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1. INTRODUCTION

Postal letters are a means of communication between two parties with at least one of them having a positive willingness to pay. Postal operators offer a service that exploits this willingness to pay. Interestingly, virtually all postal operators apply a pre-paid mechanism that goes back on Rowland Hill's proposal of charging only the sender-side of the market instead of the receivers too. This involves the potential for senders to bill the postage onward to the receivers, which varies between the various classes of mail and is essentially determined by the bargaining position between the two communicating parties. Postage for advertising mail remains on the sender-side, while postage in commercial relationships is usually – directly or indirectly – passed on to the receivers. E.g., Swiss banks increasingly bill postage for bank statements directly to their clients (i.e. the receivers).¹

The fact that mail consists of two parties communicating with each other over a choice of platforms (postal operators) makes the postal market potentially two-sided. If this two-sided market is served by only one operator (the current situation in most countries), the designated postal operator has the necessary bargaining power to choose the pricing mechanism of its choice (sender pays, receiver pays, or a mix between the two). In a second step, senders and receivers are able to reallocate postage by various means, such as billing surcharges as in the case of bank statements mentioned above. In competitive markets, two effects could potentially lead to different optimal pricing principles: (a) the historical operator loses its market power on the sender side because of competing networks, and (b) receivers get bargaining power in terms of whom to give the right to operate their P.O. box. The latter effect could in principle yield a situation where large receivers prefer P.O. boxes over mail boxes as the former gives them the possibility to exact better service or pricing arrangements, based on their size, and to allow access to their address exclusively to a specific operator.

In our contribution, we analyze whether the traditional pricing concept (sender pays principle) remains dominant in competitive postal markets. We divide the competitive postal market into a processing and delivery part,

^{*} The views expressed are those of the authors.

where a postal operator faces two kinds of customers: senders in the former and receivers in the latter part of the market. Based on the contributions by Laffont, Rey and Tirole (1998), Rochet and Tirole (2003), Armstrong (2006), and Panzar (2006) we develop a theoretical model with consumers' platform choice between two operators competing in linear upstream and two-part downstream prices and being interconnected by a symmetric access regime to P.O. boxes. Thereby, we extend the analysis of a delivery flat rate by Felisberto et al. (2006) and Friedli et al. (2006) to a competitive environment and assess optimum pricing schemes in market equilibrium.

The paper is structured as follows. Section 2 discusses the background on the theory of two-sided markets and its relevance for postal markets. Section 3 presents the model outline. Section 4 provides a rough calibration of the model and presents the derived optimal pricing structure for the two-sided P.O. box market. We conclude in Section 5.

2. BACKGROUND ON TWO-SIDED MARKETS

In two-sided markets, platforms enable the interaction of two or more groups of agents, where the surplus of one group of agents depends on the number of users connected to the platform on the other side (Armstrong 2006). Real world examples of such two-sided markets with multiple platforms include many internet applications, the credit card industry, radio or television broadcasting, peer-to-peer networks, computer operating systems, or telecommunication networks. A precise *definition of a two-sided market* is given by Rochet and Tirole (2005) and depends mainly on its pricing properties:

'Consider a platform charging per-interaction charges a_B and a_S to the buyer and the seller sides. The Market for interactions between the two sides is one-sided if the volume V of transactions realized on the platform depends only on the aggregate price level $\alpha = a_B + a_S$, i.e. is insensitive to reallocations of this price between the buyer and the seller. If by contrast V varies with a_B while α is kept constant, the market is said to be two-sided.'

Hence, postal services would not satisfy the definition of two-sided markets, if mail demand remained the same in case postage was charged to receivers instead of senders.

Two-sided markets are linked closely to *network externalities*.² Rochet and Tirole (2003) note, 'many if not most markets with network externalities are two-sided'. Armstrong (2006) even includes (cross) network externalities in his definition of two-sided markets: the number of subscribers of one group increases the surplus of the other one. Consequently, for virtually any (two-sided) platform, attaining the critical mass on both sides of the market

is the core of the business with pricing being one of the most crucial success factors to overcome the chicken-and-egg problem involved when setting up a new platform. From this point of view, two-sided markets can be seen as the subset of markets with network externalities, where the allocation of prices among the various groups of agents affects the degree of exploitation of those externalities. This, in turn, is the case if the platforms pricing policy cannot be offset by private redistribution between the various groups of agents. In postal markets, for example, where postage predominantly is prepaid by the senders, often receivers finally pay the postage, as senders bill it onwards (e.g. distance selling). Hence, it is not a priori clear, if the postal market is two-sided.

Pricing structures in two-sided markets

In two-sided markets, we often observe pricing structures in which one side (one group of agents) heavily cross-subsidizes the other side of the market. Internet search engines provide their core business (searching the internet) free, radio and TV channels are free of charge, and credit card holders even get fringe benefits for the frequent use of their card. **Table 1** provides an overview of pricing structures in selected two-sided industries.

At a first glance, the cross-subsidization is astonishing as both sides in each of those markets derive a positive utility of the platform and thus in principle would have a positive willingness to pay. Yet, those pricing policies persist even in mature markets, and it appears dominant in competitive two-sided markets not to exploit the willingness to pay on one side of the market.

Table 1: Overview of pricing structures in two-sided markets

	Credit Card	Search engine	Electronic Document viewing	Mobile	Direct Mail
Side 1: Originator	Payer (Buyer)	Searcher	Reader	Caller	Sender (Advertiser)
Pricing	Small or zero subscriber fee, fringes with use	Free	Free (zero license charge for adobe reader)	Per minute, subscriber fee	Per peace charge
Platform (Examples)	American Express, Visa, MasterCard	Google, Yahoo!	Adobe Writer and Reader	Mobile networks	Postal operators
Side 2: Enabler	Payee (Seller)	Content provider / Advertiser	Content providers	Receiver	Receiver
Pricing	Subscriber fee, % of transaction amount,	Price per hit	Licensing costs	Mostly free , subscriber fee	Free

In general, cross-subsidization aims at establishing a consumer base that as a whole can be made available to a group of individual commercial agents aiming to sell products to this consumer base. Thus, most two-sided markets are in effect intermediaries that derive their economic value by reducing transaction costs or information asymmetries (mostly between sellers and potential buyers). To get the critical mass and resolving the typical chicken-and-egg problem, the dominant strategy appears to heavily cross-subsidize one group of agents either directly (low, zero or even negative price) or indirectly through tying a valuable product (free internet query, free radio broadcasting) with a product establishing negative network externalities (advertisement).

Very close to the latter interpretation and related to the formal resolution of two-sided market models, two-sided markets can be seen as ordinary markets with the product being the provision of a client base which exhibits acquiring expenses equaling the loss on a second product offered to that client base. Thereby, acquiring takes place indirectly by offering a valuable, subsidized service (free internet query). In most of the cases, this valuable product inhibits substantial economies of scale (and only indirect network externalities over the other side of the market) which in turn reduce acquiring cost per client, whereas the marginal indirect revenue remains constant. Consequently, two-sided markets are heavily concentrated.

Two-sidedness of the postal market

We now turn to the important question whether postal markets are two-sided markets according to the definition of Rochet and Tirole (2005) cited above. Today, in most postal markets it is secured that any address is connected to the postal network by means of the “Universal Service Obligation” that obliges at least one postal network to provide “universal access” for universal services such as letters and parcels and to deliver that service to any address throughout the country. Thus, by regulation, network externalities are secured. Additionally, universal providers are – for example in Switzerland – by law not allowed to charge the receiver’s for connecting them to net network. Even New Zealand, where the postal market is since a decade fully liberalized and Universal Service was reduced to its basics, forbids in its “deed of understanding” with New Zealand Post a “rural delivery fee” aimed at residents in remote areas. Those universal service definitions indicate that senders exhibit a positive network externality if everybody is connected to the postal network.

However, it is not yet clear whether total demand is affected by a change in the pricing structure, for example if postage was to be paid by receivers

too as it was the case before the reform of Rowland Hill. History on the reform of Rowland Hill reveals that demand virtually exploded after the change in the price structure towards 'sender pays it all'. Thus, we have a first indication of the two-sidedness of the postal market.

Research by Felisberto et al. (2006) on the receiver pays principle in the postal sector analyzes the effects of the introduction of a delivery flat rate, where receivers are given the choice between free P.O. box delivery and costly last mile doorstep delivery (in the form of a yearly flat rate).³ This would enable a monopolistic platform to reduce senders' tariffs. By exclusion of a rebalancing between the two groups of agents behind the scenes and by assumption that P.O. box switchers originate the same amount of mail as before, positive demand effects were found.

More recent research by Friedli et al. (2006) on the delivery flat rate indicates that up to 35% of the customers switching to P.O. box delivery would not anymore empty their mailbox. This would cause a significant drop in mail volumes. This survey points towards the presence of two-sidedness in the postal market.

A similar argument is the following. If the receiver was about to pay, the sender has no guarantee that the receiver accepts the mail (for example, paying postage for accepting unwanted direct mailings). Receivers would most probably reject unwanted mail, which in turn postal operators would send back to the senders by charging them accordingly. This would reduce response rates clearly and reduce the amount of direct mail sent as observed in Chile.

A contrary argument might be that most senders of transactional mail bill their postage onwards to the receivers. Thereby, single piece tariffs instead of (lower) business customer tariffs are charged. Thus, receivers' perceived cost might reduce if postal operators would bill the postage directly to them (positive demand effect).

We conclude that there exists large evidence that postal markets indeed are two-sided. This was first recognized by Panzar (2006). Our main contribution to the literature is the formalization of a competitive two-sided postal market, which we calibrate to yield robust results on optimal pricing strategies.

3. THE TWO-SIDED POSTAL MARKET MODEL

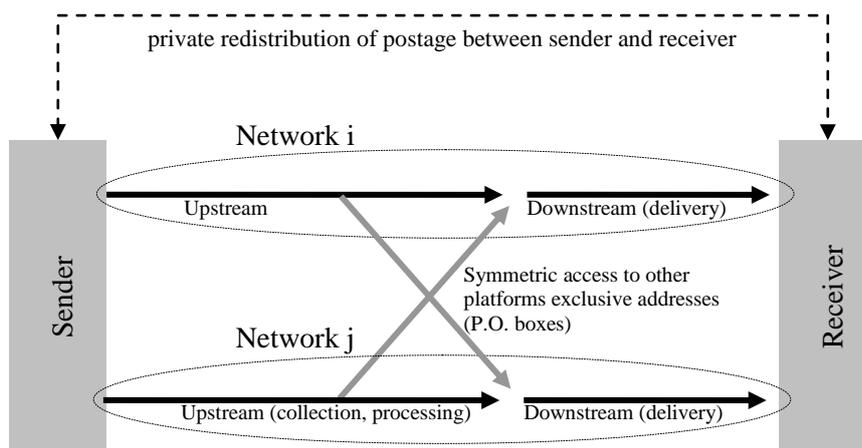
Our two-sided postal market model consists of two groups of agents, namely senders and receivers of mail, and two platforms (postal operators) linking the senders and the receivers. Senders choose over whom to hand over their mail, whereas receivers have the possibility to grant special delivery rights to one of the two operators.⁴ The assumption of special rights

involves the necessity of interconnection of the two operators; In order to offer end-to-end service to her sender, a postal operator needs access to the other's delivery network. Otherwise, an operator would not be able to reach P.O. box addresses operated by the other one. We are primarily interested, how different interconnection rates affect the platforms pricing strategies, thus we treat access prices as exogenous and provide sensitivity analysis in Section 4. For simplicity reasons, we assume reciprocal access pricing.

Thus, there are two sides in the postal market: Upstream, postal operators compete for sending customers; downstream, they compete for receiving customers. We follow Laffont, Rey and Tirole (1998) in the modeling of network competition and link the postal upstream market on the sender's side to a downstream market for local delivery monopolies.

In our model, total mail demand is a function of the sum of the sender's price p_u and the receiver's price p_d per item. Total volume is determined by the sender primarily, but we assume that through private redistribution (as observed in practice) the receiver influences the sender's communication channel and vice versa. We include the possibility that the operators' optimal behavior leads to an interdependence of these prices and a delivery flat rate, such that total volume is sensitive to reallocations of the total price. Hence, the model qualifies as a two-sided market (with multihoming). **Figure 1** provides a graphical representation of the model outline.

Figure 1: Model outline



As opposed to e.g. the telecommunications market, the two user bases (senders, receivers) are not necessarily linked together: A subscriber for delivery services with one operator does not predetermine the operator

choice when sending a letter (P.O. box holders can still send the mail with other carriers). However, downstream market share affect both cost structure and downstream income, which determines competitive behavior upstream.

In both parts of the market, consumers can chose between two competing networks i and j , which are differentiated à la Hotelling. Given income y , constant utility v from subscription to the network, and mail consumption q , a consumer (sender / receiver) located at x and joining network i has utility

$$U = y + v - t_m |x - x_i| + u(q).$$

We assume that consumers are uniformly distributed over the interval $[0,1]$ and the two networks are located at the extremes. t_m is a market-specific parameter for the substitutability of the two competing networks and determines the degree of disutility a sender perceives from the network offering services that do not exactly meet the senders preference x . Thus, a consumer located at $x = 0.5$ is just about equally dissatisfied by the two operators i and j located at $x_i = 0$ and $x_j = 1$ and finds herself indifferent. Following Laffont, Rey and Tirole (1998) we define quantity-dependent sender utility $u_s(q)$ by

$$u_s(q) = \beta^{\frac{1}{\eta}} \frac{q^{1-\frac{1}{\eta}}}{1-\frac{1}{\eta}}.$$

We allow for *redistribution* of tariffs between senders and receivers by specifying the total quantity as a function both of the senders price p_u and the receivers price p_d . If for example a bank client orders the monthly bank statement knowing that the postage will be charged on her bank account, receivers generate the mail, and the senders price still affects mail volumes although they do not actually pay for it. Similarly, if the client were charged a reception fee, this would again affect senders demand. Hence, sender's utility maximization yields total demand

$$q = \beta \cdot (p_{u,i} + \zeta p_{d,i})^{-\eta}$$

with constant price elasticity of demand $-\eta$. ζ reflects to what *degree* customers can redistribute postage by means of private negotiation and hence, to what degree senders take into account the receiver price. With ζ close to 0, senders' demand is independent of the receiver price (resulting from the lack of negotiation between senders and receivers). $\zeta = 1$ yields a situation where the mail originating party maximizes over the aggregate

variable price level, irrespective of the tariff structure. However, the market still qualifies the two-sided markets property as long as the fixed downstream reception fee P_d is nonzero (in the literature referred to as “delivery flat rate”). For $P_d = 0$, senders and receivers would be able to redistribute (pass through) charges behind the scene completely to the very same level irrespective of the operators’ pricing strategies.

The total cost for end-to-end postal service consists of a fixed part f_m in both the upstream ($m=u$) and downstream markets ($m=d$) and quantity-dependent variable cost c_m :

$$C = f_u + f_d + q \cdot (c_u + c_d).$$

The operators’ profit functions are then given by

$$\pi_i = \max_{p_{u,i}, p_{d,i}, P_{d,i}} \left\{ \begin{array}{l} \alpha_{u,i} \alpha_{d,i} [(p_{u,i} + p_{d,i} - c_{u,i} - c_{d,i})q(p_{u,i} + \zeta p_{d,i}) - f_u - f_d + P_{d,i}] \\ + \alpha_{u,i} (1 - \alpha_{d,i}) [(p_{u,i} - a - c_{u,i})q(p_{u,i} + \zeta p_{d,i}) - f_u] \\ + (1 - \alpha_{u,j}) \alpha_{d,i} [(p_{d,i} + a - c_{d,i})q(p_{u,j} + \zeta p_{d,i}) - f_d + P_{d,i}] \end{array} \right\}, \quad (1)$$

where $\alpha_{m,i}$ is market share of operator i in market m . Hence, a postal operator’s profit consists of three parts: The first part is due to letters she processes end-to-end. The second and the third ones relate to mails which originate in the own network and which are delivered through the other operator’s network, and vice versa.

To solve the model, we derive the competitive outcome in the two sides of the postal market consecutively. Thereby, the model is solved backwards in order to find subgame perfect equilibria. In a first step, we analyze upstream competition in non-discriminatory linear tariffs, where the two networks compete for senders and yield optimal prices and market share in the upstream market as a function of equilibrium downstream prices and market shares. In a second step, we derive optimal two-part pricing structures⁵ of the downstream market, i.e. competition for P.O. box subscribers.

We focus on parameter constellations, in which there exist unique and symmetric equilibria in both the upstream and downstream markets (cf. Laffont, Rey and Tirole, 1998, propositions 1 and 7).

Upstream competition in non-discriminatory linear tariffs

We start our analysis with upstream competition, where postal operators compete for quantity. At that stage, downstream prices p_d^* , P_d^* and market shares α_d^* are given from downstream competition and are symmetric. Under the assumption of uniform and non-discriminatory pricing (i.e. the postal

operator is not able to discriminate mail by destination), the sender's net surplus in the upstream market is

$$v_u(p_u, p_d^*) = \max_{q_u} \{u_u(q) - (p_u + \zeta p_d^*)q\} = \beta \frac{(p_u + \zeta p_d^*)^{-(\eta-1)}}{\eta-1}.$$

Operator i 's market share is therefore

$$\alpha_{u,i} = \alpha_{u,i}(p_{u,i}, p_{u,j}) \equiv \frac{1}{2} + \sigma_u [v_u(p_{u,i}, p_d^*) - v_u(p_{u,j}, p_d^*)]$$

where $\sigma_u \equiv \frac{1}{2\eta}$ is an index of substitutability resulting from the differentiated location of the senders and the operators.

In symmetric equilibrium, we have $\alpha_{d,i}^* = \alpha_{u,i}^* = 0.5$, $p_{u,i}^* = p_{u,j}^* = p_u^*$ and $p_{d,i}^* = p_{d,j}^* = p_d^*$. The first-order condition of (1) with respect to p_u is

$$\begin{aligned} & \frac{1}{4} [(p_u + p_d^* - c_u - c_d)q' + q] + \frac{1}{2} \frac{\partial \alpha_{u,i}}{\partial p_u} [(p_u + p_d^* - c_u - c_d)q(p_u, p_d^*) - f_u - f_d + P_{d,i}^*] \\ & + \frac{1}{4} [(p_u - a - c_u)q' + q] + \frac{1}{2} \frac{\partial \alpha_{u,i}}{\partial p_u} [(p_u - a - c_u)q(p_u, p_d^*) - f_u] \\ & + \frac{1}{4} [(p_d^* + a - c_d)q' + q] - \frac{1}{2} \frac{\partial \alpha_{u,i}}{\partial p_u} [(p_d^* + a - c_d)q(p_u, p_d^*) - f_u] = 0. \end{aligned}$$

Note that a unit increase in price lowers market share by σ_u times quantity per customer: $\partial \alpha_{u,i} / \partial p_{u,i} = -\sigma_u q$ and a unit loss of market share leads to the loss of the per-customer profit. In analogy to equation (8) in Laffont, Rey and Tirole (1998), the first-order condition can be rewritten as

$$\frac{p_u^* - \kappa}{p_u^*} = \frac{1}{\eta} \left[I - 2\sigma_u \pi(p_u^*, p_d^*, P_d^*) \right],$$

where $\kappa = c_u + \frac{a + c_d - p_d^*}{2}$ is perceived direct marginal cost and

$$\pi(p_u, p_d, P_d) = \frac{1}{2} [(p_u + p_d - c_u - c_d)q(p_u, p_d) - f_u - f_d + P_d]$$

is per-customer profit when the two networks charge identical prices.

Downstream competition in two-part tariffs

In upstream competition, downstream prices p_d^* , P_d^* and market shares α_d^* have been taken as given. They are determined in downstream competition, where postal operators compete for market share. Again, differentiation is à la Hotelling. Thereby, operators can build local monopolies, which strengthen their market power upstream. Receiver net surplus from chosen network i is

$$w_{d,i} = v_{d,0} + v_d(p_{d,i}) - P_{d,i}.$$

Receiver surplus net of per-piece price $p_{d,i}$ is in analogy to above denoted by v_d . We introduce the term $v_{d,0}$ to assure that $w_{d,i} > 0$, i.e. that every receiver is interested in joining one of the two delivery networks. Since a fraction ζ of this price is passed on to senders, we have

$$v_d(p_{d,i}) = u_d(q) - (1 - \zeta)p_{d,i}q,$$

such that operator i 's market share is

$$\alpha_{d,i} \equiv \frac{1}{2} + \sigma_d [w_{d,i} - w_{d,j}] \text{ with } \sigma_d \equiv \frac{1}{2t_d}.$$

The model allows for any functional form of $u_d(q)$. For simplicity, we choose it such that

$$v_d'(p_{d,i}) = -q.$$

Then, the first-order condition to (1) with respect to $p_{d,i}$ yields

$$p_{d,i} = c_{d,i} - (1 - \alpha_{u,i})a - \alpha_{u,i}(p_{u,i} - c_{u,i})$$

or, in a symmetric equilibrium,

$$p_{d,i} = c_{d,i} - \frac{1}{2}a - \frac{1}{2}(p_{u,i} - c_{u,i}).$$

Hence, the networks' optimal downstream usage fee equals perceived marginal cost. Downstream market share is unaffected by it. However, the symmetric equilibrium subscriber fee determines the size of the downstream user base. It is given by

$$P_{d,i} = -\frac{d\pi_i}{d\alpha_{d,i}} + \frac{1}{2\sigma_d}$$

and therefore equal to the net marginal cost of adding a subscriber to the downstream network plus the Hotelling markup.

Each unit loss of downstream market share implies a profit loss of

$$\frac{d\pi_i}{d\alpha_{d,i}} = (p_d - c_d)q(p_u, p_d) - f_d + P_d$$

which is per-customer downstream profit when the two networks charge identical prices.

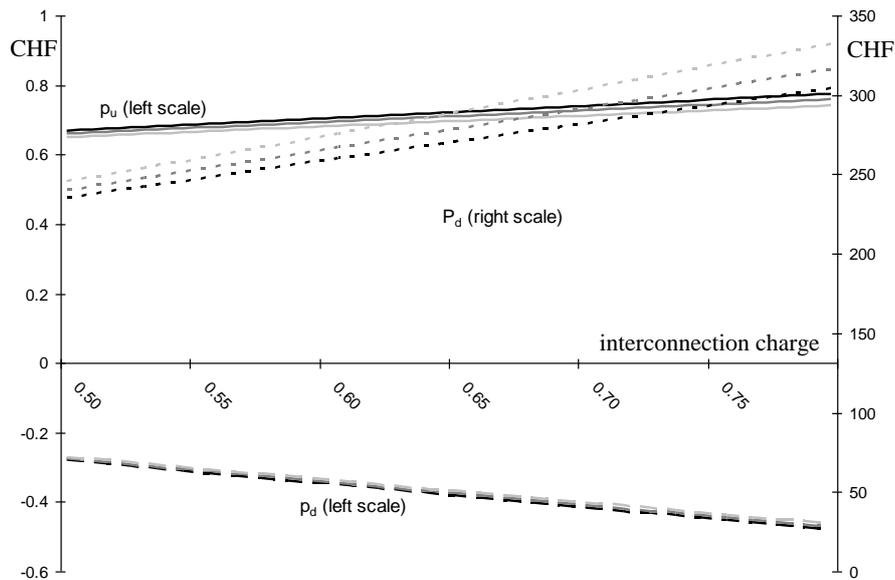
4. SIMULATION RESULTS AND DISCUSSION

Our main goal is to derive optimal pricing structures in liberalized postal markets, where potentially all involved parties (senders, receivers, and operators) can exert their bargaining power. Senders have the choice over competing operators; receivers can exclusively attribute a postal operator as their delivery partner of choice; and operators can establish a consumer base on one side of the market and sell it to the other one.

A calibration of the model enables us to compute numerically the operators' optimal pricing strategies as a function of the reciprocal interconnection rate. We calibrate the model to correspond roughly to the size and the characteristics of the Swiss letter market. The number of receivers is equal to 4m households and businesses. The current volume of addressed letters is 2.8bn at an average price of CHF 0.75 with price elasticity $\eta = 0.27$.⁶ Utility parameter β is calibrated to 650 to represent the Swiss letter market with approximately 700 letters per year and receiver. Total cost is CHF 2bn.⁷ With roughly 50% delivery cost of which 50% are fixed and a fraction of fixed cost of 30% in collection and processing, we calibrate f_u , c_u , f_d , and c_d accordingly. Moreover, we set $\sigma_u = \sigma_d = 0.2$.

The following observations and results apply for the calibration as above. Other calibrations might yield different optimal pricing strategies. Note that Switzerland exhibits a very high postal scale.⁸ Moreover, given the rough calibration and the stylized model, the results are only indicative.

Figure 2 displays the optimal pricing strategies depending on the exogenously set access price. We ran simulations with various values of ζ . Black lines are computed with $\zeta = 0.25$, dark grey lines with $\zeta = 0.5$ and light grey lines with $\zeta = 0.75$.

Figure 2: Optimal pricing structure depending on interconnection rate

Observation 1 – Optimal-pricing structure: The results partly replicate the pricing structure as observed in the completely liberalized postal market of New Zealand when market participants agreed on symmetric access prices to P.O. boxes. Given a similar regulatory regime, as set out in the model, we find an optimal pricing strategy in two-sided postal markets as follows: If the interconnection rate is about CHF 0.6, charge your key receivers a yearly delivery flat rate between CHF 250 and CHF 300. In turn, for every mail piece you deliver now exclusively, you *pay* (not charge!) your client (the receiver) about CHF 0.3 per mail piece (i.e. p_d is negative). On the sender side, you charge about CHF 0.7 per piece. In such a setting, given upstream and downstream variable costs and before considering fixed costs, net profits on end-to-end services are about break even, whereas upstream services incur a loss ($p_u - a < c_u$) and downstream products are profitable ($a + p_d > c_d$).

The results indicate that competition in two-sided postal markets forces operators to strongly cross-subsidize large receivers.

Figures 3 and 4 show the effect of an increase of the interconnection rate on operators' profit per customer and mail volumes.

Figure 3: Postal operator profit per customer

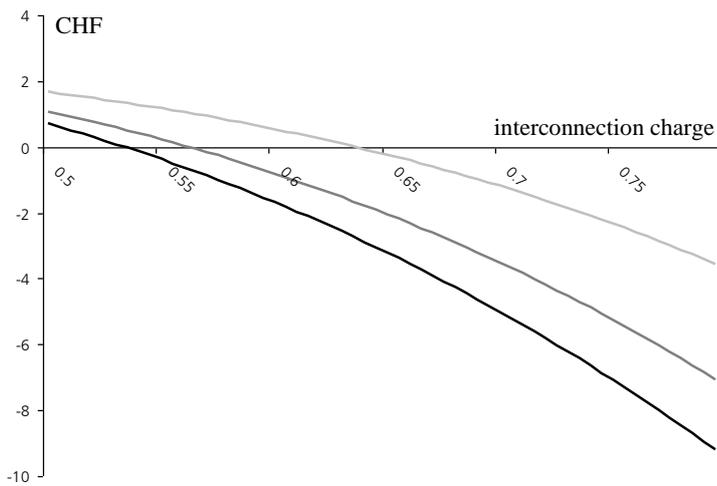
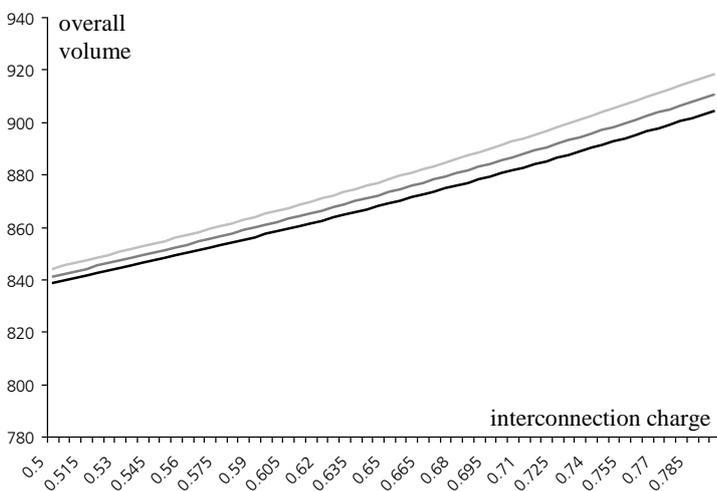


Figure 4: Mail volumes



Observation 2 – Effect of interconnection charge: Increasing interconnection rates make the downstream business more attractive (higher earnings for downstream operators) and results in fiercer downstream competition. This forces the operators to give their subscribers higher per piece incentives (more negative p_d), which are funded by higher stamp prices. Partly, operators can recover higher incentives by higher subscriber fees, too. Note that the receivers' incentives grow faster than the stamp price

due to the increased relative importance of downstream market shares (which are the basis for downstream profits). Interestingly, receivers' average price ($p_d + P_d/q$) becomes negative for high interconnection rates, i.e. they become increasingly subsidized and make a profit by being connected to the postal network⁹. Importantly, this redistribution comes at the cost of the networks, not at the cost of the senders, as the latter benefit from the receivers' better bargaining position by means of private rebalancing, which yields a lower price level $p_u + p_d$ and thus higher mail volumes q .

Thus, if we can exclude tacit collusion, high interconnection rates make the industry unattractive, as receivers enjoy increased bargaining power by means of regulation.

Observation 3 – Effect of private redistribution: A higher value of ζ enables senders and receivers better to offset pricing structures by means of private redistribution. Recapitulate that at the extreme ($\zeta = 1$) complete pass-through of per piece prices takes place such that mail volumes $q(p)$ depend just on the sum of the two variable prices $p = p_u + p_d$. Hence, the mail originating side includes total marginal postage into its calculations.

Since the downstream price p_d is negative, such redistribution leads to a participation of senders in downstream incentives, which decreases their perceived costs and thereby increases volumes (cf. Figure 4) and profits (cf. Figure 3). Put differently, if receivers not only are able to exert their market power towards the operators, but also towards the senders (lower value of ζ), we can expect negative demand effects and a significant drop of industry profits.

5. SUMMARY AND CONCLUSIONS

Practical evidence from postal markets suggests that mail markets are two-sided. Hence, postal operators are platforms that enable communication and transactions between two parties – senders/mailers on one side, and receivers/recipients on the other. This two-sidedness raises two main issues, network effects and pricing.

Network effects are present in most two-sided markets, and probably in postal markets too. Thus, we can expect the value of a postal network to increase the more customers are connected to it. We presume that the notion of ubiquitous access and delivery, which lies at the core of the Universal Service Obligation, is to be seen in this context. We do not include network effects directly in our model (although indirect network effects between the

upstream and downstream market are present) as we are primarily interested in the pricing implications of the two-sidedness of the postal market.

In terms of pricing, the two-sidedness makes things more complicated. Standard results of economic theory (related to one-sided markets) might fail in two-sided markets. Wright (2004) spells out ‘eight fallacies that arise from using one-sided logic in two-sided markets’ and concludes that ‘the results may be very different from the normal marginal cost pricing familiar in one-sided markets’. In our model, the interconnection of the two sides (upstream and downstream) of the mail market yields interesting pricing considerations, which are a challenge for pricing departments as well as for regulators and competition authorities. In posts, recipients traditionally have been served by monopoly platforms that charged the senders and served receivers free of charge. This still holds true in virtually any industrialized country. For example, Swiss recipients get home delivery and P.O. boxes free of charge, the latter having the advantage of early morning delivery.

How do things change in liberalized two-sided mail markets? Will receivers remain subsidized? Our results indicate that in liberalized markets, key receivers will likely be subsidized even more. Depending on P.O. box regulations, the optimal strategy of postal operators towards receivers will be to offer them a costly P.O. box while paying them money for every mail piece delivered to this P.O. box. Thereby, large receivers will succeed in capitalizing on their address. Such pricing would have harmful effects on overall mail volumes unless senders participate accordingly (which is unlikely for the case of direct mail). We conclude that it is quite risky for postal operators to introduce receivers’ pricing or incentives. This result may not hold for value added services. The results raise the more general question of who should pay for postal services from a welfare point of view. Jaag (2007) proposes a model and framework to address such issues.

The current common regulatory view states that P.O. boxes are monopolistic bottlenecks with a consequent need for regulation. This is somewhat astonishing as there are no sunk costs related to P.O. box provision¹⁰. Our two-sided model suggests that we can expect competition for P.O. boxes as observed in New Zealand and that operators have a common interest for low access prices. Hence, in terms of P.O. box regulations, our results contradict the common view. We leave it for further research to assess whether this holds also true for models with asymmetric equilibria. However, as Panzar (2006) points out, the two-sidedness of the postal market makes access regulation to P.O. boxes a rather complex task and cost based pricing rules rather inappropriate.

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- ¹ Often, the official single-piece tariff is billed instead of the reduced business rates.
 - ² Network externalities arise if the utility that a given user derives from joining a network depends upon the number of other users who are in the same network. *Positive* network externalities are present if a customer's utility of a good or service is an increasing function of the number of other users.
 - ³ Jaag (2007) discusses the welfare effects associated with the consumers' choice between costly doorstep delivery and free delivery to a P.O. box.
 - ⁴ In most countries, receivers have the choice between a free doorstep delivery and (sometimes-costly) P.O. box. It is important to note that as soon as a P.O. box is chosen, the P.O. box operator obtains the exclusive rights for final delivery into the P.O. box. In this view, the assumption could reflect the subset of mail destined to P.O. boxes, or a regulation where every household appoints the operator of her choice as its exclusive delivery carrier.
 - ⁵ I.e. the pricing for P.O. boxes consists of a fixed and a variable part where both parts can be positive (receiver pays), negative (receiver obtains) or zero (no money flow in either direction).
 - ⁶ For a discussion of demand parameters cf. Trinkner and Grossmann (2006).
 - ⁷ For a discussion of the cost structure of the Swiss mail market, cf. Dietl, Trinkner and Bleisch (2005) and Jaag (2006).
 - ⁸ See also PWC (2006).
 - ⁹ Recipients are therefore interested in joining a network which relaxes the previously introduced assumption of a value of $v_{d,0}$ such that $w_{di} > 0$.
 - ¹⁰ Note that considerable sunk costs are a precondition for the presence monopolistic bottlenecks.