

Balancing Access and the Universal Service Obligation*

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The situation currently faced by national post offices (POs) is quite serious in that they face competition not just from electronic media, particularly the Internet, but also pressure to open up their traditional monopoly markets to entrants. At the same time, they still face a continuing Universal Service Obligation (USO). In this situation, the problem of terms and conditions under which access should be provided to entrants is of critical importance to the future of the postal sector.

Although access has not received much attention in the postal economics literature, it is now becoming central in the debate on policies to balance competition and the USO. On one side of this argument lie the evident benefits of competition in promoting increased efficiency. Competition could also be a fundamental lever in promoting the radical change that many believe is necessary if POs are to avoid becoming a drag on the economy.¹ Access is a critical issue for competitors since they want to use the incumbent PO's network under the USO to assure ubiquity of coverage. As

* This paper appears as Chapter 1 in Crew, Michael A. and Paul R. Kleindorfer (Eds.) 2003. *Postal and Delivery Services: Delivering on Competition*. Boston, MA: Kluwer Academic Publishers. The authors are grateful for constructive comments on earlier drafts of this paper by Marion Brouwer, Robin Cohen, Robert Mitchell, Ian Reay and Sture Wallender. Remaining errors and all views expressed here are our own. We acknowledge also the programming assistance of Ralph Ahn for the examples.

¹ For example, GAO (2002), Robinson and Rawnsley (2002), Robinson (2003) and Crew and Kleindorfer (2003) examine the future of the U. S. Postal Service (USPS) and draw a rather pessimistic future, absent radical change, implying that USPS could be a major drain on public finances. Similar concerns, *inter alia*, motivate the British Regulator, PostComm (2002).

their own networks are confined only to dense low cost routes, their coverage is likely to be far from ubiquitous. Therefore, to offer one-stop shopping they wish to consolidate the remainder of the mail they collect and hand it to the PO. Such access cannot be economically prevented, e.g. by licensure, since entrants can always gain access to the PO's network without restriction at single piece rates. Regulators may sometimes provide access under more favorable conditions in pursuit of promoting increased competition. On the other side of the argument is the fact that there is still nearly universal support for the USO, essentially on the terms it currently exists. In the face of these conflicting arguments, and the considerable potential for opportunism on both sides, the time is ripe to examine the issues surrounding policy on access terms and conditions for the postal sector.

Section 1 presents some background to the problem of entry into postal markets, including the role of access in the postal arena, in the context of the continuing obligation to fund a USO. For regulators the problem is not simple because of the problem of balancing the benefits of competition against the problems of funding the USO. Moreover, the conditions in the postal sector are sufficiently idiosyncratic to preclude a simple transfer of general findings and experience from other sectors to the problem of entry and access in the postal sector. Section 2 examines some of the principles underlying how to determine terms and conditions for efficient access. The principles we articulate are based upon a model developed in the Appendix. The model enables us to examine some of the options available in the postal sector, both in upstream and downstream access. Section 3 is by way of summary and implications. The principal elements of the approach developed aim to promote efficiency while preserving the USO. We argue that these desiderata imply freely negotiated terms and conditions for upstream access, with public tariffs remaining the standard for normal worksharing, downstream access and single piece end-to-end service.

1. BACKGROUND AND MOTIVATION

The last twenty years have seen the entry of competitors into what had formerly been regulated monopolies. Along with this entry the regulated incumbents have been allowed to diversify into other industries and other commercial freedoms. This process has involved a concern that the incumbent regulated monopolist might employ its regulated monopoly to the disadvantage of competitors. Specifically, where competitors require access to monopoly or essential facilities, there has been a concern that incumbents might overprice this access or increase the costs of competitors through the

terms under which access is provided. In telecommunications and energy this has been a major issue for much of the period and has resulted in various actions by regulatory commissions. In the postal sector, which is heavily dominated by state-owned national post offices (POs), there has been less actual opening up of markets to competition and consequently less diversification by POs into competitive industries. However, the postal sector worldwide is facing pressure to open up its traditional monopoly markets to competitors and with the consequent increase in POs' desires to enter competitive markets, and thus these issues are now becoming salient for the future of the postal sector as well.

There are several ways in which an incumbent, who may have access to revenues from a monopoly market or some residual monopoly power in other markets, can engage in behavior to the disadvantage of competitors. In telecommunications such issues have been and continue to be aired extensively. Given the limited applicability of many of the issues to the postal sector and given that others have explored these issues at length we do not intend to repeat this material. Instead, we point the reader to the survey by Armstrong (2001), which provides a comprehensive review of the theory of access and applications to telecommunications as well as an extensive list of references.

In determining the terms under which entrants can access a PO's network the regulator has to balance a number of conflicting considerations involving maintaining the viability of the USO and providing entrants with access. The underlying principles are simple. Service should be provided by the most efficient producer subject to the continued viability of the USO. The approach relies on underlying cost causation. Prices are intended to convey signals that reflect the underlying costs. While this approach may not guarantee the viability of the USO it will assist in developing courses of action, which may involve a number of tradeoffs. For example, the USO may have to be modified or the terms of entry may have to be modified if the USO is to continue. We start by examining the nature of the postal access problem.

A PO's network can be accessed at various stages in the production process. These can conveniently be divided into upstream access and downstream access. Access upstream has a fairly long tradition especially in the case of USPS with its extensive tradition of worksharing. A regulator generally is concerned with access at all stages and his motivation should be the promotion of efficiency. Given the extensive and successful nature of worksharing and its ubiquity, not just in USPS, the regulator is likely to have to examine downstream access arrangements more closely given the relative minimal experience with downstream access. Regulators, in addition, may believe, given the minimal nature of downstream access and its importance

in the postal value chain, that they have resort to initiating policies that force the introduction of new products, including access to the incumbent's facilities. As argued below, the general trend in regulatory economics has been to meet this challenge through implementing regulation that provides incentives for the incumbent to act efficiently rather than through direct interventions or command and control measures on the part of the regulator. Price-cap regulation has been increasingly used with these considerations in mind.

As a starting point for our discussion of promoting efficient access, we note that in situations other than regulated monopoly firms normally do not offer access to their facilities to competitors at all. This arises for a number of reasons including the very nature of a firm. As Nobel Laureate Ronald Coase argued in 1937, a firm exists to perform a set of transactions that can be performed more economically by means of a hierarchy rather than through the market. Allowing outsiders to enter this hierarchy may result in disruptions to and loss of the synergies, scale and scope economies and the like that arise from the use of a hierarchy rather than the market.

Where effective competition exists, forcing access to facilities by regulatory fiat or by subsidies is going to provide disincentives for efficiency. If a firm, as a result of its own innovation, is forced to share this innovation with competitors by giving them access to its facilities, the edge to innovate is going to be blunted, as the firm cannot retain all benefits of innovation for itself. So forcing access in such cases may be inefficient both in a Coasian and a Schumpeterian sense. In the former case this arises because of the loss of synergies and therefore reducing internal or X-efficiency and, in the latter case, because of its adverse impact on dynamic efficiency.²

Where a regulated monopoly exists and where a decision is made to introduce competition, different considerations arise and the incumbent may be required by the industry regulator to provide access to its facilities on terms and at such prices as the regulator may determine. This is the case in electricity, telecommunications and gas, for example. The reason for requiring access is that the incumbent controls what is known in regulatory economics and law as an "essential facility". An obvious example of an essential facility is a bridge – it is the only feasible way of getting across the river! The essential facility doctrine at its simplest would require that access be provided to such essential facilities on reasonable and non-discriminatory

² Now it may be that the effect of allowing entry is to foster a different kind of innovation as well as lowering some prices as a result of competition. However, unless there is good reason to believe that this is the case and that such gains will outweigh the losses from a less innovative incumbent, then caution about forcing access is warranted.

terms. This doctrine is commonly thought to apply to electric transmission and distribution networks, gas pipelines and distribution systems and to local exchange networks. Indeed, according to Alfred Kahn the notion of essential facility should be broadened in scope in the case of incumbent network industries. "...in the context of the introduction of competition into public utility industries...an incumbent company not only will control some facilities truly 'essential' to its rivals but will enjoy economies of scale and scope...merely because of a franchised monopoly..., requiring it to share the benefit of those facilities with rivals at a compensatory price would therefore not entail penalizing successful competitive efforts." (2001, p18)

Kahn's suggested extension of the notion of essential facilities should be taken seriously, given his experience and stature in regulatory economics and given that he often provides testimony on behalf of incumbents. However, in the case of access to upstream postal facilities, for example, automated mail-processing equipment, Kahn's extension of the essential facilities doctrine does not apply. Firstly, such upstream facilities are not truly essential to an entrant. This can be seen even under existing monopoly. Indeed, instances abound where sorting and other types of mail processing are provided other than by the incumbent PO. Mail, for example, may be presorted or prebarcoded by firms other than the POs and these firms receive presort and other discounts for this type of worksharing. Thus, these types of facilities have already been demonstrated to be non-essential. Secondly, it is a stretch to argue that significant economies of scale and scope arise in the operation of these types of automated facilities. True, there is some minimum efficient scale for automated mail processing but, given the ubiquity of presorting, for example, in the United States, this is hardly likely to represent a major barrier to entry that could classify it as an essential facility even under Kahn's more expansive definition.

None of these arguments imply that a PO would or should deny access to such upstream facilities to rival entrants. It may, in some instances, be very good business to allow such access. In cases where a PO's processing equipment is under-utilized during parts of the day or night entrants who could make use of these off-peak hours would benefit as could the PO. Thus, if an entrant were able to have its mail processed only during these periods, it may be possible to do so at attractive rates. Such an entrant would have to be flexible. For example, the entrant would not be able to use the equipment at all during the Christmas rush period when all facilities are operating near or even beyond capacity. The problem facing a PO would be to avoid compromising its nationwide service standards under the USO as a consequence of providing such access.

The key issue then is not whether the industry regulator should force a PO to grant access. Even under Kahn's expanded definition of an essential

facility, there appears to be no justification for treating upstream postal facilities as essential. Moreover, under typical price-cap regulation there would be incentives for a PO to undertake process and product innovations, including those associated with upstream access, where efficient to do so. Indeed, under the current price-cap structure, upstream access would be outside the USO or Reserved Area price caps, and a PO would therefore treat upstream access as an unregulated product with all the profit opportunities associated with such products. Given this, and as argued below in more detail, there is no efficiency rationale for the regulator to force access and the terms of access in the case of upstream facilities. This does not preclude the regulator from retaining the right to monitor the terms and provisions of negotiated agreements between a PO and entrants. The argument here is that, generally, a PO should be free to determine whether and upon what terms it would provide access, in view of the complexity of balancing its costs and USO service standards. Under properly structured price caps, it should allow access if it can profit from so doing. Similarly, entrants will only enter such contracts if the terms are profitable to them relative to the alternative for mail processing available to them. The interesting question then is what are the terms under which a PO would allow access and whether regulators should force access in situations where a PO and a third party disagree as to terms. As a basis for understanding this question, we first examine some of the principles underlying the terms under which a PO would provide such access and the extent to which these are likely to comport with the statutory mission of regulators in preserving the USO, fostering competition and promoting efficiency.

As upstream access is not an essential facility, POs and third parties should be able to negotiate contracts freely and not be subject to constraints imposed by the regulator provided incentives are properly aligned. If the incentives are properly aligned for them to offer access and for competitors to seek it efficiency will be reduced by regulatory intervention. There is reason to believe that incentives are reasonably aligned.

The demand for upstream access is closely related to the demand for downstream access and a means of bypassing the PO's network partially or even completely. Upstream access is likely to be highly beneficial when there are technologies available to entrants that are much lower cost than using the existing postal technology. More problematical is the case where upstream access does not employ a lower cost technology but is primarily a way of skimming the cream from profitable postal activities, whose profits are used to provide a cross subsidy to high cost areas as required by the USO. In the former case the incentives seem reasonably aligned. The entrant because of its ability to employ the superior technology and the PO would both find it profitable to enter into a contract involving upstream

access. In the latter case problems would arise unless the PO could continue to obtain the same contribution for the new upstream product as for its existing full service product. It is hard to find examples of how this could be achieved. This is not surprising. Moreover, from an efficiency point of view, it should *prima facie* not be encouraged as it will normally result in higher cost or at best the same costs.

Currently, some upstream access is taking place in POs in addition to the extensive worksharing found in the U.S. For example, very large commercial recipients of mail could benefit from upstream access and the ability that it provides to bypass the postal network. If this is cost driven it will immediately be beneficial to the large mailer, the PO and perhaps ultimately small customers to the extent that the cost savings are passed on. Except in the case of existing worksharing, in probably most cases upstream access is going to result in some kind of bypass of the postal system. For example, access to postal automation may result in transportation being bypassed and the PO receiving the mail for final delivery. It may be that the system is entirely bypassed after the upstream access. Whatever scenario obtains, the arrangements should be governed by the guiding principle that where a third party has lower costs or can provide better service than the PO, the incentives are aligned for freedom of contract to succeed.³

There are other examples of upstream access, all of which involve bypass in varying degrees. Other large mailers, for example, utilities and credit card companies that receive large amounts of mail at a central location, may wish to employ either the pure or the hybrid version of upstream access. Provided there are cost reductions and or quality improvements the incentives are aligned for a PO and these mail recipients to be free to enter contracts. Mail order returns also have a potential for employing a hybrid system. Other examples include selling space on aircraft and ground transportation. This might be attractive in the case of items that are not very time sensitive. For example, shipment could be guaranteed within a certain number of days for an attractive rate if spare capacity were available. Again

³ There are several other complicating features of this application that strongly support freedom of contract. For example, the determination and costing of appropriate capacity of the outward offices to segregate the mail for the individual customers is complex. Sorting machines at outward offices may have a limited number of selections. As individual large users use up these selections for special arrangements of the kind discussed here, they will thus use up the sorting capacity (i.e., selections), which would reduce the efficiency of the sorting task for the remainder of the mail in that more machine passes would then be required unless more machinery is installed, at a cost. Given these complexities, balancing service standards against required capacity, and determining the appropriate cost allocation for different mail streams, including those associated with upstream access, is a task that can only be properly accomplished by the postal operator.

incentives seem to be aligned for this to happen. Such contracts would have payments for failure to meet the service standard. Setting such compensation payments requires care but is not, in principle, impossible.

Another area of concern to the PO and the regulator is whether upstream access will have a deleterious effect on the PO's ability to meet its service standards. One example, already discussed, is where the contribution is lowered as a result of upstream access. As argued, incentives are aligned to make this unlikely to happen – the PO will not voluntarily forgo contribution. A less obvious example is the service standards under the USO. If the PO were to over commit capacity to upstream access and the service standard under the USO declined, it would face penalties for failure to meet the USO service standards. If the penalties are set at a compensatory level, then incentives are properly aligned in this case. If the penalties are set too low, then upstream access might be excessive. More likely, however, is the opposite situation where penalties are set too high with the result that upstream access would be discouraged. These considerations place an added burden on the regulator in determining the penalties for failure to meet the USO service standards. The basic principles governing the setting of these penalties need to be aligned with the general hierarchy of objectives of the regulator to preserve the USO, foster competition and promote efficiency. While setting these penalties appropriately may be in principle relatively straightforward, in that the principles are well understood and can be readily made consistent with the regulator's objectives, actual implementation is likely to be complex, requiring judgment in balancing the efficiency losses noted above from setting these penalties too high or too low. In particular, there is a natural tendency to require very detailed information reporting in order to assess whether the right balance is being achieved. Both regulators and POs should be aware of the potential for excess transactions costs to arise from this process. This discussion raises the question as to the extent to which regulators should regulate postal access. The implication of this discussion is that upstream access is not a good candidate for regulation. Downstream access may be a different matter as we will see in the next section.

2. DETERMINING THE TERMS FOR EFFICIENT DOWNSTREAM ACCESS

The basic principle underlying access pricing that we have articulated is that incentives should be aligned in such a way that the producer with the highest quality/cost ratio of producing certain services, whether it is the PO or an entrant, should be the producer that actually provides them. In the case

of upstream access, which is characterized by near constant returns and low barriers to entry, we have argued that this is most likely to be the case where the PO and third parties are free to negotiate terms and conditions of entry. The transactions costs of extensive regulator participation in the process will very likely exceed the benefits. In the case of downstream access an alternative approach may be appropriate. Again the regulator needs to be concerned with the transactions costs. However, downstream access is likely to be a large part of a POs business under competitive entry, and the regulator needs to be concerned as to whether the terms and conditions of access undermine the PO's ability to maintain the USO. Generally, the approach involves unbundling, and separately pricing, the various components of the value chain.⁴ However, striking the balance between efficiency incentives and PO viability to provide the USO requires considerable care in allocating through pricing the costs of the USO. We model the resulting problem below, based on our earlier paper Crew and Kleindorfer (2001).

In the Appendix we develop a model with entry where entrants compete with the PO for end-to-end service. The model allows for three types of entry:⁵

1. Entrants provide end-to-end service for selected customers and perhaps for only a subset of their mail.
2. Entrants hand the mail to the PO for local delivery by the PO, the downstream access option.
3. Entrants hand selected mail to the PO, which then provides end-to-end service for this mail.

In Crew and Kleindorfer (2001) we considered the possible problems raised by 1 and 3. We argued that entrants would only provide end-to-end service on the lowest cost, highest profit routes. Other mail, especially mail destined for higher cost delivery areas, they would hand back to the PO. In our original analysis, mirroring current practice in many POs, we assumed that such mail would be charged a uniform rate based only on the amount of upstream work embodied in the mail (e.g., presorted, prebarcoded, and so forth). Under the model developed in the Appendix, we consider more precisely addressed pricing signals, which allow the incumbent, through publicly posted tariffs, to charge entrants for access as a function of the ultimate destination of their mail. Thus, we are effectively unbundling the

⁴ Panzar (2003) has additional caveats about the problem of mandated unbundling and access to postal networks where a PO has a USO.

⁵ In all cases we assume that the entrants take advantage of any presort, barcoding, or other kind of upstream worksharing discount.

option of downstream access and pricing it according to its cost.⁶ This enables entrants to access the PO network at two levels, either for delivery only or at the single piece rate (the latter accommodating, of course, whatever volume or upstream worksharing discounts are appropriate for the mail). As we analyze in the Appendix and discuss below, this approach does not guarantee the viability of the USO or prevent the graveyard spiral whereby the PO becomes insolvent through increasing losses in market share and a continuing USO burden, but we show that it does lower the potential and is likely to be more efficient than alternatives.

The model assumes a set of potential entrants, operating as a competitive fringe, compete for specific customers, providing both end-to-end service for those customers as well as consolidation and remailing through the incumbent PO. We assume that there is only one product, which we think of as “letter mail.” Entrants provide end-to-end service for customer mail being delivered to low-cost areas and they also compete with the PO upstream in collecting and consolidating mail, which they remail through the PO for ultimate delivery. Clearly, the latter decision depends directly on the price the PO charges entrants for access to its delivery network for remailing. We address the effect of alternative access pricing approaches on the viability of the incumbent PO to meet the USO, assuming that the PO is required to finance the USO entirely from revenues generated from its letter mail.⁷

The focus here is on the uniform pricing constraint faced by the incumbent PO. The PO faces different costs depending on where the mail is delivered. Take the simplest case, where there are two delivery zones, low-cost and high-cost. As analyzed by numerous authors, the uniform price constraint of the USO then makes the PO vulnerable to cream-skimming in the event of entry, in that the uniform price must be set high enough to allow the PO to recover fixed network costs as well as to pay for both low-cost and high-cost delivery areas. The result is that the uniform price arising from the USO in the low-cost area may well exceed the stand-alone cost of delivering to that area alone, leaving all high-cost deliveries to the incumbent PO. As noted in Crew and Kleindorfer (2001, 2002), this problem can be so severe that allowing entry pushes the PO into a graveyard spiral of increasing prices and decreasing market share as entrants take a larger piece of the lower cost

⁶ The reader with some background in postal lore will recognize immediately that this proposal enjoys a very long pedigree, going back at least to Roland Hill who discussed similar ideas in coping with the vast differences in local delivery costs under a uniform tariff. Of course, Hill was not concerned with the problem of entrants at the time, but only with the viability of the incumbent under uniform pricing. For a discussion of Hill’s contributions and the form of his proposals, see Crew and Kleindorfer (1991).

⁷ For a discussion of alternative financing proposals, see Crew and Kleindorfer (2000, 2001).

customers and routes until the USO becomes unworkable. To avoid this, either the USO must be weakened or abandoned or entry must be restricted in some manner.

As noted in Crew and Kleindorfer (2001), this problem is further exacerbated when downstream access is allowed, since then the PO not only faces the normal pressures of entry, but also faces the additional problem of having entrants re-mail the highest-cost mail they consolidate from customers with the PO. The PO then not only loses the revenue from such customers on its low-cost routes, but also suffers the additional problem of retaining from those customers precisely the mail it doesn't want, namely the mail destined for delivery to high-cost areas. Thus, if anything, downstream access seems to make the graveyard spiral problem more likely. While we have no cure for the general case, we do propose a modification of access pricing that appears to offer some promise of mitigating the effects of cream-skimming through remailing. The basic idea, which we refer to as Delivery-Area Access Pricing or DAP, is to charge higher access prices for downstream entry where such entry requires delivery to high-cost areas. Thus, the key is to charge entrants who by-pass upstream operations of the PO not according to the work they have by-passed, but according to the work yet to be performed in delivering the mail they re-mail with the PO. As we show in the Appendix this idea is both more efficient than uniform access pricing - the usual approach adopted, following avoided cost or Efficient Component Pricing Rule (ECPR) methods. In addition, it does partially mitigate the problems of a graveyard spiral identified by Crew and Kleindorfer (2001).

Our approach breaks new ground in that it specifically introduces access as a postal product. It has a number of advantages relative to the alternatives currently under consideration. If meaningful competition is going to take place and a significant USO is going to continue then current policies are not sustainable. If entry occurs POs have no alternative but to allow entrants access to their networks. At very least entrants will hand mail to the PO that they cannot deliver since they do not provide ubiquitous service. A problem with this approach is if they obtain access in the traditional manner, namely, the single-piece prices less presort or barcode discount that they will deliver mail in some areas where it is cheaper for the PO to deliver. Economic efficiency would argue for delivery by the lowest cost provider and competitive pricing would reflect these variations in costs. The USO departs from this by requiring, in addition, that the PO deliver to high cost areas where the delivery costs exceed the single-piece stamp price and require the PO to charge more than its costs in low cost delivery areas. If the PO persists with a uniform system of pricing in the face of competition and allows only uniform pricing for entrants to access its network, for example, as in Crew

and Kleindorfer (2001), then a graveyard spiral would likely ensue. The terms under which entry takes place can have a significant effect on the severity of the problem facing the PO in funding its USO. The Appendix supports an access-pricing scheme that reflects costs facing the PO. As shown in the Appendix, and as we now illustrate, such a scheme could not be nicely pigeonholed into ECPR.

As part of its USO, a PO faces a uniform pricing requirement at least for single-piece mail. Traditionally, POs have allowed discounts for work-sharing, mainly bar-coding and presorting, off this single-piece rate. However, where entrants are allowed to deliver to customers they choose and the PO still has a USO, this kind of discount off the single-piece rate will lead to major problems in funding the USO. A more responsive system of access pricing is required under which entrants make efficient choices as to whether to access the PO's network or use their own networks. Entrants' costs are usually lowest for delivery in affluent central city areas housing banks, stock exchanges, insurance and law firms, and a striking example, being the City in London. A PO's costs of delivery are usually lowest in such areas too. Costs of delivery for the PO vary depending on such factors as how affluent the area, population density and remoteness of the location.⁸ A PO would find that its delivery costs varied depending on where a letter was posted and where it was delivered. In practice, the variations in costs could be classified into a number of delivery zones or areas. The key to designing efficient access prices is to have these depend on both the origin and destination of the mail for which access is being provided by the PO. Where an entrant transported the mail to the PO's delivery unit, the origin would be the destination and a pure local delivery charge only would be levied. Additional charges would apply depending on where the mail entered the stream. An example of an access tariff that has the required efficiency properties is given in the Table 1. For simplicity we are ignoring other costs. These and contributions to the USO are intended to be recovered in the markup. Areas are ranked according to delivery costs. Area A is lowest cost and can be accessed by entrants for 13c. If the entrant's delivery costs are below 13c, he will deliver his customers' mail. The same considerations apply in the case of Areas B and C. In all three cases the access price is less than or equal to the presort price. For Area D, however, a problem arises. Even though the entrant's costs may be less than those of the PO if they exceed 20c, the price of the single-piece stamp, the entrant will not deliver here, as he will lose money. Similarly the PO will

⁸ Roy (1999) and Kolin and Smith (1999) have examined some of the factors that determine the costs of delivery in various delivery areas.

not give the entrant the presort price as this will increase the PO's expenses under the USO.

**Table 1: Illustrating Delivery Zone-Specific Access Prices
(The DAP Rule)**

| | PO's Marginal Cost | Access price | Single piece price | Presort Price |
|--------|--------------------------|-----------------|-----------------------|------------------|
| Area A | 10c | 13c | 20c | 18c |
| Area B | 13c | 17c | 20c | 18c |
| Area C | 14c | 18c | 20c | 18c |
| Area D | 25c | 20c | 20c | 20c |

This access tariff involves a number of departures from the existing structure and it should do as, after all, wholesale entry is now allowed which is going to warrant a change. Under the new structure it is essential that entrants not be given incentives to increase the burden of the USO. The access-pricing tariff must therefore send the right signals to them. From the entrant's point of view for Area D, the fact that he does not receive payment for the worksharing that he has performed may seem unfair and inefficient. In fact, it is neither. It would be both unfair and inefficient were it not for the USO, the burden of which should not be increased by entrants. Under the USO the entrant not receiving payment for worksharing in Area D is not unfair if it is considered part of his share of meeting the USO. In return for being able to access the high cost areas at below cost because of the USO, he must pay a price of entry, namely forego the value of any worksharing since the value of the subsidy he is receiving exceeds the value of the worksharing he is providing.

It is interesting to contrast this approach with the approach of ECPR, frequently recommended for determining access prices. The standard approach to ECPR (and other avoided cost approaches) essentially assumes a single-product world, with access then being priced at the avoided cost of any upstream operations performed by the entrant. The problem in the postal context is that this is not a single-product context. On the contrary, every delivery area constitutes a different product with different cost characteristics for fulfillment. Thus, the simple logic of ECPR breaks down. Consider Table 1 again. Assuming a constant markup of about one-third (which might be different from Ramsey markups) for each area, the access price paid by the entrant for downstream access and delivery to Area D under ECPR which would be around 31c (the marginal cost of delivery, 25c, plus the markup, 8c, less the presort discount, 2c). Since 31c exceeds the single-piece price of 20c, the entrant has to be charged the single-piece rate,

as the entrant would simply post the mail at a single-price rate if the access price exceeded this. Note that this is certainly not the same rate as the simple avoided cost implementation of ECPR in which the full (uniform) single-piece rate is simply discounted by the avoided cost of presort discount. Such a simple application of avoided cost logic would lead to a price of 18c for delivery to Area D, which would constitute a further subsidy beyond the 5c subsidy already contained in the single-piece rate for this area. Put differently, the proper access-pricing rule is that the entrant be charged the single-piece rate if the work remaining to be performed after the worksharing exceeds the single-piece price. We refer to this as Delivery-Area Access Pricing or DAP pricing. The simplest implementation of DAP would be to set the access charge for each delivery zone to be the maximum of the traditional ECPR/avoided cost rule and the marginal cost of delivery to that zone, truncated at the single-piece rate. This simple rule has a number of benefits, including simplicity. As expected, however (see the Appendix for details), a full Ramsey formulation of the access pricing problem brings in other factors as well, including demand information and the relative efficiencies of entrants and the incumbent in performing the required elements of the postal value chain. Nonetheless, even this simple rule has significant benefits in better alignment of cost with pricing and in avoiding subsidies to entrants that encourage inefficient entry.

From the entrant's point of view, being uncompensated for the worksharing that he has performed is not unfair in the context of the USO. If the USO did not exist, the entrant would not have the opportunity to get his customers' mail delivered by the PO at below cost. This is part of the terms he faces as an entrant into a postal market that has a USO. In addition, it creates appropriate incentives as to the type of customers an entrant acquires. As we argued first in Crew and Kleindorfer (2001), entrants seek customers depending on their mix of mail. Generally bigger is better but a large customer for who the entrant just presorted the mail for handover to the PO is likely less profitable than one where he delivered most of the customer's mail. *Ceteris paribus* the larger proportion of a customer's mail the entrant delivers, the more profitable the customer. Customers with a large proportion of mail going outside an entrant's delivery area would generally be less profitable. Indeed, it may be that such customers would generate a greater contribution to the PO in covering its USO than the profit that the entrant would make. In such cases efficiency would be enhanced if the PO continued to serve such customers. If the entrant has to cover the bar-coding costs that he has to provide as part of being a postal operator, such customers become less attractive to him and he abandons them to the

PO.⁹ More compelling is that if the entrant received this worksharing payment his customers would escape this payment for the USO. Proponents of entry have argued that all carriers, in principle, should contribute toward the cost of the USO. The difficulty has been devising workable tax-subsidy schemes. The approach adopted here has the advantage of being low in enforcement and transactions costs.¹⁰

DAP access-pricing scheme has the advantage of being low in transactions costs because of advances in computing that make the necessary technologies feasible. Entrants would employ sorting and bar-coding equipment that would sort their customers' mail into mail for delivery on their own network and for delivery by the PO network. The mail delivered by the PO would be metered with the appropriate rate collected by a trusted third party. It does not seem much of a stretch to modify the existing machinery of equipment makers like Pitney Bowes and Siemens Dematic Postal Automation to perform such functions. It may amount to little more than a software upgrade whereby the rate for the Zip Code is "looked up" and recorded. The role of the trusted third party is important here. The entrant and the PO both need to be confident that they will pay or receive the correct rate.

From an antitrust perspective the approach has a number of advantages in that it may safeguard entrants from anticompetitive practices, for example, predation and safeguard POs from excessive antitrust litigation. The access price provides a floor price. *Prima facie* if the PO sets the price to its customers above the access floor, it may be considered not to be predatory. In the case of CityMail's case against Sweden Post there was no equivalent floor established by the regulator. Where an access price is established by the regulator and made publicly available to all, the prices are transparent. A PO, where it competes with entrants, cannot charge below this price for its end-to-end services without making it rather easy for a competitor to charge predation. The issue of how much above this price the PO would have to charge is clearly debatable. However, by setting a floor for the biggest slice of the value chain, the regulator has reduced significantly the money in contention providing the right incentives for both parties to steer away from anticompetitive practices and to avoid inflated claims of such practices.

⁹ Postcomm (2002), Cohen et al. (2000) and Rawnsley and Lazar (1999) have a point in arguing that the USO also conveys benefits upon the incumbent. Some customers who would not be profitable may be so under a USO. Typically such customers are small and the surplus generated may only go a small way to funding the USO.

¹⁰ Crew and Kleindorfer (2000) find a number of benefits from taxation to cover the USO but concluded that the policing and transactions costs made most such schemes infeasible.

While the scheme does not guarantee the funding of the USO, it certainly offers prospects that are a good deal more promising than earlier proposals. It has numerous other advantages including creating incentives for POs to set access prices correctly. If they attempt to overprice access, more delivery will be done by competitors and at higher cost. While it is true that in some situations a PO has some monopoly power in access, it is not likely to be large under entry. Moreover, the regulator will clearly be vigilant, within the limits of the information asymmetries involved, to prevent monopoly pricing of access. Similarly, the regulator's role will militate against unfair competitive practices, like predation. Finally, the regulator can also control the single-piece price. And price-caps and other incentive-based regulation can capture through global price caps incentives for promoting dynamic efficiency across both end-to-end services and access services. All of this is likely to be beneficial in promoting robust funding of the USO. The result is that the regulator will have a strong interest in overseeing increases in this rate but at the same time would see the consequences of such rates against the desired balance in funding the USO. These are not trivial tasks but, as regulators become better informed about the forces at work, it seems likely that they will be able to address them in a reasonable manner.

3. CONCLUDING COMMENTS

We have attempted to develop an approach to making the postal system more competitive by allowing significant entry and wholesale access to a PO's network on a scale not previously considered except recently by Postcomm in its consultative documents. The approach we have floated here envisions tariffed downstream access and negotiated upstream access. This approach is new for the postal sector and may offer opportunities to both POs and those regulators who are attempting to institute significant competition. Concerning downstream access, our approach, which we have called DAP for Delivery-Zone Access Pricing, emphasizes the importance of charging for downstream access according to work yet to be done by the PO and not only for avoided cost upstream work accomplished by Entrants.

In terms of future research, a number of promising avenues are evident. First and foremost from a practical policy point of view the need to determine the conditions under which DAP could preserve the USO and the financial viability of POs. This would include investigating the effects of various approaches to implementing DAP on the values of the access price and the single piece price. Other related issues include extending DAP to account for price-caps, studying the effects of DAP in a more micro-structure world of customer and entrant dynamics (as in Crew and

Kleindorfer, 2001), extending the analysis to include more general cost functions (e.g., with increasing returns in the local delivery area), and the details of implementation of DAP to account for informational restrictions and associated cost allocation procedures characteristic of postal practice.

There is no guarantee that our proposals will safeguard the USO, and so continued caution is warranted in monitoring a gradual and conservative introduction of change. One thing is very clear. Relative to alternatives previously discussed, the approach outlined here is more likely to enable the preservation of the USO. Moreover, the proposed Delivery Access Price (DAP) Rule at least partially eliminates subsidies that would otherwise promote inefficient entry and use of the incumbent PO's facilities for downstream access at rates that do not even cover marginal cost of such access. This would affect not only efficiency but the sustainability of the USO. The numerical results in the Appendix provide further insights on this issue. Of course, some simulations on the part of actual POs and their regulators would be useful before tearing headlong into this approach. These would be useful in throwing light on some other changes that might need to take place, that may be country specific, in striking the right balance between entry and the USO.

REFERENCES

- Armstrong, Mark. 2002. "The Theory of Access Pricing and Interconnection." In *Handbook of Telecommunications Economics*, edited by Martin Cave, Sumit Majumdar, and Ingo Vogelsang. Amsterdam, Netherlands: North Holland.
- Awerbuch, Shimon and Alistair Preston. 2000. "Postal ABC: What are the Reasonable Expectations?" In *Current Directions in Postal Reform*, edited by Michael A. Crew and Paul R. Kleindorfer. Boston, MA: Kluwer Academic Publishers.
- Coase, Ronald H. 1937. "The Nature of the Firm." *Economica* 4:386-405.
- Cohen, Robert H., William W. Ferguson, John D. Waller, and Spyros S. Xenakis. 2000. "Universal Service without a Monopoly." In *Current Directions in Postal Reform*, edited by Michael A. Crew and Paul R. Kleindorfer. Boston, MA: Kluwer Academic Publishers.
- Crew, Michael A., and Paul R. Kleindorfer. 1991. "The Contributions of Roland Hill to Postal Economics." In *Competition and Innovation in Postal Services*, edited by Michael A. Crew and Paul R. Kleindorfer. Boston, MA: Kluwer Academic Publishers.
- Crew, Michael A., and Paul R. Kleindorfer. 1992. *The Economics of Postal Service*, Boston, MA: Kluwer Academic Publishers.
- Crew, Michael A., and Paul R. Kleindorfer. 1996. "Incentive Regulation in the United Kingdom and the United States: Some Lessons." *Journal of Regulatory Economics* 9 (May): 211-226.
- Crew, Michael A., and Paul R. Kleindorfer. 2000. "Liberalization and the Universal Service Obligation in Postal Service." In *Current Directions in Postal Reform*, edited by Michael A. Crew and Paul R. Kleindorfer. Boston, MA: Kluwer Academic Publishers.

- Crew, Michael A., and Paul R. Kleindorfer. 2001. "Whither the USO under Competitive Entry: A Microstructure Approach." In *Future Directions in Postal Reform*, edited by Michael A. Crew and Paul R. Kleindorfer. Boston, MA: Kluwer Academic Publishers.
- Crew, Michael A., and Paul R. Kleindorfer. 2003. "Postal Privatization: in General and for the United States Postal Service." In *Handbook on Privatization*, edited by David Parker and David Saal, London, U.K.: Edward Elgar, *forthcoming*.
- Crew, Michael A., Paul R. Kleindorfer and Marc A. Smith. 1997. "Peak Loads and Postal Services: Some Implications of Multi-Stage Production." In *Managing Change in The Postal and Delivery Industries*, edited by Michael Crew and Paul R. Kleindorfer. Boston, MA: Kluwer Academic Publishers.
- General Accounting Office. 2002. U.S. Postal Service: Deteriorating Financial Situation Increases Need For Transformation, GAO-02-355, February, Washington, DC.
- Kahn, Alfred E. 2001. *Whom the Gods Would Destroy or How Not to Deregulate*, AEI-Brookings Joint Center for Regulatory Studies, Washington, DC.
- Kolin, Marshall, and Edward J. Smith. 1999. "Mail Goes Where the Money Is: A Study of Rural Mail Delivery in the United States." In *Emerging Competition in Postal and Delivery Services*, edited by Michael A. Crew and Paul R. Kleindorfer. Boston, MA: Kluwer.
- Panzar, John C. 2003. "Reconciling Competition, Downstream Access, Universal Service in Postal Markets." In *Postal and Delivery Services: Delivering on the Competition*, edited by Michael A. Crew and Paul R. Kleindorfer. Boston, MA: Kluwer Academic Publishers.
- Postcomm. 2002. Postcomm's Proposals for Promoting Effective Competition in U.K. Postal Services. London, U.K.
- Rawnsley, David, and Nomi Lazar. 1999. "Managing the Universal Service Obligation." In *Emerging Competition in Postal and Delivery Services*, edited by Michael A. Crew and Paul R. Kleindorfer. Boston, MA: Kluwer Academic Publishers.
- Robinson, Alan. 2002. "Managing Decline in a Marketing Depression," unpublished manuscript, Direct Communications Group, Silver Spring, MD, March.
- Robinson, Alan, and David Rawnsley. 2002. "USPS Finances: Is there a financially viable future?" In *Postal and Delivery Services: Pricing, Productivity, Regulation and Strategy*, M. A. Crew and P. R. Kleindorfer. Boston, MA: Kluwer Academic Publishers.
- Roy, Bernard. 1999. "Technico-Economic Analysis of the Costs of Outside Work in Postal Delivery." In *Emerging Competition in Postal and Delivery Services*, edited by Michael A. Crew and Paul R. Kleindorfer. Boston, MA: Kluwer Academic Publishers.

APPENDIX: MODELING THE CONSEQUENCES OF ENTRY AND DOWNSTREAM ACCESS

A set of potential entrants, operating as a competitive fringe, compete for specific customers, providing both end-to-end service for those customers as well as consolidation and remailing through the incumbent PO. We assume that there is only one product, “letter mail.” Entrants provide end-to-end service for customer mail being delivered to low-cost areas and they also compete with the PO upstream in collecting and consolidating mail, which they re-mail through the PO for ultimate delivery. Clearly, the latter decision depends directly on the price the PO charges entrants for access to its delivery network for remailing.

We employ the following notation:

$y(\theta) = (y_L(\theta), y_H(\theta))$ = demand for entrants’ products by consumer θ for delivery zone L = low-cost and H = high-cost

$z(\theta) = (z_L(\theta), z_H(\theta))$ = demand for Incumbent’s product by consumer θ for delivery zone L = low-cost and H = high-cost

$Y = (Y_L, Y_H)$ = aggregate consumption of y

$Z = (Z_L, Z_H)$ = aggregate consumption of z

so that, for $k \in \{L, H\}$,

$$Y_k(P) = \int_{\theta} y_k(\theta) dF(\theta); \quad Z_k(P) = \int_{\theta} z_k(\theta) dF(\theta) \quad (1)$$

where

$dF(\theta)$ = number of consumers of type θ

Q_k = amount of mail from entrants’ customers destined for delivery zone $k \in \{L, H\}$ that is delivered by entrants, so $Y_k - Q_k$ = amount of mail from entrants’ customers destined for zone $k \in \{L, H\}$ that is remailed through the PO’s network for delivery by the PO; where, of course, $Q_k \leq Y_k$

$P = (P_{YL}, P_{YH}, P_Z, P_{AL}, P_{AH})$ = vector of end-to-end prices for products Y and Z and a vector of access prices, where

P_{Yk} = Price charged by entrants for end-to-end service to delivery zone $k \in \{L, H\}$

P_Z = Uniform price charged by the Incumbent for end-to-end service for either delivery zone

P_{Ak} = access price charged by Incumbent to entrants for use of downstream facilities and delivery in zone $k \in \{L, H\}$

C_{Uj} = cost per unit of upstream operations (consolidation, presorting, etc.) for firm $j \in \{E, I\}$, where E = entrants and I = Incumbent

C_a = cost per unit for entrants to access Incumbent's downstream facility, assumed to be borne by the Incumbent; we think of C_a as the unit cost of metering and accepting a unit of an entrant's product as it enters the Incumbent's downstream facilities

C_{Djk} = cost per unit for firm $j \in \{E, I\}$ for delivery in zone $k \in \{L, H\}$

F = fixed cost per period for the Incumbent to maintain downstream facilities and other non-volume variable obligations required by the USO

Consumers Choice Problem

We assume the products offered by entrants and the Incumbent are imperfect substitutes. Thus, demands $y(P, \theta)$ and $z(P, \theta)$ for consumer θ arise from the standard consumer maximization problem:

$$\text{Maximize } [V(y, z, \theta) - P_{Y_L} y_L - P_{Y_H} y_H - P_Z (z_L + z_H)] \quad (2)$$

where $V(y, z, \theta)$ is the willingness-to-pay of consumer θ and satisfies the usual concavity and differentiability properties. We assume that y and z are substitutes within the same delivery zone (i.e., y_L and z_L and y_H and z_H are substitutes), so that increases in the price of one lead to increases in demand for the other. However, we will assume throughout that demands for L and H zones are independent, for both the incumbent as well as entrants. Denote the demand functions derived from (1) as $y(P, \theta)$ and $z(P, \theta)$, with $Y_k(P)$ and $Z_k(P)$ defined through (1). These demand functions are easily seen to satisfy the usual properties.

Entrants Choice Problem

Profits for entrants Π_E are given as:

$$\Pi_E(P) = \sum_{k \in \{L, H\}} [(P_{Y_k} - C_{uE}) Y_k - C_{DEk} Q_k - P_{Ak} (Y_k - Q_k)] \quad (3)$$

where $Q_k \leq Y_k$ is required. Since we assume that entrants operate as a competitive fringe, prices will be driven down to least cost levels, i.e.

$$P_{Y_k} = \text{Min}[C_{UE} + C_{DEk}, C_{UE} + P_{Ak}], \quad k \in \{L, H\} \quad (4)$$

where $Q_k = 0$ if $C_{UE} + C_{DEk} > C_{UE} + P_{Ak}$ and $Q_k = Y_k$ otherwise, i.e.

$$Q_k(P) = Y_k(P) \varphi(P_{Ak} - C_{DEk}), \quad k \in \{L, H\} \quad (5)$$

where $\varphi(p)$ is the real-valued function satisfying $\varphi(p) = 0$ if $p \leq 0$ and $\varphi(p) = 1$ if $p > 0$. The reader can verify that at the prices and quantities defined by (4)-(5), $\Pi_E(P) = 0$, as required for the competitive fringe.

Incumbent Choice Problem

The Incumbent's profits $\Pi_I(P)$ are given by

$$\begin{aligned} \Pi_I(P) = & \sum_{k \in \{L, H\}} (P_Z - C_{UI} - C_{DIk}) Z_k(P) \\ & + \sum_{k \in \{L, H\}} (P_{Ak} - C_a - C_{DIk}) (Y_k(P) - Q_k(P)) - F \end{aligned} \quad (6)$$

The first term in (6) represents gross profit derived from end-to-end services of the incumbent's products (Z_L and Z_H), and the second term in (6) represents gross revenues from downstream access products offered to entrants. Notice that the latter are reduced by the metering and acceptance costs C_a , which are assumed here to be incurred by the incumbent and paid for in the access prices P_{Ak} .

Let us now consider the Ramsey-optimal prices for this problem. These are obtained from maximizing the traditional welfare function, subject to $\Pi_I(P) \geq 0$, as determined by (6). Thus:

Ramsey Problem

$$\begin{aligned} \text{Maximize } W(P) = & \int_{\theta} V(y(P, \theta), z(P, \theta), \theta) dF(\theta) \\ & - \sum_k [(C_{UI} + C_{DIk}) Z_k(P) + (C_a + C_{DIk}) (Y_k(P) - Q_k(P))] - F \quad (7) \\ & - \sum_k [C_{UE} Y_k(P) + C_{DEk} Q_k(P)] \end{aligned}$$

subject to: $\Pi_I(P) \geq 0$

The Ramsey solution to the above problems is derived in the usual manner (see, e.g., Crew and Kleindorfer (1986), Chapter 2). This yields in the present a number of sub-cases of interest, as noted below. Each of these are obtained by substituting for $Q_k(P)$ the appropriate expression from (5) (where, in each instance, the Ramsey number $r = \lambda/(1+\lambda)$, with $\lambda \geq 0$ the

Lagrange multiplier on the profit constraint) and deriving the first-order conditions (FOCs) for the resulting problem.

(i) Ramsey Prices when $P_{Ak} > C_{DEk}$, $k \in \{L, H\}$

In this case, $Q_k = Y_k$ for $k \in \{L, H\}$. Access price is so high that entrants find it cheaper to deliver all mail themselves, even in the high-cost delivery zones. Under these circumstances, $P_{Yk} = C_{UE} + C_{DEk}$, for $k \in \{L, H\}$, and the only price that matters in the Ramsey problem is P_Z . The resulting FOC characterizing the solution to (6)-(7) is:

$$\sum_{k \in \{L, H\}} (P_Z - C_{UI} - C_{DIk}) \frac{\partial Z_k}{\partial P_Z} = -rZ(P) \quad (8)$$

which is the standard Ramsey result for a uniformly priced joint product. Together with the zero-profit condition $\Pi_i(P) = 0$, (8) determines the optimal price P_Z and the optimal value of the Ramsey number r . One may inquire as to when case (i) could occur in practice. This might be the case when the cost C_a of accepting mail from entrants is very high, as well as when the fixed costs of the USO are high and entrants are relatively efficient in delivering mail in both L and H zones.

(ii) Ramsey Prices when $P_{AL} < C_{DEL}$ and $P_{AH} > C_{DEH}$

In this case, $Q_L = 0$ and $Q_H = Y_H$. Substituting for Q_k in (6)-(7), and noting in this case that $P_{YL} = C_{UE} + P_{AL}$, so that $\partial Y_k / \partial P_{YL} = \partial Y_k / \partial P_{AL}$, we obtain the following two FOCs for the two prices of interest (P_Z and $P_{AL} = P_{YL} - C_{UE}$):

$$\begin{aligned} & (P_{YL} - C_{UE} - C_a - C_{DIL}) \frac{\partial Y_L}{\partial P_Z} \\ & + \sum_{k \in \{L, H\}} (P_Z - C_{UI} - C_{DIk}) \frac{\partial Z_k}{\partial P_Z} = -rZ(P) \end{aligned} \quad (9)$$

$$\begin{aligned} & (P_{YL} - C_{UE} - C_a - C_{DIL}) \frac{\partial Y_L}{\partial P_{YL}} \\ & + (P_Z - C_{UI} - C_{DIL}) \frac{\partial Z_L}{\partial P_{YL}} = -rY_L(P) \end{aligned} \quad (10)$$

Together with the zero-profit condition $\Pi_i(P) = 0$, (9)-(10) determine the optimal prices P_Z and $P_{AL} = P_{YL} - C_{UE}$ and the optimal value of the Ramsey number r . Note that $P_{YH} = C_{UE} + C_{DEH}$ in this case. Note also that in deriving (10) we have used the independence of demands across zones so that, in particular, $\partial Z_H / \partial P_{YL} = 0$.

One would expect case (ii) to result if entrants enjoyed advantages in high-cost areas and disadvantages in low-cost areas, relative to the incumbent. This would seem to be a relatively unusual case in practice.

(iii) Ramsey Prices when $P_{AL} > C_{DEL}$ and $P_{AH} < C_{DEH}$

In this case, $Q_L = Y_L$ and $Q_H = 0$. Thus, here we have the expected case in which entrants use the PO's network for high-cost deliveries, but use their own network for low-cost deliveries. Substituting for Q_k in (6)-(7), and noting in this case that $P_{YH} = C_{UE} + P_{AH}$, so that $\partial Y_k / \partial P_{YH} = \partial Y_k / \partial P_{AH}$, we obtain the following two FOCs for the two prices of interest (P_Z and $P_{AH} = P_{YH} - C_{UE}$):

$$\begin{aligned} & (P_{YH} - C_{UE} - C_a - C_{DIH}) \frac{\partial Y_H}{\partial P_Z} \\ & + \sum_{k \in \{L, H\}} (P_Z - C_{UI} - C_{DIk}) \frac{\partial Z_k}{\partial P_Z} = -rZ(P) \end{aligned} \quad (11)$$

$$\begin{aligned} & (P_{YH} - C_{UE} - C_a - C_{DIH}) \frac{\partial Y_H}{\partial P_{YH}} \\ & + (P_Z - C_{UI} - C_{DIH}) \frac{\partial Z_H}{\partial P_{YH}} = -rY_H(P) \end{aligned} \quad (12)$$

Together with the zero-profit condition $\Pi_i(P) = 0$, (11)-(12) determine the optimal prices P_Z and $P_{AH} = P_{YH} - C_{UE}$ and the optimal value of the Ramsey number r . Note that $P_{YL} = C_{UE} + C_{DEL}$ in this case. Note also that in deriving (12) we have used the independence of demands across zones so that, in particular, $\partial Z_L / \partial P_{YH} = 0$.

One would expect case (iii) to result if entrants enjoyed advantages in low-cost areas and disadvantages in high-cost areas, relative to the incumbent.

(iv) Ramsey Prices when $P_{Ak} < C_{DEk}$, $k \in \{L, H\}$

Finally, consider the case in which access is priced sufficiently low relative to entrants' downstream delivery costs that entrants only consolidate and presort but do no final delivery. In this case, the Ramsey problem must solve for the entire price vector, P_Z , P_{AL} and P_{AH} , where resulting prices in the entrant sector are then competed down to $P_{Yk} = C_{UE} + P_{Ak}$, $k \in \{L, H\}$. Noting in this case that $Q_k(P) = 0$, $k \in \{L, H\}$, the FOCs for (6)-(7) can be written as:

$$\begin{aligned} \sum_{k \in \{L, H\}} (P_{Yk} - C_{UE} - C_a - C_{DIk}) \frac{\partial Y_k}{\partial P_Z} \\ + \sum_{k \in \{L, H\}} (P_Z - C_{UI} - C_{DIk}) \frac{\partial Z_k}{\partial P_Z} = -rZ(P) \end{aligned} \quad (13)$$

$$\begin{aligned} (P_{YL} - C_{UE} - C_a - C_{DIL}) \frac{\partial Y_L}{\partial P_{YL}} \\ + (P_Z - C_{UI} - C_{DIL}) \frac{\partial Z_L}{\partial P_{YL}} = -rY_L(P) \end{aligned} \quad (14)$$

$$\begin{aligned} (P_{YH} - C_{UE} - C_a - C_{DIH}) \frac{\partial Y_H}{\partial P_{YH}} \\ + (P_Z - C_{UI} - C_{DIH}) \frac{\partial Z_H}{\partial P_{YH}} = -rY_H(P) \end{aligned} \quad (15)$$

While in general it is not possible to rule out any of the above cases at the Ramsey optimum, one thing should be clear immediately. This is the simple fact that the usual procedure of providing uniform discounts to entrants for mail redeposited with the PO, irrespective of the destination of this mail, is non-optimal. This procedure is usually justified on the basis of logic based on "avoided cost" or the "Efficient Component Pricing Rule" and essentially is based on a logic giving credit to the entrant for work the entrant spares the PO. The correct logic, however, is to base downstream access prices not on the work saved the PO but on the work yet to be performed downstream. Note that requiring that the presort and consolidation discounts $P_Z - P_{AL}$ and $P_Z - P_{AH}$ should be equal implies that $P_{AL} = P_{AH}$ must be equal. But this is almost certainly not the case at the Ramsey optimum. In any case, imposing such a constraint on the optimization problem (6)-(7) can only reduce overall efficiency.

Indeed, it seems intuitive that $P_{AH} > P_{AL}$ at any Ramsey optimum since the costs of providing access downstream are more costly for H mail than for L mail. To see why this is the case, consider each of the case (i)-(iv) above. In case (i), we may assume without loss of generality that $P_{AH} > P_{AL}$ since the relative prices of access for L and H are not relevant in the range considered (access is too expensive in any case for entrants to use for either zone, e.g., setting $P_{Ak} = C_{DEk}$ satisfies the required ordering). In case (ii), we see directly from the assumptions of this case that:

$$P_{AH} > C_{DEH} > C_{DEL} > P_{AL}$$

where the second inequality follows from the definition of high and low-cost areas. In case (iii), we may assume without loss of generality that $P_{AL} = C_{DEL}$ (which is still at the boundary at which no entrant would use the services of the PO for downstream access). Let us further assume that $C_{DIH} > C_{DEL}$ (so that the incumbent's cost in the H zone is greater than entrants' cost in the L zone). Then from the assumptions of case (iii),

$$C_{DEH} > P_{AH} \geq C_a + C_{DIH} > C_{DEL} = P_{AL}$$

Finally, in case (iv), as noted $P_{Ak} = P_{Yk} - C_{UE}$, for $k \in \{L, H\}$, so that $P_{AH} > P_{AL}$ would follow directly from $P_{YH} > P_{YL}$. But noting that the unit costs in (14)-(15) for units of Y_H are greater than for Y_L (i.e., $C_{UE} + C_a + C_{DIH} > C_{UE} + C_a + C_{DIL}$), we see that unless Y_L is significantly more inelastic than Y_H , the normal logic of the multi-product Ramsey problem implies that $P_{YH} > P_{YL}$. We see from these arguments that as long as $C_{DIH} > C_{DIL}$, $C_{DEH} > C_{DEL}$ and $C_{DIH} > C_{DEL}$, and there exist no substantial elasticity differences between H and L products for entrants, then we must have $P_{AH} > P_{AL}$ at the Ramsey optimum.

Note also that the above logic applies equally to the existence of a solution as well as to its optimality. Imposing the additional constraint of equal access prices for both L and H delivery zones could destroy the possibility of a solution when one exists in the absence of such additional restrictions. This is especially intuitive in the present context since imposing equal access tariffs will reduce the access tariff of the H zone, increase the access tariff of the L zone and lead to an obvious increase in the difficulty of meeting the zero profit constraint, i.e. to the necessity of increasing the uniform price P_Z as well. Thus, the possibility of a graveyard spiral (no feasible solution to (6)-(7)) is increased when equal access tariffs are imposed on this problem.

We can summarize this analysis by noting that the logic embodied in each of the four cases above is this: Entrants should not be given a discount

for downstream access based on what they have performed in upstream work bypassed, but rather on the basis of the cost of accomplishing remaining work in the postal value chain required by the mail they redeposit for delivery by the PO. Notice that this departs markedly from the usual avoided cost or ECPR logic and the reason is simple. When different costs arise downstream in providing delivery for different mail products, these must be reflected in efficient access prices. To do otherwise would be essentially to subsidize entrants for their customers' mail destined for the high-cost delivery zones. Doing so clearly reduces efficiency and it may lead to a graveyard spiral when the optimal (unequal) access tariffs would allow the PO to continue to meet its USO.

Illustrative Numerical Examples

Let us finally illustrate the above discussion with some numerical results. Concerning the cost structure, we investigate several scenarios that build on the following cost parameters:

Table 2: Cost Parameters

| | Low-Cost Values | High-Cost Values |
|-----------|-----------------|------------------|
| C_{UE} | 4 | 4 |
| C_{UI} | 6 | 6 |
| C_a | 1 | 1 |
| C_{DIL} | 15 | 15 |
| C_{DIH} | 30 | 50 |
| C_{DEL} | 13 | 18 |
| C_{DEH} | 60 | 60 |
| F | 200 | 400 |

Concerning demand, we assume a single representative consumer with the following structure for the WTP function $V(y, z, \theta) = V(Y, Z)$ in (2):

$$V(Y, Z) = \sum_{k \in \{L, H\}} V(Y_k, Z_k, k) \quad (16)$$

where, for $k \in \{L, H\}$,

$$V(Y_k, Z_k, k) = a_k Y_k^2 + b_k Z_k^2 + c_k Y_k Z_k + d_k Y_k + e_k Z_k \quad (17)$$

where $a_k < 0$, $b_k < 0$, $c_k < 0$, $d_k > 0$, $e_k > 0$. Taking FOCs implied by (2) and inverting the resulting linear system then gives rise to the following linear demand structure (which because of the separability of the WTP function

$V(Y, Z)$ in (16) is independent across postal products for the L and H delivery zones, but with imperfect substitution between the Entrants and Incumbent products within each zone):

$$Y_k = A_{Yk} - B_{Yk}P_{Yk} + C_kP_{Zk}, \quad k \in \{L, H\} \tag{18}$$

$$Z_k = A_{Zk} - B_{Zk}P_{Zk} + C_kP_{Yk}, \quad k \in \{L, H\} \tag{19}$$

The results reported below are for the WTP parameters and corresponding demand structure shown in the Tables 3-4 below. The demand functions in Table 4 are illustrated at the price vector $P = (P_{YL}, P_{YH}, P_Z, P_{AL}, P_{AH}) = (17.0, 34.1, 30.1, 13.1, 30.1)$, which is the welfare-optimal price vector for the low-cost parameters given in Table 2 above.

Table 3: WTP Parameters for the WTP Structure (17)

| Low-Cost Zone WTP Parameters | High-Cost Zone WTP Parameters |
|------------------------------|-------------------------------|
| $a_L = -6$ | $a_H = -3$ |
| $b_L = -8$ | $b_H = -6$ |
| $c_L = -1$ | $c_H = -1$ |
| $d_L = 100$ | $d_H = 60$ |
| $e_L = 300$ | $e_H = 120$ |

Table 4: Demand Functions for the Demand Functions (18)-(19)

Demand Functions Evaluated at

$P = (P_{YL}, P_{YH}, P_Z, P_{AL}, P_{AH}) = (17.0, 34.1, 30.1, 13.1, 30.1)$

| Entrants Demand | | Incumbent Demand | |
|------------------|------------------|-------------------|------------------|
| Low-Cost Zone | High-Cost Zone | Low-Cost Zone | High-Cost Zone |
| $A_{YL} = 6.806$ | $A_{YH} = 8.451$ | $A_{ZL} = 18.325$ | $A_{ZH} = 9.296$ |
| $B_{YL} = 0.084$ | $B_{YH} = 0.169$ | $B_{ZL} = 0.063$ | $B_{ZH} = 0.085$ |
| $C_{YL} = 0.005$ | $C_{YH} = 0.014$ | $C_{ZL} = 0.005$ | $C_{ZH} = 0.014$ |
| $Y_L = 5.539$ | $Y_H = 3.120$ | $Z_L = 16.526$ | $Z_H = 7.236$ |

We report results in Figures 1-4 below for a range of scenarios, all of which build on the above parameters. For all cases reported, we assume $C_{UE}, C_{UI}, C_a, C_{DIL}$ and C_{DEH} as shown in Table 2 are fixed. The remaining

cost parameters are varied to cover “low” and “high” cost cases as reflected in column 1 or 2 of Table 2. We note in passing that the Ramsey-optimal price PAL in Figures 1-2 can be any price larger than C_{DEL} (and not just the value shown on these Figures); that is, any price that assures that the more efficient Entrants will deliver their own mail to low-cost areas is equally efficient.

The reader will note from these Figures that the welfare-optimal prices typically exceed the avoided cost/ECPR price $P_Z - C_{UI} + C_a$. This is especially important for high fixed cost and large differences between low-cost and high-cost delivery (as seen in Figures 2-4). We examined the welfare consequences of several rules besides the Ramsey rule. These included the following:

Avoided Cost/ECPR Rule: Maximize $W(P)$ subject to Breakeven Profit Constraint and subject further to access prices being determined by $P_{Ak} = P_Z - C_{UI} + C_a$ for $k \in \{L, H\}$. This amounts to finding the lowest first-class letter rate P_Z for which breakeven operations are possible, with access prices determined by the avoided cost rule.

Approximate Delivery-Zone Access Prices: Maximize $W(P)$ subject to Breakeven Profit Constraint and subject further to access prices being set according to the approximate rule (DAP) described in the Text, namely:

$$P_{Ak} = \text{Min}[\text{Max}[P_Z - C_{UI} + C_a, C_{DIk}], P_Z] \quad (20)$$

The Avoided Cost/ECPR Rule suffered only minor efficiency losses except in the case where USO fixed costs were high and there were significant differences between CDIL and CDIH. Of course, this case is likely to be the typical case in practice. By contrast, the Approximate DAP rule in (20) did uniformly well across all scenarios with welfare losses never greater than 0.1 % of the Ramsey optimal. Of course, these are only illustrative numerical examples and more realistic situations might yield different conclusions. But the logic of the argument here and these results suggest that the DAP rule is a reasonable approach to avoiding subsidies to inefficient entrants and is, in any case, clearly welfare superior to the avoided cost rule.



