Pricing "Competitive" Postal Products

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1 Introduction

The US Postal Service (USPS) provides "market-dominant" services on an exclusive basis, e.g., first class mail, and "competitive" services in markets with other rivals, e.g., parcel delivery. Rivals in the competitive market have long complained that USPS cross-subsidizes its competitive offerings.[1] In the USA, the Supreme Court on May 20, 2019, declined to hear a challenge by the United Parcel Service (UPS), a leading rival to USPS in parcel delivery, to the authority of the US Postal Regulatory Commission (PRC) to determine USPS's attributable cost of providing parcel delivery.[2] Bradley et al. (1999) and others have argued that as long as USPS's competitive offerings cover their incremental cost, there is no cross subsidization.

[1] Postal Regulatory Commission, Revised Notice of Proposed Rulemaking, Institutional Cost Contribution Requirement for Competitive Products, Docket No. RM2017-1, Order No. 4742 (Aug. 7, 2018).

[2] United Parcel Service, Inc. v. Postal Regulatory Commission, Petition for a Writ of Certiorari, Supreme Court of the United States (Dec. 26, 2018), available at https://www.supremecourt.gov/DocketPDF/18/18-853/77552/20181226122249306_UPS%20Petition%20for%20Cert.pdf. The Supreme Court's denial of a writ of certiorari is at https://www.supremecourt.gov/orders/courtorders/052019zor_1bn2.pdf. The opposing brief filed by the Solicitor General of the US Department of Justice on behalf of the Postal Regulatory Commission is at https://www.supremecourt.gov/DocketPDF/18/18-853/95477/20190405110310785_18-853%20UPS%20-%20Opp.pdf. The central legal issue is whether the PRC has the discretion under PAEA to define attributable costs as it did, a question of administrative law more than economics as such.

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On the other hand, a 2018 report by a Presidential Task Force on the United States Postal System concluded, "While there is no direct financial subsidy of competitive products, mail products and the mailbox monopoly allow for an indirect delivery subsidy. The USPS needs to provide full transparency and fully distribute costs."[3]

I examine this debate by asking what prices of the market-dominant and competitive services maximize net economic welfare across the market-dominant and competitive service markets.[4] Section 2 provides the basic Ramsey pricing model (Baumol and Bradford 1970), which points out that a service's welfare-maximizing price need not cover its fixed costs. Section 3 discusses Ramsey pricing with perfect competition in one market and monopoly in the other, finding that the monopoly PO should charge the market price for its competitive products and use the profits to fund reductions in market-dominant service prices. Section 4 shows that when the PO firm sets price facing a competitive fringe of rivals with an upward-sloping supply curve for an identical product, the optimal prices fit the Ramsey formula based on the elasticity facing the PO in the competitive market, as calculated by Landes and Posner (1981).

Section 5 shows how this result should be modified if the rival in the competitive market offers a differentiated product. Prieger (1996) addressed the question of optimal pricing by a regulated firm in an unregulated market. He examined this optimization problem when the regulated firm is the price leader and the rivals are the followers in the competitive product market. With differentiated products, the regulated firm's price in the competitive market should be adjusted upward from that Ramsey level because the rival is producing too little output. Increasing the regulated firm's price in the competitive market increases demand for the rival's product, which produces a first-order welfare gain from marginally increasing the regulated firm's price.

Section 6 discusses modeling when both the regulated firm's and rival's prices are endogenous in the competitive market. Since the rival's price is that which maximizes profits given the regulated firm's price in that unregulated market, this Bertrand equilibrium price is unlikely to be the price that maximizes welfare overall. Since given demands and the Bertrand interaction, prices are determined by marginal cost, the only instrument available to the regulator would be to change the dominant firm's marginal cost in the competitive market, either through a subsidy or tax. The regulator should implicitly tax (subsidize) output in the competitive market only if the Bertrand price in that market is below (above) the PO's welfare-maximizing price as determined above, since the rival's price always equals the price that maximizes its profits given the regulated firm's price in that market. Section 7 offers concluding observations.

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[3] Task Force on the United States Postal System, United States Postal Service, A Sustainable Path Forward (Dec. 4, 2018) at 54, available at https://home.treasury.gov/system/files/136/USPS_A_Sustainable_Path_Forward_report_12-04-2018.pdf

[4] In general, net economic welfare includes both producer and consumer surplus. In the models below, I assume that the regulator is maximizing welfare subject to a requirement that the PO is just covering cost, that is, it is getting no producer surplus. However, when we add in rivals, I include any surplus they may get in the overall welfare calculation.

2 Basic Ramsey Pricing

Ramsey prices are markups over marginal cost that maximize net economic welfare subject to a constraint that the revenues raised by those markets reaches a specified amount. Originally found by Ramsey (1927) in the context of per unit taxes to provide a given amount of revenue, Baumol and Bradford (1970) applied the idea to finding optimal markups to cover the revenues of a multiproduct firm with sufficient economies of scale that prices equal to marginal cost do not generate enough revenue to cover the firm's total cost. We assume that the goods or services provided by the firm are neither substitutes nor complements, so that the price of one good does not affect demand for the other.[5] With this simplification, if the firm sells N products, the optimal prices P_i, $i = 1, \ldots, N$, are given by the familiar "inverse elasticity" rule, that is, that price-cost margins are proportional to the absolute value of the elasticity of demand. That is,

$$\frac{P_i - MC_i}{P_i} = \frac{K}{|e_i|},$$

where MC_i is the constant marginal cost of producing good i and e_i is the elasticity of demand for good i.[6] K, constant across all products, is set just large enough for the firm to cover its total cost.

This basic relationship illustrates some of the controversies regarding cost recovery. Suppose there are two products, X and Y, and the cost of producing X and Y is given by

$$C(X,Y) = F + F_X + F_Y + MC_X X + MC_Y Y,$$

where F is the common fixed cost, F_X is the fixed cost associated with producing X, F_Y is the fixed cost associated with producing Y, and MC_X and MC_Y are respectively the marginal costs of producing X and Y. The optimal markups $P_X - MC_X$ and $P_Y - MC_Y$ generate revenue together to cover the sum of $F + F_X + F_Y$. Those optimal markups are the same regardless of how that sum is divided among F, F_X, and F_Y. Hence, there is no guarantee that optimal markups for both X and Y generate revenues sufficient to cover their respective incremental costs $F_X + MC_X$ and $F_Y + MC_Y$, that is, optimal Ramsey pricing need not be subsidy-free.

This effect highlights what has become a central issue in the dispute between UPS and the PRC—the appropriate time frame for defining marginal cost. The above result could be an artifact of the use of short-run marginal cost, and that the appropriate marginal cost to use is longer run, perhaps even the average incremental

[5] This rules out applications where the market-dominant service is an input to the competitive service, in particular, where the USPS's "mail" service is used to deliver "parcels" or is provided under other worksharing arrangements.

[6] If goods are substitutes or complements, the elasticity expressions here become matrices of own price and cross price elasticities (Scott 1986).

cost, including fixed costs, of adding a particular service to the mix. I do not resolve the question of the right time frame here. However, if one believes that MC_Y, for example, should be larger because regulators should be using a longer run marginal cost, then the same argument should be used in principle to increase MC_X. When all "marginal" costs are similarly adjusted to reflect a common time frame, be it instantaneous, eternity, or sometime in between, it may well be that P_Y should fall. Calculating which prices go up and which go down depends on the demand curves for the products as well as how changing the time frame over which marginal costs are measured and differences in how changing the time scale affects marginal cost across products.

3 Perfect Competition for Competitive Products

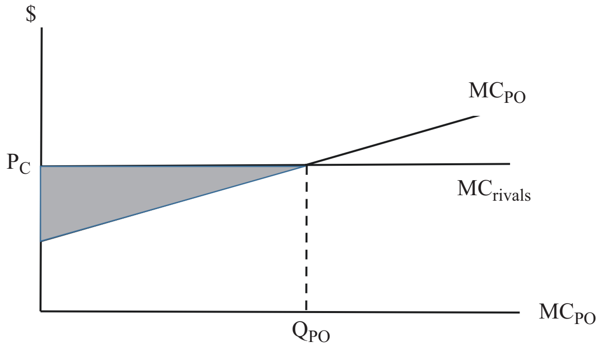
To garner insights more in line with postal disputes, treat one of the two products as that for which the PO is market-dominant, and simplify by treating this as a monopoly, e.g., letter delivery. Indicate this by the subscript "*M*." The other product will be "competitive," with subscript "*C*"—parcel delivery as the stereotypical example—although the competition need not be perfect. The market is competitive in the sense that there are rivals to the PO that independently set prices to maximize their profits—perhaps waiting to see the price the PO charges and perhaps choosing prices strategically anticipating the price the PO would charge in that market.

Here, though, suppose that the market is perfectly competitive, in the sense that the PO takes the price in that market P_C, as given. Rivals in this competitive market may have constant and equal minimum average cost equal to P_C, making that the equilibrium price. For this case to differ from the above, assume that the PO's marginal cost of supplying the competitive product is increasing and reaches P_C at a level of output below market demand at the price. Figure 1 displays the PO's operations in the competitive market.

Figure 1 illustrates the optimal course of action for the regulator. Since demand is perfectly elastic at P_C, the PO should charge P_C for its competitive product, supplying Q_{PO}. Operating profits, indicated by the shaded area, would then be used to contribute to covering aggregate fixed cost across both the market-dominant and competitive product, as in the previous section. The regulator would set the price for the market-dominant product, P_M, just high enough to cover the remaining fixed cost. In effect, the regulator has only one instrument, P_M, as the price in the other market, P_C, is dictated by competition. The regulator, along with the regulated firm, takes P_C as given.[7]

[7] Even with this ambiguity, if a PO cannot cover its incremental—fixed and variable—costs of supplying the competitive service at the optimal price, it should not enter if the market is already competitive. The optimal entry question is more complex in settings below where, because of product differentiation, the "competitive" market is less than fully competitive. If so, PO entry can cause price to fall, generating consumer benefits that it does not capture.

Fig. 1 PO supply in a perfectly competitive market



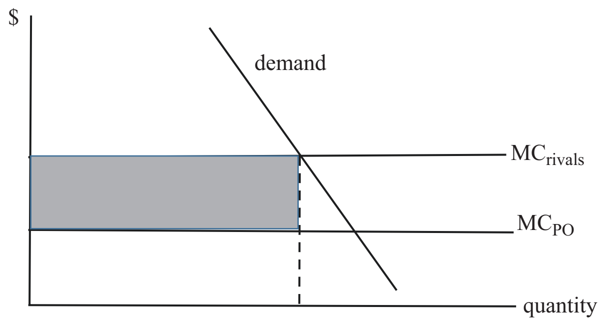


Fig. 2 Revenue capture when matching competitive product price

The result that operating profits be used to reduce price of the market-dominant service also holds if the PO could meet all competitive market demand at a price above its marginal cost but that demand in the competitive market is not so elastic as to have the Ramsey markup at a price below P_C, at which point demand becomes perfectly elastic. This implies that the Ramsey price would be P_C. Figure 2 illustrates this possibility.

The shaded area indicates the profits that would be used to hold down the price of the market-dominant service when the PO sets price just below that would induce entry by the rivals.

4 The PO as Dominant Firm Facing a Competitive Fringe

The next step is to treat the PO’s rivals in the competitive market as taking the PO’s price as the market price and supplying to the point where their marginal cost just equals the PO’s price. To model this, let $Q_C(P_C)$ be demand in the competitive product market, and let $S_F(P_C)$ be fringe supply, dictated by the quantity where the marginal cost for the fringe’s supply equals P_C. The PO’s sales of the competitive product are thus $Q_C - S_F$. The PO's costs in both markets thus depend on Q_M, the sales of its market-dominant product, and $Q_C - S_F$, the sales of its competitive product. Prices P_C and P_M in the market-dominant or monopoly market that maximize net economic welfare subject to the PO's revenues covering its total cost are those that solve the first-order conditions for the following:

$$\int_0^{Q_M(P_M)} P_M(z)dz + \int_0^{Q_C(P_C)} P_C(z)dz - C^{PO}\left(Q_M(P_M), Q_C(P_C) - S_F(P_C)\right) - C^F\left(S_F(P_C)\right)$$
$$-\lambda\left[P_M Q_M(P_M) + P_C\left[Q_C(P_C) - S_F(P_C)\right] - C^{PO}\left(Q_M(P_M), Q_C(P_C) - S_F(P_C)\right)\right].$$

The top line is total surplus less costs for the market-dominant and competitive product, where Q_M is demand for the monopoly product, C^{PO} is the PO's cost as a function of its production of both products, and C^F is the fringe's cost of producing the competitive product. The bottom line represents the constraint that the PO's revenues from both markets cover its total cost from both markets.

The first-order conditions for maximizing net surplus subject to this constraint for P_M and P_C give:

$$P_M : \frac{P_M - C_M^{PO}}{P_M} = \frac{-\lambda}{1-\lambda}\frac{1}{\left|e_M^d\right|}.$$

$$P_C : \frac{P_C - C_C^{PO}}{P_C} = \frac{-\lambda}{1-\lambda}\frac{Q_C - S_F}{\left|Q'_C - S'_F\right|}\frac{1}{P_C}.$$

The first of these is of the familiar format, with the price-cost margin equal to a constant across markets times the inverse of the elasticity of demand in the monopoly market. The second of these is the same, under closer inspection, as the last two terms together equal the inverse of the elasticity of demand facing the PO for the competitive product. $Q_C - S_F$ represents its sales in that market, and $Q'_C - S'_F$ is the change in the PO's sales of the competitive product as it changes its price.

Following Landes and Posner (1981), the elasticity of demand facing the PO can be decomposed into its component parts as follows:

$$\left[\frac{-Q_C' + S_F'}{Q_C - S_F}\right]P_C = \frac{-Q_C' P_C}{Q_C - S_F} + \frac{S_F' P_C}{Q_C - S_F}$$
$$= \frac{-Q_C' P_C}{Q_C}\frac{Q_C}{Q_C - S_F} + \frac{S_F' P_C}{S_F}\frac{S_F}{Q_C - S_F}$$
$$= \left|e_C^d\right|\frac{1}{SHARE_{PO}} + e_F^s\frac{1 - SHARE_{PO}}{SHARE_{PO}},$$

where $e^d{}_C$ is the elasticity of demand for the competitive product at P_C, $e^s{}_F$ is the elasticity of supply of the competitive fringe at P_C, and $SHARE_{PO}$ is the market share of the PO in the competitive market, given by $[Q_C - S_F]/Q_C$. $1 - SHARE_{PO}$ is the market share of the competitive fringe. With $SHARE_{PO}$ less than one, that is, when the fringe makes some sales in equilibrium, this demand facing the PO in the competitive product market will be more elastic than demand for that competitive product as a whole.

One needs to be careful making inferences from an equilibrium condition in which all of the terms are endogenous. That said, the larger is the elasticity of demand facing the PO in competitive market, the smaller will be its price-cost margin. In turn, that elasticity facing the PO will be larger, all else equal, the more elastic is the fringe supply and the larger share of the market the fringe holds, that is, the smaller is $SHARE_{PO}$. This suggests that the stronger is the competition facing the PO for the competitive product, the lower the PO's price for it and the higher should the PO's price be in the market in which it holds a monopoly. This welfare-maximizing behavior is qualitatively the same as if the PO were cross-subsidizing its competitive product with revenues from its monopoly market-dominant product. A regulator that wants to set prices to maximize welfare will likely be vulnerable to arguments that it permits cross-subsidization.[8]

5 PO Price Leadership with Differentiated Products

We drop the assumption that there is a single price in the market for the competitive product. Rather, there are different prices, the one that the PO charges for its product, and those the rivals choose in response. To simplify the analysis, we assume that there is just one rival, which sets its price to maximize profits given the price the PO charges for its (differentiated) product.

Even with just one rival, having two different products on the competitive side requires modifying the above model. Instead of an integral to measure gross surplus, designate W^C as welfare in the competitive market. This welfare will be a function of the output of the postal service in that market, Q^{PO}, and the output of the rival, Q^R. These, in turn, are both functions of the price the PO charges, P_{PO}, and the rival's profit-maximizing price in response, $P_R(P_{PO})$. Putting this all together gives welfare in the competitive product market as

$$W^C\left(Q^{PO}\left(P_{PO}, P_R\left(P_{PO}\right)\right),\ Q^R\left(P_{PO}, P_R\left(P_{PO}\right)\right)\right).$$

The partial derivatives of this gross welfare measure are the respective prices, that is, $W^C{}_{PO} = P_{PO}$ and $W^C{}_R = P_R$.

[8] There should be a test to see if PO entry increases welfare, which if the entered market is competitive will be equivalent to asking if the price in the competitive market is sufficient to cover the PO's fixed and variable costs of entry. See *supra* n. 7.

The PO's cost of providing quantity Q^M market-dominant monopoly service and quantity Q^{PO} of its competitive product becomes

$$C^{PO}\left(Q^M\left(P_M\right), Q^{PO}\left(P_{PO}, P_R\left(P_{PO}\right)\right)\right).$$

The rival's cost is

$$C^R\left(Q^R\left(P_{PO}, P_R\left(P_{PO}\right)\right)\right).$$

With these notational adjustments, the equation describing choosing P_M and now P_{PO} to maximize welfare across the market-dominant and competitive market, subject to revenues from both markets covering the PO's cost, becomes:

$$\int_0^{Q_M(P_M)} P_M\left(z\right)dz + W^C\left(Q^{PO}\left(P_{PO}, P_R\left(P_{PO}\right)\right), Q^R\left(P_{PO}, P_R\left(P_{PO}\right)\right)\right)$$
$$-C^{PO}\left(Q^M\left(P_M\right), Q^{PO}\left(P_{PO}, P_R\left(P_{PO}\right)\right)\right) - C^R\left(Q^R\left(P_{PO}, P_R\left(P_{PO}\right)\right)\right)$$
$$-\lambda\left[P_M Q_M\left(P_M\right) + P_{PO}\left[Q^{PO}\left(P_{PO}, P_R\left(P_{PO}\right)\right)\right] - C^{PO}\left(Q^M\left(P_M\right), Q^{PO}\left(P_{PO}, P_R\left(P_{PO}\right)\right)\right)\right].$$

The first-order condition for $\mathrm{P_M}$ in for this constrained welfare maximization is the familiar

$$P_M : \frac{P_M - C_M^{PO}}{P_M} = \frac{-\lambda}{1-\lambda}\frac{1}{\left|e_M^d\right|}.$$

To derive and interpret the first-order condition for P_{PO}, define

$$\frac{dQ^{PO}}{dP_{PO}} = Q_{PO}^{PO} + Q_R^{PO} P'_R$$

as the total derivative of the PO's output in the competitive market as a function of the price it charges, taking into account the effect of its change on the rival's price P_R and the effect of the change in that price on demand for its competitive product. Similarly, define

$$\frac{dQ^R}{dP_{PO}} = Q_{PO}^R + Q_R^R P'_R$$

as the total derivative of the rival's output when the PO's price changes, taking into account both the direct effect of the PO's price on demand for the rival's output and the effect on the rival's output when it changes its price in response to the change in the PO's price.

With this notation, and recalling that the marginal effect on gross welfare in the competitive market from increasing output of either product is that product's price in that market, the first-order condition for P_{PO} is

$$P_{PO}: \frac{P_{PO} - C_{PO}^{PO}}{P_{PO}} = \frac{-\lambda}{1-\lambda}\left[\frac{-Q^{PO}}{\frac{dQ^{PO}}{dP_{PO}}}\frac{1}{P_{PO}}\right] + \frac{1}{1-\lambda}\frac{P_R - C'_R}{P_R}\frac{P_R}{P_{PO}}\left[-\frac{\frac{dQ^R}{dP_{PO}}}{\frac{dQ^{PO}}{dP_{PO}}}\right].$$

The fraction in the brackets is just the inverse of the absolute value of the elasticity of demand facing the PO in the market for the competitive products, taking into account the effect of its price on rival's price. This is the same as the term in the first-order condition for the PO's price for the competitive product in the case where a competitive fringe supplies an identical product.

Were this all, one would have the Ramsey inverse elasticity rule, adapted for the higher elasticity of demand facing the PO in the market for the competitive product because of rivals' supply response. The second term on the right, however, changes the results.[9] Because λ is negative,[10] $1 - \lambda$, the first denominator, is positive. The second term is the rival's price-cost margin, which we can presume is positive if it offers a differentiated product. The next term is the ratio of the price of the rival's competitive product to the price of the PO's competitive product.

The fraction in the brackets is the ratio of the change in output of the rival to (the absolute value of) the decrease in output of the PO when the PO increases the price of its product. In merger analysis, this is known as the "diversion ratio" (U.S. Department of Justice and Federal Trade Commission 2010). Increasing the PO's price will generally increase demand for the rival's product, but it could be negative, if an increase in the PO's price reduced the elasticity of demand for the rival's product, leading it to increase its price so much that sales fall.[11] However, one would expect that when one competitor increases price, rivals, as suppliers of substitutes, would increase output, leading to a positive diversion ratio.

If the diversion ratio is positive, then the first-order condition for PPO says that the price-cost margin for the PO's competitive product should be *greater* than that

[9] Prieger (1996) finds a somewhat similar term.

[10] See *supra* n. 8.

[11] These remaining three terms constitute what Salop and Moresi (2009) call, in the context of merger analysis the "Generalized Upward Pricing Pressure Index" or "GUPPI." There is an important difference, however. The GUPPI is calculated taking the rival's price as fixed, because it is applied to simultaneous pricing models where one price does not influence another. When the rival sets price based upon the dominant firm's price, in a sequential model as here, the diversion ratio needs recognized that the rival will raise price. Hence, in this setting the diversion ratio can be negative, whereas it is always positive in the simultaneous pricing models used in merger assessment.

dictated by the Ramsey inverse elasticity rule alone.[12] The first-order condition supplies the intuition, which is essentially a "second best" argument.[13] Suppose the PO's price in the competitive market was set to satisfy the Ramsey rule. With a positive diversion ratio, incrementally increasing that price would increase output of the rival's product. Because price exceeds marginal cost for that product—the first part of this term in the first-order condition—the rival is supplying too little of that product, hence increasing supply increases welfare. At the price that satisfies the Ramsey rule, the direct effect on welfare ignoring the effect from the rival's product is zero at the margin, so increasing P_{PO} increases overall welfare. The magnitude of that welfare loss is rival's price-cost margin; all else equal, the larger is that margin, the greater is that welfare loss.

Measuring the size of that marginal effect requires measurement of the diversion ratio and the difference between price and cost for the rival, or rivals as the case may be. Merger simulation techniques (Werden and Froeb 1994; Berry 1994; Nevo 2000) may be of use in estimating this in practice. However, this is only a marginal effect and in and of itself tells us little about how much above the Ramsey price the PO should set for its competitive product. However, assumptions about the specific form of the demand functions (linear, constant elasticity) may allow calculations of those prices (Salop and Moresi 2009, p. 47).

6 Differentiated Bertrand Equilibrium for Competitive Products

The last complication is to go from a sequential equilibrium, in which the rival in the competitive product market sets price after observing the PO's price, to a simultaneous (Bertrand) equilibrium, in which both the PO and the rival set prices at a Nash equilibrium, where each supplier's price maximizes its profits given the price the other charges. In such an equilibrium, the PO's price is endogenous, which implies that it is not directly under the regulator's control.

Consequently, if the postal regulator wishes to manipulate pricing in the competitive product market to maximize welfare, it must do so indirectly. As the controversy on the PO's competitive product pricing centers is in part over its contribution to institutional cost—that is, costs that cannot be attributed to a specific product—one might approach this not as requiring a minimum contribution from sales of the competitive product but limiting the contribution to institutional cost from sales of the market-dominant product. However, this is highly unlikely to be optimal. In one

[12] Conversely, to the extent that the PO's competitive product is a complement to differentiated services in other markets, its price should be lower than that prescribed by the Ramsey inverse elasticity rule, also to increase output in market where differentiation implies too little. Prieger (1996) makes this point as well.

[13] One could say, because Ramsey pricing is itself second-best, that this is a "third best" pricing argument.

direction, the PO's variable profits from the competitive product Bertrand equilibrium could be too low for the PO to cover its cost. In the other direction, the PO's variable profits from sales in the Bertrand equilibrium could be more than enough to cover its total cost, implying that welfare could be increased by reducing the PO's prices for both the market-dominant and competitive products.

Two more direct possibilities present themselves. One is for the regulator to add a per-unit contribution to the PO's marginal cost for its competitive product, thereby changing the equilibrium price in that market. A policy and modeling question is whether that per-unit contribution or the PO's entire profit from the competitive product market should count toward that contribution toward institutional cost. A second possibility would be for the postal regulator to impose a fixed cost requirement on the PO's provision of the regulated product. This could lead the PO to withdraw from the competitive product market, which would reduce welfare in the competitive market. To the extent competitive market profits contribute to common costs, withdrawal would reduce welfare in the monopoly market as well.[14] If the PO continues to supply the competitive product, this requirement would be either nonbinding or, in effect, set a floor on the PO's competitive market price, forcing a sequential rather than Bertrand equilibrium.

In either case, the relevant comparison is with the result in the previous section. In any differentiated Bertrand equilibrium, the rival's price will be their best response to the price it expects the PO to charge for its product. Therefore, the optimal differentiated Bertrand equilibrium will be where the PO charges the prices that satisfy the first-order conditions in the sequential model where the PO sets its competitive product price first and the rival follows.[15] To the extent that either adding an amount to (or subtracting an amount from) the PO's marginal cost, it will lead to lower total welfare if it leads to a different outcome. Similarly, a minimum contribution requirement will reduce welfare if it leads to a different set of prices chosen by the PO and rival in the market for competitive products.

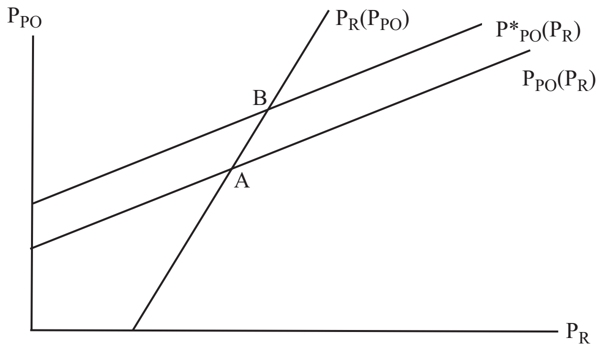
This does not mean that the differentiated Bertrand equilibrium is itself optimal; however, one must proceed with caution. As Fig. 3 shows, because prices are strategic complements (Bulow et al. 1985), a policy, such as requiring greater per unit contributions to covering institutional costs, which increases the PO's optimal price given the rival's price, will lead to both charging higher prices.

The response functions $P_{PO}(P_R)$ and $P_R(P_{RO})$ are both increasing, with prices as strategic complements. If a policy intervention increases the price the PO would charge in response to the rival's expected price from $P_{PO}(P_R)$ to $P*_{PO}(P_R)$, the

[14] In practice, these potential benefits accruing from economies of scope—the existence of common costs—have to be weighed against potential harms from discrimination and cross-subsidization that can follow regulated firm participation in unregulated markets (Brennan 1987).

[15] In a repeated game, perhaps the PO and its rival would institute the collusive price. I am not considering that here, in part because models of firm interaction used in merger analyses, as noted above, use one-shot games. If one thinks tacit collusion between a PO and its rivals in, say, parcel delivery, is likely, one might expect that a welfare-maximizing regulator might effectively prevent it by forcing the PO to charge the one-shot equilibrium price. But this could be a subject for future investigation.

Fig. 3 Effect of increasing per unit contributions on competitive product prices



Bertrand equilibrium would move from point *A* to point *B*, with both charging higher prices.

This reduces welfare in the market for competitive products. That could be offset if the per unit contributions to institutional costs or, more generally, the PO's profits in that market would be offset by a lower price for the market-dominant product. However, the simultaneous Bertrand prices for the differentiated competitive products could be too high relative to the sequential prices found above, for example, if demand for the market-dominant product is very inelastic at the price that, with the PO's price for its competitive product, generates just enough revenues to cover the PO's total cost. In that case, it would increase overall welfare to reduce the contribution to institutional costs from the competitive product, to reduce prices of both the PO and rival's competitive products below those that would prevail in the differentiated Bertrand equilibrium. Simpler models above indicated that the stronger is competition from a rival's competitive product, the higher is the elasticity of demand facing the PO in that market, and thus the lower is its price in that market that maximizes total economic benefit net of the PO's costs.

7 Concluding Observations

The above traces out considerations in setting optimal prices for a regulated firm, here a postal operator, that operates in a market for competitive products. It is not surprising that increased competition for competitive products justifies lower prices by the regulated firm in that market. It may be surprising that those optimal prices should be tweaked upward when the rival offers a differentiated product, when increasing the PO's price in that market increases the rival's supply. When the rival offers a differentiated product, its price will be above marginal cost, indicating too little supply.

All of these results are in a framework where the regulator can use profits from competitive product sales to defray overall costs so as to reduce price for the market-dominant products. This implies that prices of those products are tied to net costs.

This is not the case with price caps, which are designed to be separated from costs to give the regulated firm the incentive to control costs and to remove incentives to cross-subsidize based on misallocating competitive product costs to the regulated product (Brennan 1989, 1990). However, the PRC's proposal "to revisit a [price cap] plan's performance quickly enough to prevent either persistent windfalls to the firm that harm consumers or persistent revenue shortfalls that damage the producer" suggests that to some extent prices will be tied to costs.[16] This renders the Ramsey pricing framework relevant, at least as a periodic target.

An additional concern is that the analysis, particularly of the Bertrand equilibrium, presupposes that the PO maximizes profits or at least minimizes costs. Pragmatically, profit maximization is necessary to apply the market simulation models noted above that might be used to estimate the appropriate prices if parcel carriers offer differentiated services. Michael Crew extensively advocated for privatizing USPS because it was not a profit-maximizing enterprise (Crew and Kleindorfer 2008; Crew and Brennan 2015). Sappington and Gregory Sidak (2003a, b) more generally argued that state-owned enterprises may be well-positioned to cross-subsidize operations in competitive markets, as they may be able to draw on public resources to cover losses from pricing below costs. That, and the lack of incentive to be efficient when costs are covered by the treasury—or by ratepayers, when prices are tied to costs—inevitably complicate the persistent legal and policy debates on pricing by dominant firms in competitive markets. Whether one can model optimal regulation in the face of these complexities remains a task for future research.

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[16] Postal Regulatory Commission, Notice of Proposed Rulemaking for the System for Regulating Rates and Classes for Market-dominant Products, Statutory Review of the System for Regulating Rates and Classes for Market-dominant Products, Docket No. RM2017-3, Order No. 4258 (December 1, 2017), at 37.

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