Funding the USO: Cross-Subsidization and Net Cost Balancing

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1 Introduction

With increasing digitalization, traditional universal service obligations (USO) such as daily universal delivery become less profitable, because revenues are declining, while costs cannot be reduced accordingly. Therefore, financing the USO has become more relevant than ever in many countries. The main funding options are well-known and include service provision under monopoly, compensation funds, and government subsidies. Ultimately, the first two are financed by the consumers and the latter by the taxpayer. To increase the economic utilization of the postal networks, many postal universal service providers (USP) are active in related business segments, thereby decreasing the financing needs as long as the related businesses earn more than their incremental (postal) network costs. In this case, part of the USO is financed by consumers in other markets.

In such an environment, different potential sources of (cross) subsidization are a competitive concern, e.g., over- or under-compensation of the USP, or contributions imposed on competitive operators if compensation funds are in place. In case the USP is being active in related markets, cross-subsidization can be an issue. Consequently, various kinds of price regulations and accounting rules are in place, affecting costing and pricing of (universal) services. If pricing is affected, overall welfare is too.

In this paper, we analyze the competitive and welfare properties of the Swiss net cost balancing mechanism (NCB), applied since 2013, and compare it to the traditional fully distributed cost approach based on activities (activity-based costing,

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P. L. Parcu et al. (eds.), *The Changing Postal Environment*, Topics in Regulatory Economics and Policy, https://doi.org/10.1007/978-3-030-34532-7_10

ABC). For the welfare properties, we refer to Haller et al. (2014). We find that NCB resolves the relevant competitive concerns while having superior welfare properties.

The remainder of this paper is structured as follows: Section 2 discusses the competitive properties of NCB as opposed to ABC. Section 3 compares the two cost allocation mechanisms in terms of overall welfare based on a stylized calibrated model. Section 4 concludes.

2 USO Funding and Cross-Subsidization

Medium-term sustainability of the Swiss USO financed by the residual monopoly is jeopardized by the increasingly intensive competition from electronic means of communication. At the same time, there is strong price regulation of Swiss Post's services (see Jaag and Maegli 2015). For the reserved area, the Postal Act authorizes the Federal Council to define and approve the adaptation of regulated prices for individual services. Outside of the reserved service, another (non-sector-specific) authority, the Price Supervisor, is responsible, provided that the prices are not the result of effective competition. This price regulation is cost-based, which prevents services arising that generate a significant surplus to Swiss Post. However, it also prevents these services from covering losses from unprofitable services due to the USO.

Jaag and Maegli (2015) show that the ordinance on the new Postal Act resolves this conflict by means of a specific financing instrument, net cost balancing. Swiss Post is allowed to reallocate the net cost of the USO through transfer payments between its units and subsidiaries. It can charge these costs to the services for which it is able to generate high prices in order to relieve unprofitable services. By shifting costs to the more profitable services, it increases its costs and can therefore opt for higher prices under the cost-based price regulation. Hence, the legislation made cost-based pricing consistent with USO funding by allocating USO net costs to profitable services and including that in the "cost" used to set prices. Hence, the monopoly for letter mail contributes to financing the USO, but it is also a potential source for cross-subsidies of competitive services.[1]

The European Commission applied a modified form of the Faulhaber rule (Faulhaber 1975), stating that cross-subsidization occurs where "the earnings from a given service do not suffice to cover the incremental costs of providing that service and where there is another service or bundle of services from which exceed the stand-alone costs" (OJ L 125 of 5.5.2001, p. 29, para 6, Deutsche Post AG. COMP/35.141). Also, according to Swiss postal legislation, problematic cross-subsidization is present if there is a product that does not cover its incremental cost, while the earnings of another product or product bundle (in the reserved area) exceed its stand-alone costs.

[1] For more details on the implementation in the Swiss Postal market, see Jaag and Maegli (2015).

Consequently, this implementation of the Faulhaber rule consists of two tests:

(i) The *incremental cost test* is satisfied if the revenue from any quantity of service (or service bundle) of a multiproduct firm is greater than or equal to the change in total cost caused by not producing the service (or service bundle). The increment in cost is the difference in total cost with and without this quantity of service (or service bundle). If incremental costs are covered by revenues, it is considered that the service does not receive a cross-subsidy.
(ii) The *stand-alone cost test* is satisfied if the revenue of a product or product group in the reserved area does not exceed its stand-alone cost. This test is about whether revenues from the reserved area are cross-subsidizing services outside the reserved area.

If the incremental cost test is satisfied, there is no cross-subsidization. If it is not satisfied, the service can still be considered to not receive a cross-subsidy from reserved area revenues if the stand-alone cost test is satisfied (see Parsons 1998). Cross-subsidization according to Faulhaber is present if both tests are not satisfied.

We now investigate how NCB relates with the Faulhaber rule and highlight under what conditions NCB satisfies the Faulhaber rule. Under NCB, a regulated USP is allowed to reallocate the net cost of the USO through internal transfer payments.[2] The net costs are the difference in profits of the USP with and without the USO (Jaag and Trinkner 2011). In this way, the USP can charge the services for which it is able to generate a surplus on the market and support unprofitable (USO) services. This interplay between the financing of the USO and price regulation facilitates in providing universal services without external financing (with a USP inhibiting significant market power, SMP). Alternatively, if the USO is granted a legal monopoly over a subset of services to finance the USO, a net cost balancing mechanism will cap prices in the monopoly area such that the additional return will not exceed the net cost of the USO.

NCB has the following economic properties: Compared to the same amount of external funding of the net cost of the USO, the USP is strictly worse off under NCB. With external funds, net costs are fully compensated. Under NCB, however, allowed price increases of services with market power are mirrored by price decreases of other USO services. (NCB aims at a better allocating the burden of the USO to products, not at compensating the USP for net costs.) NCB however has a positive effect on overall profits of the USP (compared to a situation without NCB or external funding) if the USP allocates net costs to products with comparably lower price elasticities. These additional profits are however strictly lower than external funding of net costs, i.e., with NCB as the only financing mechanism, the USP is systematically exposed to an "underfunded" situation as compared to an external funding of the net cost.

[2] As a side effect, net cost balancing makes it possible for a USP to separate operational accounting from regulatory accounting: In a first step, cost can be allocated according to regular accounting principles (business accounting); in a second step, the net cost balancing is carried out in the form of transfer payments (regulatory accounting).

In addition, under NCB, cost-regulated services with significant market power (SMP) can at most be surcharged to cover the USO net costs, i.e., the disadvantage the USP has in the market because of the USO. Again, no net advantage to the USP arises. Under reasonable cost regulation, stand-alone costs of such SMP services are likely to be substantially higher than regulated earnings, as regulators, following EGRP accounting standards, tend to apply ABC accounting standards which do not allow allocating common costs to SMP services entirely. If net costs are accepted as costs,[3] the Faulhaber stand-alone test is passed in general. However, if the cost of services outside the USO after NCB payments does not exceed their incremental costs, then Faulhaber's incremental cost test is not passed for these services.

Combining these observations suggest that the Faulhaber rule will be fulfilled under NCB because NCB transfer payments are generally free of cross-subsidization. If competitive concerns related to cross-subsidization of non-USO services are considered more important than public policy objectives related to financing the USO, then general competition law might apply. Such a regulatory setting would be stricter than the Faulhaber rule. In either case, the USP is systematically underfunded under NCB.

We conclude that NCB is as least as strict as the standard Faulhaber (1975) rule. If general competition law applies to nonuniversal services, NCB can be considered stricter and puts the USP at a net disadvantage compared to external funding of the net cost. NCB can therefore be seen as an implementation of the Faulhaber rule, because NCB restricts pricing of SMP USO services in a way consistent with the rule.

3 Cost Allocation Rules and Impact on Welfare

Most incumbent postal operators are active in business segments outside the universal service obligation (USO). Often, price regulation is cost-oriented and differentiated between USO and non-USO products. Hence, regulatory rules on cost allocation impact regulated prices and overall welfare.

In this section we analyze the effects of cost allocation based on NCB on pricing and welfare relative to fully distributed cost based on activities (activity-based costing, ABC),[4] assuming profit regulation in place. We use a stylized model with a set of products characterized by different price elasticities perceived by the USP. As a benchmark, we derive a welfare optimal allocation of costs based on Ramsey prices such that the incumbent USP breaks even. We then compare this result to ABC and NCB cost accounting.

[3] If net costs are not compensated (see a), they are a real opportunity cost and should be accepted.

[4] ABC is tandard method and is most widely used in the postal sector (ERGP 2012). Its key principle is the following: cost objects (products, customers...) consume activities which in turn consume resources (ERGP 2013).

We consider a postal operator that is active in a set of I markets. In each market $i \in I$, the postal operator can set its price p_i and faces a demand function $x(p_i)$. The supply of goods in market i causes variable cost, denoted by $C_i(x_i(p_i))$, and fixed cost, denoted by F_i. Moreover, the USO is assumed to cause a fixed cost independent of serving a specific market, denoted by F_G. We interpret this fixed cost to be the net cost of the USO.

The profit function of the postal operator is given by

$$\pi = \sum_{i \in I} p_i x_i\left(p_i\right) - \sum_{i \in I} C_i\left(x_i\left(p_i\right)\right) - \sum_{i \in I} F_i - F_G$$

and welfare (measured by consumer surplus and assuming independent demands) is given by

$$W = \sum_{i \in I} \int_{p_i}^{\infty} x_i\left(\tilde{p}_i\right) d\tilde{p}_i .$$

We study three different regulatory frameworks: Ramsey pricing (RP), net cost balancing (NCB), and activity-based cost allocation (ABC). In our setup, they correspond to a zero-profit condition to the following maximization problems:

$$\begin{aligned} &\left(RP\right): \max_{p_i} W \; s.t. \pi = 0 \left(NCB\right): \max_{p_i} W \; s.t. p_i x_i\left(p_i\right) - C_i\left(x_i\left(p_i\right)\right) \\ &-F_i - \alpha_i F_g = 0 \forall i \in I, \; \sum_{i \in I} \alpha_i = 1, 0 \le \alpha_i \le 1 \forall i \in I \end{aligned}$$

$$\left(ABC\right): \max_{p_i} W \; s.t. p_i x_i\left(p_i\right) - C_i\left(x_i\left(p_i\right)\right) - F_i - \frac{x_i\left(p_i\right)}{\sum_i x_i\left(p_i\right)} F_g = 0 \forall i \in I$$

The following welfare ordering arises $W_{AC} \le W_{NC} \le W_{RP}$, because the constraints in RP are less strict than NCB, and the NCB constraints related to the distribution of F_g are less strict than in ABC, where the weights are predefined. Intuitively, the NCB regime allows more flexibility in allocating costs and hence in determining prices which results in higher welfare under the assumption that the postal operator's objective function is indeed welfare.

The zero-profit condition and the postal operator maximizing welfare may not be realistic. Therefore, we also study the case of a profit regulation instead of a zero-profit condition. Additionally, a Faulhaber rule is imposed as a constraint in the sense that the price of a product must at least cover its incremental costs.[5] The postal

[5] Formally, Faulhaber's incremental cost test is to be applied to individual services and to all possible groups of services. In a two-product company with break-even constraint, this translates to the restriction that $p_i x_i \ge c_i x_i + F_i$. If there are no product-specific fixed costs ($F_i = 0$), the restriction simplifies to $p_i \ge c_i$, i.e., prices must exceed variable cost. For analytical convenience, the latter is assumed in the formal part of the analysis (Sect. 2). The results are nevertheless in line with the numerical findings in Sect. 3 (which assume $F_i > 0$).

operator is allowed to make profits of at most β percent of total revenues ("profit regulation"). Formally, the three regimes then correspond to the following maximization problems:

$$(RP): \max_{p_i} W \; s.t. \beta \sum_i p_i x_i(p_i) \le \pi, p_i \ge c_i \forall i$$

$$(NCB): \max_{p_i} \pi \; s.t. (1-\beta) p_i x_i(p_i) \le C_i(x_i(p_i)) + F_i + \alpha_i F_g \forall i \in I, \sum_{i \in I} \alpha_i = 1, 0 \le \alpha_i \le 1 \forall i \in I, p_i \ge c_i \forall i$$

$$(ABC): \max_{p_i} \pi \; s.t. (1-\beta) p_i x_i(p_i) \le C_i(x_i(p_i)) + F_i + \frac{x_i(p_i)}{\sum_i x_i(p_i)} F_g \forall i \in I, p_i \ge c_i \forall i$$

We can derive the prices of these regimes and do comparative statics. However, in this general specification, it is not possible to make a statement about whether the NCB or ABC regime is superior in terms of welfare and, more importantly, how large the differences are. Therefore, we calibrate the model for a scenario representing the postal market in industrialized countries. We assume that the postal operator is active in two markets. One market has a higher price elasticity of demand, whereas the other market has a lower price elasticity of demand for a given price and quantity. The demand function for the two markets is assumed to be linear and of the form

$$x_i(p_i) = A_i - \theta_i * p_i \text{ where } i \in \{h,l\}.$$

For the numerical simulations, we set the following parameters $\beta = 0.05$, $C_i = 0.5$. Demand parameters A_i, θ_i are then calibrated to satisfy the following three equalities for a price set to unity, i.e., $p_l = p_h = 1$: (i) $x_h = x_l = 1{,}000{,}000{,}000$, (ii) $e_l = -0.5 = \frac{\partial x_l}{\partial p_l} \frac{p_l}{x_l}$, and (iii) $e_h = \frac{\partial x_h}{\partial p_h} \frac{p_h}{x_h}$, where the elasticity of demand e_h is varied from -0.75 to -3 (at $p_l = p_h = 1$ and $x_h = x_l = 1{,}000{,}000{,}000$). In our base case, we set $e_h = -1.5$. This value corresponds to empirical estimates of postal price elasticities (see, e.g., Nikali 2011). Moreover, we set $F_h = F_l = (CHF\ 1'000'000'000 - F_g)/2$ and let the net costs F_g vary from CHF 10 million up to CHF 500 million. In the base case, we set F_g = CHF 200 million. This calibration setup mirrors the cost and demand structure in the Swiss postal market.

In the base case, the optimal prices as shown in Table 1 emerge in the different regimes. The regime "monopolist" is the case with an unconstrained monopolist

Table 1 Simulation results base case calibration

	RP	Monopolist	NCB	ABC	Elasticity at RP prices
Price *h* (in CHF)	0.87	1.08	0.89	1.11	−1.09
Price *l* (in CHF)	1.27	1.75	1.25	1.08	−0.73
Welfare	1226.62	645.83	1225.76	1148.22	

Table 2 Sensitivity analysis welfare difference

F_g(Mio. CHF)\Elasticity	−0.75	−1.00	−1.25	−1.50	−2.00
100	7.34	11.01	13.21	14.68	16.51
300	36.68	55.03	66.03	73.37	82.54
500	71.19	106.92	128.14	142.38	160.18

Table 3 Summary statistics sensitivity analysis

	Mean	Median	Min	Max
Welfare differential NCB-ABC (%)	4.29%	3.41%	0.07%	12.46%
Welfare differential NCB-ABC (Mio. CHF)	61.75	48.86	1.14	174.87

charging the monopoly price in both market segments. Relative to an unconstrained monopoly, the prices in NCB are closer to the welfare optimal prices in RP than the prices under ABC, as indicated also by higher welfare in NCB compared to ABC in the last row of the table.

To check the robustness of this result in our base calibration, we let e_h vary from −0.75 to −3 in incremental steps of 0.25 and let F_g vary from 10 million up to 500 million in incremental steps of 10 million. Tables 2 und 3 summarize the results of this computation. Table 2 reports the welfare difference between NCB and ABC for different parameter constellations. For example, with an elasticity of −0.75 and net costs of CHF 100 million, welfare with NCB is CHF 7.3 higher than with ABC. Table 3 contains the descriptive statistics of the sensitivity analysis. In all our parameter constellations, NCB is always better than ABC in terms of welfare. On average NCB offers a welfare surplus of 4.29% compared to ABC which corresponds to an absolute difference of CHF 61.75 million.

Table 3 shows that the welfare difference between NCB and ABC increases with a larger difference between the two elasticities and a higher level of net cost F_g. This makes intuitive sense, as NCB allows for pricing closer to the Ramsey solution: With a higher the difference between the two elasticities, welfare losses under ABC are higher, which are then partially offset under NCB; if net costs are higher, more costs can be allocated to services with low elasticities, which increases welfare.

4 Conclusions

Incumbent operators providing universal services are increasingly active in competitive markets. Prices of USO products are often regulated. The traditional solution is to regulate the USO products by separating accounts between USO and non-USO products and imposing a product-specific rate-of-return regulation on US products with fully allocated cost based on activities (activity-based costing, ABC) as a point of reference.

In this paper we have analyzed the competitive and welfare effects of the Swiss net cost balancing mechanism (NCB). NCB is applied since 2013 and allows the regulated USP to reallocate its net cost of the USO through internal transfer payments. The analysis in Section 2 leads to the conclusion that NCB is as least as strict as the standard Faulhaber (1975) rule. If general competition law applies to nonuniversal services, NCB can be considered stricter. NCB can therefore be seen as an implementation of the Faulhaber rule. The main reason is that NCB restricts pricing of SMP USO services consistently with the Faulhaber rule.

The welfare analysis in Section 3 compares NCB to ACB. As an economic benchmark, a welfare-maximizing regulation regime is derived resulting in Ramsey prices. All three scenarios are held cross-subsidy free in the sense of Faulhaber (1975). The formal analysis reveals that with all mechanisms, optimal prices depend (negatively) on demand elasticity. Because the constraints in RP are less strict than NCB and the NCB constraints are less strict than the predefined weights of ABC, generally welfare of NCB will be between RP (optimal) and ABC (lowest).

A numerical analysis based on a stylized calibrated model reflecting an industrialized postal market confirms that Ramsey prices result in the highest welfare. An unconstrained monopolist results in a clear welfare loss as compared to all three regulated regimes. Interestingly, the NCB regime leads to results that almost replicate the Ramsey optimum. As expected, the NCB regime is generally superior to ABC costing, because in comparison it is less restricted by the amount of the net cost which is allowed to be reallocated. With the chosen calibration, on average, NCB increases welfare by 4% compared to ABC costing. The welfare difference between NCB and ABC is large if the difference in elasticities of products is high or net costs are high.

In summary, a net cost balancing mechanism increases welfare as compared to ABC costing clearly. In relative terms, ABC costing decreases overall welfare consistently. The welfare increases are induced by a more market-oriented but cross-subsidy free pricing by the USP. A net cost balancing mechanism may hence reduce external compensation for the USO.[6] The results indicate that a net cost balancing mechanism can be applied to effectively and optimally constrain a universal service provider with a legal monopoly that is active in other markets as well. By analogy, an NCB regime could be imposed on a USP with significant market power (SMP) that is active in other markets as well. A NCB-kind approach may be an alternative to regulate SMP.

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[6] Price regulation can represent a means for (partial) financing of the USO; see Jaag (2013).

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