage both clearance and delivery. Furthermore, control over riders' performances is pervasive: he or she is provided with equipment, receives specific training, and is encouraged to follow the route indicated by the application. As stated in the ECJ ruling on UBER in Sect. 4, by managing the overall performance of riders, last-mile platforms therefore clear, sort and deliver items that have the same features of postal packets.

These new players may also represent an opportunity for established postal operators. Some are already cooperating with express couriers, in the field of short-distance deliveries in some urban areas, as in the case of TNT and Ponyzero in Turin.

5   Summary and Conclusions

The postal market is changing extensively. The amount of letter items is declining, while that of parcel items is concurrently rising. It is possible to anticipate that, in a few years, postal services will be restricted only to parcel services, delivering physical goods that might not otherwise be brought to a destination.

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[14]https://glovoapp.com/en/.

[15]http://www.ponyzero.com/.

Postal users are changing their preferences and needs as well, since they increasingly demand express services and are willing to pay for them—although they still demand lower prices for basic products and are willing to accept longer transit times under some circumstances (Universal Service products). In addition, users appear more sensitive than ever to the reliability of the postal service. Finally, at least in the case of parcel products, users require longer and more flexible opening hours for clearing and delivery points.

To define postal services according both the type of items and the activities that they involve, this chapter refers to relevant EU legislation and jurisprudence. At the same time, it provides a description of the postal production chain and analyses activities performed in its different sections. This study traces the transformation within the postal production chain to technological developments such as connectivity, robotics and artificial intelligence.

One new feature analyzed in the document is the vertical integration of e-commerce platforms with postal services. In some cases, these platforms are developing their warehouse logistic with a network of hubs and depots and, in some areas, they are entering the delivery business, pushing competition in the most profitable segment. Operations might be conducted through the control of crowdsourcing platforms, where members (local couriers) receive an applicative with tools for the management of both routing and delivery. In this way, e-commerce platforms maintain a decisive control over all the production and business chain, including data (e.g. users' preferences) that are not available to the traditional postal operators.

Another innovation is the rise of new services such as automatic parcel lockers (APLs) and proximity points. In these cases, virtual platforms manage the operations of physical locations where to deposit and access postal items. Users, in fact, are willing to receive postal items to places near their premises that can be reached during more working hours compared to postal offices.

Algorithms, geolocation and connectivity are empowering the rise of last-mile express providers linking sellers to non-professional local couriers for the delivery of small items. The business model relies on crowdsourcing of local couriers to create a cost-effective network. The platform organizes operations through its algorithms, de facto as a virtual sorting activity: the task is assigned to the courier closest to the place where the item needs to be cleared and delivered. Such platform has a decisive control over the delivery as well. The local courier is paid by the operator, who receives equipment, specific training, and has an incentive to follow the route indicated by the applicative provided by the platform.

The transformations illustrated in this study suggest that technology is empowering the management of logistic networks by virtual platforms. This is changing postal services in two concurrent ways: through the segmentation of the production chain into amorph segments (e.g. APLs, proximity points, last-mile express services) and the vertical integration strategy followed by e-commerce platforms. It allows also the management of a crowdsourced network, based on the use rather than the ownership of instruments.

Technology is innovating the way to perform activities as clearance and delivery, but it is necessary to meditate as well how artificial intelligence is modifying concepts as the traditional sorting and routing. The wave of innovation described in this document is transforming production processes by the virtualization and the automation of sorting processes, algorithms to optimize routing, geolocation tools, with new means of delivery and business models. Technology modifies how activities are performed, but processes are *de facto* equivalent. The bundle of activities generating postal services as we know them today are unaffected.

Platform operations should be then regarded as part of the overall postal service and not a mere (virtual) intermediation between different players. Therefore, it is important that the forthcoming revision of the Postal Service Directive takes into consideration the disruption of traditional business models and production chains achieved through technology to provide future-proof definitions of postal services.

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Postal Industry Diversification: Exploring New Worlds and Facing New Regulations

Virginie Alloo

1 Introduction

This paper aims to show how the changing operational diversification of Postal Operators (POs), broadens the regulatory framework that they must consider. In Sects. 2 and 3, we analyze, as two representative examples, how the Belgian and French POs succeed in using their infrastructure and their reputation for trust to diversify their activities towards e-commerce and digital services, to counter-balance revenue loss resulting from the decline in letter volumes.

All these new activities can have important implications in terms of the new regulatory areas that must be taken into account. Section 4 details the new regulatory issues related to privacy faced by postal operators when offering these new digital services. Section 5 analyses the postal operators' new duties related to cybersecurity. Section 6 describes the postal operators' liabilities towards online sellers and buyers. Indeed, in relation to online shopping, postal operators must also familiarize themselves and comply with a series of new European rules aimed at improving the protection afforded to European consumers, in particular the new proposals on better enforcement of existing consumer rules. Section 7 concludes that new diversified activities, which postal operators anticipate will have a positive impact on their turnover and business future but will also bring new challenges in term of the scope of the regulations applying to them, in particular in the privacy, security and consumer protection fields.

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2 bpost: Entry in the (e)-Retailing Value Chain

"To counter the decline of our historical business, we continue to diversify our activities (. . .). bpost is committed to offering customers a robust cross- border service that covers the entire e-commerce logistical chain", explained Koen Van Gerven, bpost CEO in bpost annual report (Van Gerven, 2017). In particular, bpost aims to cover the entire e-commerce logistical chain, not only ensuring the last mile in parcel delivery, but also managing and preparing online shopping orders. On average, bpost handled 190,000 parcels per day in 2017, up 28% on 2016 (Van Gerven, 2017). In 2017 bpost focused its efforts to substantially enhance parcel delivery options for customers, who can now choose their delivery location (at a safe place around their house, at a neighbor or at a pick-up point) in case they are absent (bpost, 2017).

In this context, bpost launched Cubee, Belgium's biggest parcel locker network, which is open to all retailers, online customers and couriers. This network consists of secured lockers (including refrigerated ones), which are accessible 24/7 and can be managed by an app that allows a multitude of services. The open nature of the network allows any customer to use any free locker capacity throughout the network (bpost, 2017).

In 2017, bpost also acquired Parcify, a Belgian start-up company. Parcify developed a smartphone app that aims to reduce the number of missed parcel deliveries by using the recipient's phone geo-tracking to deliver parcels at his preferred location and time. In addition, bpost acquired the Belgian subsidiary of the retail operator Lagardère Travel Retail under the name Ubiway, which increases its network of parcel pick-up points (further enhancing delivery options) and retail services with, for example, the distribution of press, lottery and tobacco products. These Ubiway points of sales are mainly located in the Belgian train stations and airports (bpost, 2017).

The bpost subsidiary Speos manages outgoing financial and administrative document flows, such as invoices, bank statements and salary slips. The services offered include document generation, printing and enclosing, electronic distribution and archiving. In addition, bpost's Certipost service provides document security, digital certification and Belgian e-ID activities.

At present, it appears that nearly half of bpost's total revenues comes from sources other than mail (44%).[1] Some 27% of bpost revenue was generated by parcels and logistics activities, which grew by more than 100% in 2017. A further 22% of bpost's revenues came from value added and retail services, including from the integration of Ubiway. The last 7% of bpost's revenues came from international mails.

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[1]This estimate is made by Cullen International based on bpost's annual total operating income (revenues) published in the 2017 annual report (p. 7).

3 La Poste: Entry into Digital and 'Elderly Economy' Markets

The French postal operator, La Poste, is testing new services which seek to respond to the strong growth in online shopping, an aging population and the demand for local services that these trends generate. La Poste offers postal users a service called Digiposte which offers a certified digital identity tool and an electronic safe to store pay slips and other important documents. This service can be accessed through an online application certified as secure, encrypted and with the users' personal data hosted in France. La Poste has also launched an online services platform dedicated to businesses, offering electronic administrative services like e-signature, e-invoices and archiving. La Poste's mobile app allows having a webmail address (laposte.net) to send and receive e-registered letters. Finally, La Poste has established its own "data charter" to comply with the different rules on the protection of personal data (La Poste annual report, 2017).

La Poste also aims to become a key player in home services by acquiring businesses in the home services sector and creating ecosystems where different providers offer local services in synergy with La Poste's own services. La Poste has also launched a service called "*Veiller sur mes parents*" (Watch over my parents), which includes a regular visit from the local postman and a 24/7 helpline. Through this level of contact, old people can be helped to remain self-sufficient and live in their own homes for much longer. Finally, La Poste has invested in tablet computers specially designed for the use of older people (La Poste annual report, 2017).

Mail activity, with revenue of €6.6 billion in 2017, still remains the leading activity of the universal service provider (63.8%).[2] Parcels and e-commerce logistics is the second important activity of La Poste, with 16.4% of the 2017 group revenues. Direct mail remains an important part of the group revenues (13%). Press distribution brought 4.5% of La Poste's total revenues. In 2017, the new silver economy division and local services generated revenue that represented only 1.3% of the annual group revenues.

4 Postal Operators' Duties Related to Privacy

The development of digital services like Digiposte (La Poste), Certipost (bpost) and the growth in local services such as for the elderly (La Poste) raise policy questions regarding how carefully these POs handle the processing of personal data. Postal operators, as data controllers, need to understand their new and enlarged responsibilities and duties in relation to the processing of personal data. In particular, postal

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[2]This estimate is made by Cullen International on the basis of La Poste's annual total operating income (revenues) published in the 2017 annual report (p. 299).

operators have to comply with a series of European rules, including the new General Data Protection Regulation (GDPR) and will be affected in the future by the proposal for an e-Privacy Regulation. The main objectives of these new European rules are to improve rights for data subjects and impose more accountability for data controllers.

4.1 Personal Data Protection: The General Data Protection Regulation (GDPR)

The GDPR (European Commission, 2016) has entered into force in the EU from the 25 of May 2018. The GDPR replaces a patchwork of 28 different national data protection laws based on the old Data Protection Directive (European Parliament and Council, 1995) with one single framework directly applicable throughout the whole EU. The regulation applies both to companies established in the EU and to companies not established in the EU but that offer their services in the EU or that anyway monitor the behavior of individuals in the EU.

Most postal operators are active as data controllers and should thus be able to demonstrate compliance with their data protection obligations. Of relevance to the new diversified postal activities, Article 37 of the GDPR includes an obligation for companies to designate a data protection officer (DPO). DPOs should inform and advise the controller or processor, especially in the context of data protection impact assessments. They should also monitor compliance with the GDPR and cooperate with the supervisory authority.

The GDPR also includes in its Article 20 a right to 'data portability' (e.g. a Digiposte service user could ask La Poste to move his data to a competitor's platform when terminating the contract with La Poste), including the right to transfer data to another controller, and an obligation to notify personal data breaches to individuals or Data Protection Authorities. Breaches of the regulation could lead to companies incurring significant penalties, with fines of up to 4% of the total worldwide turnover of a company. The table below describes the main rules in relation to data protection, data portability and data breach notification (Table 1).

Article 68 of the GDPR establishes a new European Data Protection Board (EDPB), bringing together the heads of national data protection authorities (DPAs), thus replacing the former Article 29 Working Party (WP29). The EDPB is endowed with the power to adopt binding decisions. So far, WP29 has published a series of guidelines on various aspects of implementation of the GDPR, in particular on the right to data portability, the personal data breach notification and the designation of a data protection officer.[3]

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[3]Article 29 Data Protection Working Party—Guidelines on the right to data portability—5 April 2017; Guidelines on on Data Protection Officers (DPOs)—5 April 2017; Guidelines on personal data breach notification—3 October 2017.

Table 1 Main obligations for data controllers under GDPR

Issue	Obligation
Data protection by design and by default (articles 5 & 25)	Data protection by design: controllers must "*implement technical and organizational measures*" from the earliest stage of development of their products and services Data protection by default: controllers must ensure that "*by default*", only the personal data necessary for the purpose of the processing is processed
Data portability (article 20)	Under the GDPR, individuals have the right to • receive in a "machine readable format" the personal data concerning them and which they provided to the controller; and • transfer that data to another controller When "technically feasible", individuals also have the right to have the data transferred directly from controller to controller
Data breach notification (articles 33 & 34)	From controller to data protection authority (DPA): breaches that are likely to result in a risk for individuals must be notified "*without undue delay*" and when feasible, within 72 hours after becoming aware of them
	From controller to affected individuals: breaches that are likely to result in a high risk for individuals must be notified "*without undue delay*". Controllers are exempted from this obligation if measures such as encryption have been adopted
Data protection impact assessment (DPIA) (article 35)	Prior to a processing operation likely to result in a high risk for individuals, controllers must carry out an assessment of the impact on the protection of personal data For example, DPIAs are required before undertaking profiling operations and processing sensitive data on a large scale When a DPIA indicates that a processing operation would result in a high risk for individuals, controllers must consult the DPA. If the DPA considers that the operation does not comply with the GDPR, it advises the data controller. The DPA can also ban the operation

4.2   Additional E-Privacy Protection for Electronic Communications Services

On 10 January 2017, the European Commission adopted a legislative proposal for a new e-Privacy Regulation (ePR).[4] The ePR would replace the current e-Privacy Directive (European Parliament and Council Directive, 2002). The ePR would

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[4]European Parliament and Council proposal for a Regulation concerning the respect for private life and the protection of personal data in electronic communications and repealing Directive 2002/58/EC—10 January 2017.

complement the GDPR with specific rules applicable to the electronic communications sector (in which La Poste, for example, is also active). In areas where the ePR does not impose specific privacy rules, the GDPR would continue to apply. Companies that breach this proposed law would face fines of up to €20m or 4% of worldwide annual turnover (whichever is higher).

The Commission is proposing to extend the scope of the existing e-Privacy Directive to cover not only traditional telecommunications services but also over-the-top (OTT) communications services, such as messaging (e.g. Apple iMessage, WhatsApp, Facebook Messenger), webmail (e.g. Gmail) and voice/video calling (e.g. FaceTime, Skype) services. This extension is in line and consistent with the new definition of electronic communications services (ECS) contained in the proposed European Electronic Communications Code (EECC).[5] Like the GDPR, the ePR would apply to ECS situated both inside and outside the EU but offering services in the EU.

Unless certain exceptions apply (e.g. processing for transmission purposes), ECS providers would generally need their users' consent to process electronic communications data, including both content (e.g. the message contained in an email) and metadata (i.e. the who, what, where and when the email was sent). Once consent is given, providers would not be limited regarding the purposes for which they can process such data. The electronic communication services by La Poste Mobile and the mail service Laposte.net would have to comply with this new rule.

5 Postal Operators' Duties Related to Cybersecurity

As providers of eID services (eID cards, e-registered letters, e-invoicing, e-archiving etc.), postal operators must also comply with a series of new rules aimed at ensuring the security of their different network and information systems in cyberspace. Postal operators would have to report and notify security breaches. New rules regarding certification of Information and Communication Technology (ICT) products and services are also expected in the coming years.

5.1 Security Breach Reporting and Notification

One of the main actions taken under the previous cybersecurity strategy of 2013 was the adoption in 2016 of the first EU-wide law on cybersecurity, the Directive on the Security of Network and Information Systems (NIS—European Parliament and Council, 2016a, 2016b). The NIS Directive aims to achieve a high common level of security of network and information systems within the EU, by requiring

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[5]Proposal for a European Parliament and Council Directive establishing the European Electronic Communications Code—14 September 2016.

"operators of essential services" (like operators in the health and transport sectors) and "digital service providers" to report and notify security breaches. The Directive covers activities of some postal operators, for example, cloud computing services.

Under the NIS Directive, postal operators offering cloud computing services must take "appropriate technical and organizational [cybersecurity] measures" and report all incidents having a "substantial impact" on the continuity of the services they provide. Incidents must be reported without undue delay to the national NIS competent authority or Computer Security Incident Response Team (CSIRT). The public should also be informed when this would be in the public interest.

The NIS Directive does not define the thresholds for what constitutes an incident with a substantial impact. The Commission adopted in January 2018 an implementing regulation which states that an incident must be considered as having a substantial impact (and therefore must be reported) where at least one of the following situations has taken place:[6] (1) the service provided was unavailable for more than five millions user hours (where the term user hour refers to the number of users affected for a duration of 60 min); (2) the incident has created a risk to public safety, public security or loss of life or it has caused material damage to at least one user exceeding €1million; or (3) the incident has resulted in a loss of integrity, authenticity or confidentiality of stored or transmitted or processed data or the related services offered by, or accessible via a network and information system affecting more than 100,000 users in the EU.

EU member states are expected to have incorporated the NIS directive into national law since May 2018. At the time of this writing only France, Germany and Italy have transposed the directive. The European Commission has set-up an online interactive map showing a country-by-country overview of the state of play of implementation of the NIS Directive.[7] The NIS Directive complements the GDPR that, as stated above, requires all companies that process personal data to report personal data breaches to Data Protection Authorities or users.

5.2 EU Certification for ICT Products and Services

In September 2017, the European Commission published a new EU cybersecurity strategy, including a legislative proposal for an EU Cyber Security Act (European Commission, 2017). The strategy would establish a new framework at EU level for the cybersecurity certification of ICT products and services such as eID services offered by postal operators. ICT vendors or suppliers would be able to obtain one

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[6]Commission Implementing Regulation laying down rules for application of Directive 2016/1148 of the European Parliament and of the Council as regards further specification of the elements to be considered by digital service providers for managing the risks posed to the security of network and information systems and of the parameters for determining whether an incident has a substantial impact—30 January 2018.

[7]https://ec.europa.eu/digital-single-market/en/state-play-transposition-nis-directive.

cybersecurity certificate that would be valid across the EU. Negotiations between Parliament, Council and the Commission on the final text of the proposed Act are scheduled to start in September 2018.

6 Postal Operators' Duties Towards Online Sellers and Buyers

Growth in online shopping puts postal operators at the core of the contractual relationship between online retailers and consumers. Parcel delivery operators need to understand and, where required, to comply with the consumer protection rules that apply to the online buying process.

6.1 Complying with the EU Consumer Protection Regulatory Framework

The Directive on consumer rights (CRD) is the main directive in the field of consumer protection (European Parliament and Council, 2011). It applies to contracts concluded between traders and consumers and includes specific provisions for online contracts. It includes a series of (pre-) contractual information requirements for delivery and the provision of a right of withdrawal of fourteen days for purchases made online which, consequently, increases the number of returns for goods bought online.

The so-called consumer acquis also includes six other directives. Two directives deal with unfair contract terms[8] (listing unfair contract terms in business to consumer (B2C) contracts) and with unfair commercial practices[9] (regulating misleading and aggressive B2C commercial practices). The Misleading and Comparative Advertising Directive (European Parliament and Council, 2006) regulates comparative advertising and prohibits misleading advertising, thereby protecting traders against unfair business practices. There is also a Price Indication Directive (European Parliament and Council, 1988), which requires traders to indicate the selling price and the price per unit, also in the context of advertising. Another Directive regulates aspects of the sale of consumer goods and associated guarantees (European Parliament and Council, 1999) and the Injunctions Directive (European Parliament and Council, 2009) contains mechanisms to stop infringements of EU consumer rules that harm the collective interests of consumers.

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[8] European Council Directive on unfair terms in consumer contracts—5 April 1993.

[9] European Parliament and Council Directive concerning unfair business-to-consumer commercial practices in the internal market—11 May 2005.

Since 2012, the European Commission has undertaken various initiatives to improve consumer trust regarding online shopping and delivery. In May 2016, the European Commission launched a public consultation on a possible review of the CRD and the *consumer acquis*.[10] The consultation aimed to understand difficulties faced by consumers when they order goods from national or non-national websites. Based on the responses received, the Commission concluded that, in general, the current consumer protection rules "are capable of addressing existing consumer problems" in the digital age, but traders' compliance with EU consumer law has not significantly improved since 2008.[11]

According to the Commission in a press release in 2017, there is an insufficient enforcement of the rules and shortcomings over redress opportunities.[12] It also noted in its assessment that there is a strong call, especially from consumer and some business associations, to introduce transparency requirements for online platforms. Consequently, the Commission decided to focus on a few issues that will be addressed in future legislative proposals, including enforcement and transparency of online marketplaces.

On 11 April 2018, the Commission presented legislation reviewing the existing EU consumer rules that apply to all sectors. The proposed legislation includes two directives on "better enforcement and modernization of EU consumer rules"[13] and on "representative actions for the protection of the collective interests of consumers".[14] As expected, the Commission has not proposed a major overhaul of the existing EU consumer rules but instead proposed a series of amendments to improve the enforcement of the existing directives. Subsequent amendments are expected to have an impact on delivery services provided by parcel delivery operators.

6.2 Right of Withdrawal: Ensuring Effective Returns and Attribution of Responsibility

Traders would always be allowed to withhold reimbursement until they have received returned goods back from consumers. This new provision would amend Article 13 of the CRD, which provides that consumers have 14 days to withdraw from an online contract. Until now, in the case of withdrawal, the trader was expected to reimburse the consumer even before it has received the goods back (the consumer's proof that the goods have been sent back to the trader was enough to

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[10]Commission consultation on the existing EU consumer rules—May 2016.

[11]Consumers reported about the same number of infringements in 2008 and 2016.

[12]Commission press release on the assessment of the existing EU consumer rules—29 May 2017.

[13]Commission proposal for a directive on better enforcement and modernization of EU consumer protection rules—11 April 2018.

[14]Commission proposal for a directive on representative actions for the protection of the collective interests of consumers—11 April 2018.

claim reimbursement). As a result, a rapid return delivery process would be crucial in the future in order for consumers to get reimbursed in a reasonable time. Furthermore, the number of returns following a lack of conformity is expected to grow since the proposed directive on enforcement of consumer rights includes some important amendments allowing consumers to claim for more remedies (i.e. repair, replacement or withdrawal from the contract).

According to the CRD, in the event of the loss or damage of goods during transport, the risk should only pass onto the consumer when he or a third party of his choice (not the carrier's choice) takes possession of the goods. However, when it is the consumer that arranges the carriage of the goods back to the seller (or manufacturer) in case of a lack of conformity, the risk should pass on when the goods are handed over to the consumer's chosen carrier.

6.3 Fines in Case of Infringements of Consumer Protection Rules

Under the proposed directive on better enforcement of EU consumer protection rules, EU member states would now have to impose fines for infringements of the consumer protection rules which take account of criteria such as the number of consumers affected, the financial benefits arising from the infringement, or the infringer's annual turnover and net profits. For infringements affecting consumers in at least two EU countries, traders would be subject to fines of at least 4% of their annual turnover in the concerned countries.

Unlike the harmonized approach adopted for data protection, consumer protection rules are likely to remain somewhat divergent in the EU as member states want to keep their own national rules which sometimes impose a higher level of consumer protection. Whereas there will be a European supervisory board for data protection, national consumer protection authorities will remain in charge of consumer protection issues. A new regulation was adopted in 2017 to improve the cooperation of the different national authorities responsible for the enforcement of consumer protection rules (European Parliament and Council, 2017). It contains a cooperation mechanism between national authorities to give a coordinated response to cross-border infringements of EU consumer law but still does not extend to establish a single EU consumer protection body. Table 2 below summarizes the main EU requirements applying directly or indirectly to parcel delivery operators in relation to online consumer protection.

Table 2 Main EU requirement applying to parcel delivery operators in relation to consumers

Consumer rights directive	Directive on aspects of the sale of consumer goods and associated guarantees	Proposed directive on enforcement of consumer protection rules
– Goods must be delivered within a maximum of 30 calendar days everywhere in Europe – Carriers bear the risk of the goods until consumer receives the good in hand if the consumer has arranged the carriage of goods with a specific carrier. If there is no specific arrangement with a carrier, traders will bear the risk if they provide consumers with a delivery service	No consumer-related provision directly applicable to parcel operators but expected impact on shipping back and forth following repair, replacement or contract termination in the case of a good with a lack of conformity	No consumer-related provision directly applicable to parcel operators but the new rule allowing online traders to withhold reimbursement of a returned good until its receipt would put a greater focus on the effectiveness of the returns solutions provided by parcel operators

7   Conclusions

E-commerce is one of the main new sources of revenues for postal operators. To increase trust in online shopping, the European Commission has decided that new rules are necessary and that these rules should be better enforced then in the past. The recently proposed directive on better enforcement of consumer protection rules, in particular with the new rule allowing online traders to withhold reimbursement of a returned good until its receipt, will put more focus on the efficiency of the returns solutions provided by parcel operators. In addition, online traders will have to comply with stricter rules in relation to contracts and remedies in case of damage and lack of conformity of the goods. The need to transport repaired items or replacements will lead to a higher number of shipments back and forth for a single transaction. What will be the impact for postal operators in terms of operations and revenues of these rules and if it will be the consumer or the online retailer to pay for any additional shipments' cost remain to be seen.

Other new diversified activities, which postal operators hope and anticipate will have a positive impact on their turnover and future, also have an impact on the scope of the regulations applying to them, in particular in the fields of privacy, security and consumer protection. Postal operators offering digital services, such as certified digital identity tools and electronic safes, will have to monitor and comply with requirements on the protection of personal data and cybersecurity. Standardization, interoperability and portability of the systems (and contents) will become the general rule.

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European Parliament and Council Directive 1999/44/EC on aspects of the sale of consumer goods and associated guarantees – 1999.

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