Preliminary and Incomplete: Please do not quote or reference!

The Economic Effects of Combining Liberalization and Unbundling Policies in Postal Markets

Prepared by John C. Panzar, Northwestern University for

IDEI/La Poste Third Conference on

Regulation, Competition, and Universal Service in the Postal Sector

Toulouse, November 13-14, 2003

Introduction

The introduction of competition into postal markets has taken many forms. On a value added basis, the United States has had more competition, for a longer time, than any other nation despite the continuing presence of letter and postal box monopolies. This is because competition has been introduced almost entirely through the offering of work-sharing discounts.[1] New Zealand and Sweden have fully liberalized their postal

[1] See Cohen, et. al. (2002)

markets with little emphasis on unbundling or work-sharing. The United Kingdom is proceeding with *both* elimination of the monopoly and the introduction of downstream access.[2]

My purpose in this paper is to develop a simple economic model that demonstrates that liberalization and unbundling are interrelated in interesting and important ways. The model allows for three types of competitors, providing upstream, downstream, and end-to-end services. I study a postal authority whose objective is to minimize the uniform price paid for end-to-end service subject to the constraint that the incumbent postal provider break-even. I find, not surprisingly, that the liberalization of end-to-end services is always inimical to the pursuit of that goal. More interestingly, I find that both upstream and downstream competition make it possible to lower the uniform price as long as *piecemeal bypass* is not allowed.

A Theoretical Framework: Costs and Supply

The incumbent post serves a high cost area and a low cost area at the uniform stamp price p. The incumbent incurs delivery costs of $F_H + c_H V_H$ in the high cost area, where F_H and c_H, respectively, denote the fixed and marginal costs of delivery in the high cost area and V_H is the volume of mail delivered by the incumbent in the high cost area.

---

[2] See Postal Service Commission (2003).

Similarly, delivery costs in the low cost are given by $F_L + c_L V_L$. In addition, the incumbent incurs "upstream" costs of $F_U + c_U V_U$. Here, F_U and c_U, respectively, denote the fixed and marginal costs incurred upstream and V_U are the volumes processed by the incumbent at its upstream facilities. Finally, the incumbent may incur network fixed costs of F_N. It is useful to define $F = F_N + F_U + F_H + F_L$, since only the sum of these costs are usually considered.

There are, potentially, two types of fringe competitors. The first group of fringe firms provide delivery bypass services in the low cost area according to the upward sloping supply schedule $\alpha_A A(a-t)$, where a is the downstream access rate set by the incumbent and $\alpha_A \in [0,1]$ is an access liberalization policy variable. This variable denotes the extent of competitive downstream access permitted: i.e., the proportion of potential supply allowed to enter the market. Alternatively, an "either, or" interpretation of access entry policy would result in $\alpha_A \in \{0,1\}$. The second group of competitors provides end-to-end service for mail addressed to the low cost area according to the upward sloping supply schedule $\alpha S(p)$, where, again, $\alpha \in [0,1]$ is a liberalization policy variable.

The Demand Model

The demand for letter service is assumed comprised of many types of users, indexed by $s \in [0,1]$, the (constant) unit cost they would incur if they performed the

needed upstream functions ("sorted" their letters) themselves. The demand for letter service of *all* mailers with a self-sorting cost of s is defined to be $D(\pi,s)$.[3] For simplicity, I assume that the proportion, δ, of mail addressed to the high cost region is the same for all mailer types.[4] The demand measure is assumed to be twice continuously differentiable, with $D_\pi < 0$. The first, "price," argument of the demand measure is the total mailing cost per piece *optimally* faced by mailers of that type. That is, $\pi = \min\{p, p-\delta+s)\}$, where δ is the work-sharing discount offered by the incumbent.

In the absence of any work-sharing discount, the total market demand for the end-to-end service is given by

$$(1) \qquad X(p,0) = \int_0^s D(p,s)ds.$$

(Here, the zero argument reflects the fact that no discount is offered for work-sharing.) Now suppose that a discount of δ is offered to mailers that presort their letters before presenting them to the incumbent for delivery. There are now *two* demand functions to consider. The first is for unsorted mail to be sorted and delivered by the incumbent. This demand function is now given by

---

[3] Thus the demand measure includes the measure of mailer types: i.e., $D(\pi,s) = d(\pi,s)f(s)$, where $d(\pi,s)$ is the demand of an individual mailer of type s and $f(s)$ is the measure of mailers of that type.

[4] This also ensures that the results are not driven by arbitrary demand assumptions.

(2) $X(p,\delta) = \int_{\delta}^{\bar{s}} D(p,s)ds.$

In words, this equation states that the demand for end-to-end, undiscounted mail service is the total demand of all mailers whose cost of self-sortation is greater than or equal to the discount δ. Such mailers will not find it advantageous to use the discount, and will continue to offer their unsorted mail to the incumbent. As one would expect, a decrease in the full service price will increase the quantity of service demanded:

(3) $X_p(p,\delta) = \int_{\delta}^{\bar{s}} D_p(p,c)dc < 0.$

Less obviously, but intuitively, an increase in the presort discount will decrease the demand for the undiscounted service:

(4) $X_\delta(p,\delta) = -D(p,\delta) < 0.$

Those customers who, because of the nature of their business, can sort their outgoing mail rather cheaply will choose to take advantage of this discounted service.[5] The demand for discounted service from these customers is given by

---

[5] To simplify the exposition, I do not distinguish between customers who actually presort their mail themselves and those who hire outside consolidators to presort it for them. As long as the consolidation market is competitive there is no need to model it explicitly. Presumably, the same characteristics of a customer's mail stream which make it relatively cheap to presort its mail itself, for example, a large volume of computer addressed envelopes, would also make it relatively inexpensive to contract out its presorting tasks. It is these intrinsic features that differ across mailers that the customer specific variable *s* is designed to capture.

(5) $$W(p,\delta) = \int_0^{\delta} D(p - \delta + s, s)ds$$

Here, it is important to note two effects of the size of the discount δ on the demand for discounted service. First, a larger the discount increases the number of mailers who find it profitable to presort their mail. Second, a greater discount also stimulates the demand of all those already utilizing of the discount. Together, these two effects give rise to the following result:

(6) $$W_{\delta}(p,\delta) = \int_0^{\delta} D_{\delta}(p - \delta + s, s)ds + D(p,\delta) > 0.$$

Of course, an increase in the stamp price will also decrease the demand for presorted service:

(7) $$W_p(p,\delta) = \int_0^{\delta} D_{\delta}(p - \delta + s, s)ds < 0.$$

Putting these facts together yields the following important result relating the demand for the discounted and undiscounted services:

> Proposition 1. The marginal effect of an increase in the discount on *total* demand is equal to the marginal effect of a stamp price *decrease* on *work-sharing* demand.
>
> Proof: Adding equations (4) and (6), and using equation (5) yields
>
> $$W_{\delta} + X_{\delta} = \int_0^{\delta} D_{\delta}(p - \delta + s)ds = -W_p > 0.$$

Another important characteristic of this demand structure is summarized in the following result:

Proposition 2. Discounts stimulate aggregate demand.

Proof: Subtract the initial volume of mail at any full service price from the *total* of the presorted and end-to-end mail offered at that price in conjunction with the discount δ. That is, the discount stimulation T is given by

$$T(p,\delta) \equiv X(p,\delta) + W(p,\delta) - X(p,0)$$

From the definitions of X and W, we can rewrite this expression as

$$T(p,\delta) = \int_0^{\delta} \left[D(p - \delta + s, s) - D(p,s) \right] ds > 0.$$

Intuitively, this stimulating effect arises from the fact that mailers taking advantage of the discount face a lower net effective price for mail service. (Only the marginal pre-sorter, with $s = \delta$, is indifferent.) As long as mail demand is price elastic, total mail volumes must increase.

Profits and Welfare

With the demand structure clearly specified, it is now possible to define expressions for the incumbent economic profits as well as social surplus. By construction, incumbent profits are given by

$$C = F + tV_U + c_L V_L + c_H V_H + a - \alpha_A A. \quad (8)$$

(Here, $a\lambda_A A$ is the amount spend on access services purchased from competitive downstream providers.) When work-sharing discounts are offered and there is end-to-end bypass, the incumbent's upstream volumes is just the traditional mail demanded less the supply of the fringe. That is,

(9) $V_U = X(p,\delta) - \lambda S(p)$.

The volumes delivered by the incumbent in the low cost region consist of the traditional and work-shared volumes addressed there *less* the volumes delivered by end-to-end and delivery competitors. That is,

(10) $V_L = (1-\delta)[X(p,\delta)+W(p,\delta)] - \lambda S(p) - \lambda_A A(a)$.

The volumes delivered by the incumbent in the high cost region consist of all of the traditional and work-shared volumes addressed there since there are assumed to be no competitors operating in the high cost region. That is,

(11) $V_H = \delta[X(p,\delta)+W(p,\delta)]$.

Recognizing the possibilities for work-sharing discounts and bypass, the incumbent's revenues are given by:

(12) $R = p[X(p,\delta)-\lambda S(p)] + (p-\delta)W(p,\delta)$

Combining all of the above yields the equation for incumbent profits:

(13) $\pi(p,\tau,a;\beta,\beta_A) = (p - t - c)(X + W) + (t - \tau)W - (p - t - c_L)\tau S - (a - c_L)\beta_A A - F$,

where $c = \beta c_H + (1-\beta)c_L$, the incumbent's average delivery cost.

Social surplus in this model is just the sum of incumbent profits, fringe profits, and mailers' net benefits. Let the net benefits (consumers' surplus) accruing to mailers of cost characteristic s be defined as $B(\tau,s)$. Thus for presort mailers, $\tau = p-\tau+s$, while for mailers not taking advantage of the presort discount, $\tau = p$. Because the focus of the analysis is on business mailers, the relevant measure of consumer benefits is mailers' economic profits. Thus it is possible to apply Hotelling's Lemma to obtain the result that $B_\tau(\tau,s) = -D(\tau,s)$.[6] It is now possible to write social surplus as:

(14) $$Z(p,\tau,a) = \pi(p,\tau,a;\beta,\beta_A) + \int_0^{\tau} B(p - \tau + s,s)ds + \int_{\tau}^{1} B(p,s)ds + \pi_\tau(p) + \beta_A \pi_A(a).$$

Break-Even Outcomes in the Absence of Upstream bypass

One could proceed by conducting a standard Ramsey analysis. That is, maximize Z with respect to the policy parameters p, τ, and a subject to the constraint that the incumbent at least break-even. While there are some novel aspects of the current

---

[6] This just says that the decrease in a business's maximized profits of a small increase in the net price it faces for postal service is just equal to the volume of mail it produces.

formulation, the basic results of such an analysis are well known.[7] Therefore, I shall proceed to analyze a situation in which the object of postal policy is not (necessarily) to maximize social surplus. Instead, policy makers are assumed to satisfy their statutory mandates by choosing policies to provide Universal Service at the lowest possible uniform price subject to the constraint that the incumbent break-even. While not generally "optimal" in the economist's sense, studying the implications of such a policy objective seems to me to be of considerable practical relevance.

Since the incumbent is assumed to operate under conditions of increasing returns to scale, this break-even price p^0 will be greater than the marginal cost of providing full service in the low cost area: i.e., $p^0 > c_U + c_L$. The break-even uniform price will be a function of the policy parameters in the model. Its properties are determined (implicitly) by the condition:

(15) $\Pi(p^0(\delta, a; \delta, \delta_A), \delta, a; \delta, \delta_A) = 0$

I begin the policy analysis by considering the effects of introducing a work-sharing discount when neither end-to-end nor delivery bypass is permitted ($\delta = \delta_A = 0$). Totally differentiating the zero profit conditions yields the standard system of comparative statics results:

---

[7] See, for example, Armstrong, et. al. (1996) and De Donder et. al. (2001).

(16) $$\frac{\partial p^0}{\partial i} \equiv p_i^0 = -\frac{\Pi_i}{\Pi_p}; \text{ for } i = \tau, a, \theta \text{ and } \alpha_A.$$

If the break-even constraint is strictly binding, it must be the case that $\Pi_p > 0$. That is, an increase in the uniform rate would increase, not decrease, the incumbent's profits. This establishes:

Proposition 3. $\text{sgn}(p_i^0) = -\text{sgn}(\Pi_i)$; for $i = \tau, a, \theta$ and α_A.

This result is quite intuitive. An increase in any variable whose direct effect increases (decreases) the incumbent's profits must decrease (increase) the break-even price, *ceteris paribus*.

However, in order to analyze the impact of various parameters on the equilibrium uniform price, it is necessary to take account of the fact that policy makers are (assumed to be) actively adjusting their policy variables in order to make the uniform price as possible. In this context, the minimized uniform priced, is defined as

(17) $$p^*(\tau, \alpha_A) = \min_{a \in \Omega} p^0(\tau, a; \theta, \alpha_A)$$

The First Order Necessary Conditions associated with this optimization problem are given by:

(18) $$\frac{\partial p^0}{\partial a} = -\frac{\Pi_a}{\Pi_p} \geq 0; \; a \geq 0 \quad \perp \quad \Pi_a = -\alpha_A A(a) - (a - c_L)\alpha_A A'(a) \leq 0$$

and

$$(19)\qquad \frac{\partial p^0}{\partial \alpha} = -\frac{\partial \Pi_\alpha}{\partial_p} \geq 0;\ \alpha \geq 0 \quad \Rightarrow \quad \Pi_\alpha = (p - t - c)(X_\alpha + W_\alpha) - W + (t - \alpha)W_\alpha \geq 0$$

(Recall that ∂_p must be positive when the break-even constraint is binding.)

These First Order Necessary Conditions are themselves informative. In fact, they enable me to directly establish:

> Proposition 4. The optimal work-sharing discount is always positive. Therefore, the introduction of a small work-sharing discount makes it possible to charge a lower uniform price.
>
> Proof: Using equation (19) to evaluate Π_α at $\alpha = 0$, yields
>
> $$(\Pi_\alpha)_{\alpha=0} = (p - t - c)[X_\alpha + W_\alpha] - W(p,0) + tW_\alpha > 0,$$
>
> where the sign follows from Proposition 1 and equations (5) and (6). Thus $\alpha = 0$ violates the First Order Necessary Condition, so the optimal work-sharing discount must be strictly positive. This implies that a "small" work-sharing discount is better than none at all.

A similar analysis can be used to analyze the properties of the optimal delivery price. In particular, we have

Proposition 5. *In the absence of piecemeal bypass*, the optimal delivery price is always less than the incumbent's marginal cost.[8]

Proof: Solving equation (18) yields the optimality requirement that $(a - c_L) \frac{\partial_A A(a)}{\partial_A A(a)} < 0.$

At first, this result seems surprising. How can it be desirable to price access below the incumbent's cost? The answer lies in the incumbent's *monopsony* power that results from the absence of (implicit or explicit) piecemeal bypass. The access providers in the current formulation of the model have no option but to sell to the monopolist.[9] In particular, they are not allowed to provide delivery services for work-shared mail *except* through the incumbent. Thus, they are really in the business of supplying *downstream* work-sharing services to the incumbent. The incumbent sets a to extract the maximal monopsony profit, which enables it to lower the uniform price.

Given this, it is not surprising that the existence of competing providers of delivery services makes it possible to charge a lower uniform price.

Proposition 6. *In the absence of piecemeal bypass*, an increase in the supply of competitive delivery services results in a lower uniform price.

---

[8] Here, I continue to assume that the market outcome is such that the incumbent's delivery operation in the low cost area is not completely replaced by competitors: i.e., the fixed costs F_L cannot be avoided.

[9] Below, I will introduce (what amounts to) piecemeal bypass. This leads to dramatically different results.

Proof: Differentiating equation (17), using the Envelope Theorem, equation (16), and equation (18) yields:

$$\frac{\partial p^*}{\partial \Delta_A} = \frac{\partial p^0}{\partial \Delta_A} = -\frac{\partial \Delta_\Delta}{\partial_p} = \frac{(a - c_L)A}{\partial_p} < 0 . \square$$

End-to-end competition has an effect opposite to that of upstream and downstream work-sharing competition. Because end-to-end competition reduces the incumbent's volume, it forces the incumbent to raise the uniform price. It is possible to state the following result.

Proposition 7. An increase in the supply of end-to-end competitors always increases the uniform price.

Proof: As above, differentiate equation (17) and apply the Envelope Theorem, obtaining:

$$\frac{\partial p^*}{\partial \Delta} = \frac{\partial p^0}{\partial \Delta} = -\frac{\partial \Delta}{\partial_p} = \frac{(p - t - c_L)S}{\partial_p} > 0 \ \square$$

Let me summarize the results so far. In the absence of piecemeal bypass, the expansion of work-sharing competition facilitates the postal authority's efforts to maintain a low uniform price for end-to-end service. In contrast, the expansion of end-to-end competition frustrates the pursuit of this objective by reducing the incumbent's volumes and its ability to exploit its economies of scale.

Conclusion: Problems Posed by Upstream Bypass

Additional issues emerge when mailers are permitted to bypass the facilities of the incumbent on, what I shall term, a "piecemeal" basis. That is, mailers have the following options regarding their purchases from competitors: end-to-end service, upstream service *only*; downstream service *only*; and, *separately provided* upstream *and* downstream services. In contrast, the analysis of the previous section allowed *either* upstream *or* downstream, *or* end-to-end bypass. The distinction may seem minimal, but the market impact is pronounced. Because, when piecemeal bypass is permitted, postal rate-maker looses the ability to independently set the rate for downstream access and the upstream discount. In the current model, mailers can obtain a perfect substitute for the incumbent's end-to-end service by having their "work-sharing" contractor hand over their mail, not to the incumbent, but to a competitive delivery service.

An intuitive explanation of the situation is as follows. The introduction of work-sharing discounts brought into being an industry of competitive suppliers of upstream services. Similarly, the practice of "contracting out" of delivery services created a competitive supply for that component as well. Without the ability of mailers to engage in piecemeal bypass, these industries had no customer but the incumbent. Thereby making it possible for the incumbent to engage in monopsonistic exploitation of both industries in order to keep the uniform stamp price low.

The incumbent can still exercise substantial control over the market, even when piecemeal bypass is possible. For example, the incumbent may choose *not* to contract out its own volumes to competitive delivery providers, leaving them to compete for the volumes of work-shared mail destined for the low cost area.

References

Armstrong, Mark, Chris Doyle and John Vickers. 1996. "The Access Pricing Problem: A Synthesis." *Journal of Industrial Economics* 44: 131-150.

Cohen, Robert H., William W. Ferguson, John D. Walker and Spyros S. Xenakis. 2002. "Impacts of Using Worksharing to Liberalise a Postal Market". In *Liberalisation of Postal Markets*, edited by Gabrielle Kulenkampff and Hilke Smit. Bad Honnef: WIK.

De Donder, Philippe, Helmuth Cremer, Jean-Pierre Florens, André Grimaud and Frank Rodriguez. 2001. "Uniform Pricing and Postal Market Liberalization". In *Future Directions in Postal Reform*, edited by Michael A. Crew and Paul R. Kleindorfer. Boston, MA: Kluwer Academic Publishers.

Postal Services Commission. May 2003. *Notice of a Proposed Direction on Downstream Access, by UK Mail, to Royal Mail's Postal Facilities: Reasons*. London.