Chapter 5

Dynamics of Downstream Entry in Postal Markets*

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1. INTRODUCTION

In the European Union (EU), the postal sector is now partially opened to competition, with full opening of all national markets foreseen for January 1, 2009. After 2009 competitors will be able to enter EU postal markets more or less freely and offer mail services to their customers in all segments of the postal value chain, both upstream (in worksharing and consolidation activities) and downstream (in delivery activities). Entry into downstream services means that the incumbent postal operator will no longer be a monopolist in the delivery activity. This is in sharp contrast with the U.S. situation where the historical operator remains a monopolist for final delivery.

In a competitive postal market, the competitors of the incumbent operator have two options for mail delivery. They can either build up their own delivery network (**downstream bypass**) or they can use the delivery network of the incumbent postal operator (**downstream access)**. Different costs are associated with these two options. If the operator chooses downstream bypass, its delivery cost is a network cost while if it chooses downstream access, its delivery cost is the *access price* paid to the incumbent operator. This choice between access and bypass is a standard make-or-buy choice for mail distribution.

In the European countries that already experience full market liberalization, both types of delivery strategies are observed. In Sweden, the monopoly position of Sweden Post was abolished in 1993. Since then, the main competitor of Sweden Post has been *CityMail.* CityMail chooses the downstream bypass option and delivers mails with its own delivery network.

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However, CityMail still has limited geographical coverage. The business model of CityMail is original. The firm concentrates on the delivery of pre-sorted bulk mails and delivers mails twice a week at predetermined dates. By doing so, CityMail has a very flexible cost structure with almost no collection and sorting costs. So far, the market share of CityMail represents 7.5 per cent of the total mail volume, but it reaches a higher market share (around 25 per cent) for the bulk mail market (Jonsson and Selander, 2006). Sandd operates on a similar business model in The Netherlands. The company now covers the whole territory and delivers direct mails twice a week. In 2005, Sandd has a market share of 8.5 per cent and plans future growth.

In 2005, 16 companies have received a license to operate postal services in the UK. Most of these new companies offer E2E mail services but the mails they collect are ultimately delivered by the incumbent operator, Royal Mail (downstream access). For the moment, around 7-8 per cent of the mails delivered by Royal Mail are pre-sorted by competitors and posted at access points and the importance of this type of mail is expected to grow. An originality of the access pricing system in the UK is the existence of a non-uniform access tariff (Hill and Robinson, 2006). The territory is divided into five delivery zones according to delivery point density[1] which is the main driver of delivery costs. The access price for a given mailing is set according to its delivery zone. There are significant price variations across zones: the access prices range from £0.111 to £0.215 with a mean price of £0.13. Non-uniform access pricing can be seen as an attempt to limit the possibilities of downstream bypass in the most profitable--high density–delivery regions. By setting a price below the average for the delivery in the high-density regions, Royal Mail lowers the incentives to bypass its delivery network.

In this article, we are interested in the determinants of the access vs. bypass choice by a new postal operator and the consequences of this choice in term of welfare. We particularly concentrate on the influence of the incumbent prices–stamp and access prices–on the choice of a delivery technology by the entrant. The starting point of our analysis is the computation of the welfare maximizing prices for the incumbent operator. These efficient prices are standard Ramsey prices (see Laffont and Tirole, 1994, 2000 for general principles and Crew and Kleindorfer, 1992; Billette de Villemeur et al., 2005; De Donder, 2006 for applications to the postal sector). Ramsey prices include a mark-up above marginal costs to finance the universal services obligations (USO) imposed on the incumbent. We

[1] Defined for each postcode as the total surface area divided by the number of delivery points.

show that this type of USO financing distorts the access vs. bypass decision of the entrant. In particular, there is excessive bypass if Ramsey prices are applied.

However, modifying the access price modifies the incentives to bypass and the regulator can depart from Ramsey prices to induce the desired amount of bypass. To determine the appropriate modifications to Ramsey prices, we integrate, as a constraint, the delivery choice of the entrant in the derivation of welfare maximizing prices. At these modified Ramsey prices, the access charge is lower and excessive bypass is partially corrected. But, inducing an efficient delivery choice is costly in terms of welfare.

The second part of our analysis concentrates on the influence of access price on the type of entry (access vs. bypass) and on the timing of entry in a dynamic context. The postal sector is ahead of many changes: full market liberalization, reform of the USO, decline in mail volumes, and growing importance of bulk mail, to name a few. Considering this changing environment, the entrant has numerous entry strategies, immediate or delayed entry (to full market opening) with either access or bypass. The entrant has also the possibility of entering the market without a delivery network and later switching to bypass. Access price affects these strategic choices of entry. We show that a lower access price induces earlier entry with access. Moreover, if the entrant has scale economies in its delivery activity and if the demand faced by the entrant is growing, a lower access price induces a later switch to bypass. Eventually, the incumbent can always prevent bypass with sufficiently low access prices.

2. THE CHOICE BETWEEN ACCESS AND BYPASS IN A STATIC CONTEXT

Our static model is similar to De Donder (2006) except that we do not distinguish two delivery regions with different delivery costs. We consider a market where two postal firms, an incumbent operator (I) and a new entrant (E), offer end-to-end (E2E) mail services to consumers. We denote by p^I and p^E the stamp prices charged by I and E for this service. In addition to its E2E mail product, the incumbent operator offers a second product: access to its delivery network. Access (or worksharing) is available to both consumers and the entrant at the same price of a. This restriction can be viewed as an application of the non-discrimination principle imposed by the European Directives.[2]

[2] The preamble of the second postal directive (2002/39/EC) states that "The universal service providers normally provide services, for example to business customers, consolidators of mail for different customers and bulk mailers, enabling them to enter the mail stream at different

To buy access, the consumers and the entrant must pre-sort their mails and transport them to an access point. The consumers can perform these operations at a unit cost of k. The price for consumer direct access (CDA) is the sum of the consumer's upstream cost k and the access price: $p^D = a+k$.

The three products are imperfect substitutes. The incumbent delivers mail 5 or 6 days a week and the entrant offers a J+3 mail product. If E chooses the bypass options, it delivers mails twice a week. With the access option, the entrant deposits mails at an access point two days after collection. The characteristics of the entrant's mail product are not affected by the delivery method. This means, in particular, that the entrant can achieve the same reliability in delivery as the incumbent.

The surplus of a representative consumer who posts mail volumes q^I with the incumbent, q^E with the entrant and q^D at access points is:

$$V(q^I, q^E, q^D) - p^I q^I - p^E q^E - p^D q^D$$

From this consumer surplus, we can derive demand functions. For product K = I, E, D, the inverse demand is given by:

$$p^K(q^I, q^E, q^D) = \frac{\partial V(q^I, q^E, q^D)}{\partial q^K}$$

There are two types of costs associated with the E2E mail products: an upstream cost (cost of collection, transport and sorting) and a downstream (or delivery) cost. We denote by c^J and d^J the unit cost of upstream and downstream operations for the incumbent (J = I) and the entrant (J = E).

Universal service obligations (USO) are imposed on the incumbent operator. USO may include the requirement to serve all customers (universality/ubiquity), the imposition of a geographically uniform tariff for a bundle of products, obligations in term of service quality (frequency of delivery, accessibility of contact points) and constraints on prices. It is commonly accepted (Crew and Kleindorfer, 2006 for example) that universal service obligations are associated with large fixed costs for the universal service provider (USP). We denote these fixed costs by F.

Firm E has the choice between two delivery methods: it can either build up its own delivery network–which has a cost d^E per mail delivered–or it can perform only the upstream activities and buy access from the incumbent.

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points and under different conditions by comparison with the standard letters service. In doing this, the universal service providers should comply with the principles of transparency and non-discrimination, both as between different third parties and as between third parties and universal service providers supplying equivalent services. It is also necessary for such services to be available to private customers who post in similar conditions, given the need for non-discrimination in the provision of services."

Because the entrant' product has the same quality with the two delivery methods, this choice is a make-or-buy choice and the entrant chooses the cheapest option. Firm E then chooses access if $a < d^E$ and bypass otherwise. In the sequel, we denote by *z* the total demand for access; thus, z is equal to q^D under bypass and to q^D+q^E under access.

Firm E acts as a competitive fringe and sets its stamp price at marginal cost. Then we have:

$p^E = a+c^E$ If E chooses access,
$p^E = d^E +c^E$ If E chooses bypass.

The incumbent operator is regulated and the regulator fixes the incumbent's prices in order to maximize the total surplus (consumer surplus + firms' profits) subject to a non-negative profit constraint for the incumbent.[3] The regulator determines the welfare maximizing prices by solving the following problem:

$$\underset{a,p^I}{Max}\ \mathrm{W}(\theta) \equiv V(q^I,q^E,q^D) - (c^I + d^I)q^I - (c^E + \theta d^E + (1-\theta)d^I)q^E - (k + d^I)q^D - F$$

Subject to:

$$\Pi^I(\theta) = (p^I - c^I - d^I)q^I + (1-\theta)(a - d^I)q^E + (a - d^I)q^D - F \geq 0$$

$$p^E = c^E + \theta d^E + (1-\theta)a$$

$$p^D = a + k$$

where θ is a dummy variable equal to 1 if the entrant chooses to bypass and to 0 if it chooses access..

2.2 Welfare maximizing prices

This welfare maximization program gives Ramsey prices for access and letters. The computation of these prices is standard (see Laffont and Tirole, 2000). They can be expressed as:

$$p^I(\theta) = c^I + d^I + \frac{\lambda}{1+\lambda}\frac{p^I(\theta)}{\eta_I} + (a(\theta) - d^I)\sigma_1(\theta)$$

[3] Billette de Villemeur et al. (2003) show that welfare maximizing prices can be decentralized by imposing an appropriate global price cap on the incumbent.

$$a(\theta) = d^I + \frac{\lambda}{1+\lambda}\frac{a(\theta)}{\theta\eta_D + (1-\theta)\eta_Z} + (p^I(\theta) - c^I - d^I)\sigma_2(\theta)$$

where λ is the Lagrange multiplier associated with the zero profit constraint for firm I, η_K, (K=I, D, Z) are the absolute values of elasticity of product K and $\sigma_1(\theta)$, $\sigma_2(\theta)$ are the displacement ratios that measures the substitutability between products:

$$\sigma_1(\theta) = -\frac{dq^D/dp^I + (1-\theta)dq^E/dp^I}{dq^I/dp^I} \quad \text{and}$$

$$\sigma_2(\theta) = -\frac{dq^I/da}{dq^D/da + (1-\theta)dq^E/da}.$$

The welfare-maximizing prices can be expressed as the sum of three terms: the marginal cost of the product plus a Ramsey term inversely related to the product elasticity, plus a displacement term. These last two terms constitute a mark-up above the marginal cost and the incumbent covers the fixed cost F with this mark-up. The Ramsey term means that the product for which the demand is highly sensitive to price is charged a lower contribution to the USO financing than a less price elastic product. The third term is a displacement term. The ratios σ measure the displacement between access and E2E mails. A value of σ_1 equals to 1 means that each additional E2E letter sent displaces one letter sent previously through access (either by the entrant or by the consumer). The presence of this term implies that the incumbent is compensated for the lost profit due to a lost of mail volume. Note that in the above formulas, the access price is equivalent to the ECPR(Armstrong, 2001) when $\lambda = 0$ and $\sigma = 1$.

There are two differences between prices under access and bypass. First, the displacement ratios are different. Under access, there is no compensation for consumers switching from CDA to firm E because there is no lost in access receipts. Second, because the incumbent looses access receipts $(a-d^I)q^E$, the overall level of price increases. This is captured by a change in the Lagrange multiplier.

2.2 Access vs. bypass

2.2.1 Welfare maximizing delivery method

We can associate to the efficient prices under bypass and access welfare levels W(1) and W(0). The comparison between both gives the following result:

Result 1: *(i) There exists a cut-off level* $\tilde{d}^E$ *for the entrant's delivery cost such that access is preferred for* $d^E > \tilde{d}^E$ *and bypass is preferred for* $d^E < \tilde{d}^E$. *(ii)* $\tilde{d}^E < a(0)$.

The intuition behind this result is simple.[4] First, the welfare under bypass W(1) decreases with the delivery cost of the entrant: a less efficient competitor reduces welfare. Second, the welfare under access is independent of the delivery cost d^E. Thus, there exists a cut-off level for the delivery cost such that W(1) = W(0). This means therefore that below that cut-off point, the benefit of a more cost-effective competitor more than compensates for the fact that, with bypass, the entrant does not contribute to USO financing. We can show that this cut-off value is below the access price. For a delivery cost d^E equal to the access price, the letter price of the entrant is the same with the two delivery methods, but only in the access case does the entrant contributes to USO financing. Therefore at that point, we have W(0) > W(1). By continuity of the welfare functions, the cut-off point is smaller than the access price.

2.2.2 Choice of a delivery method by the entrant

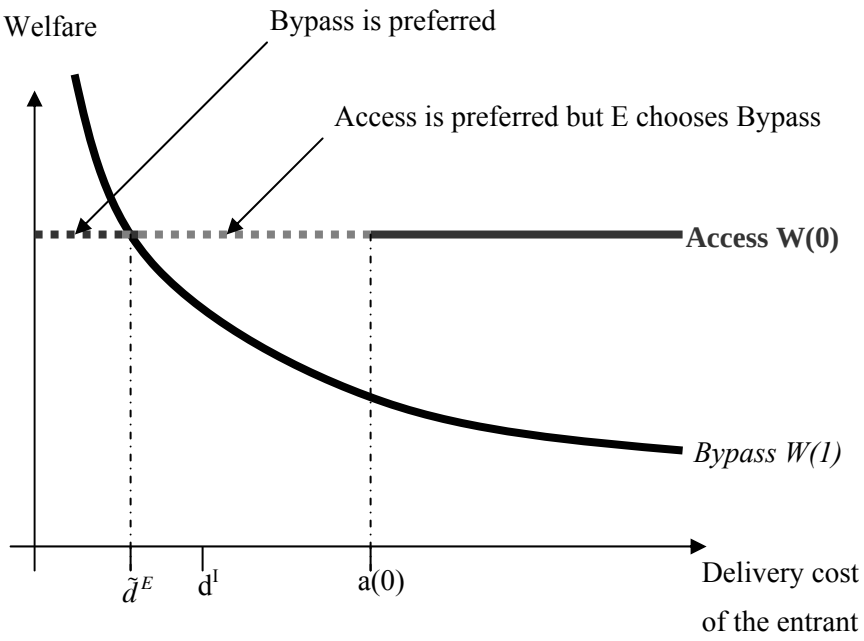
But, the entrant does not base is access vs. bypass decision on the cut-off value $\tilde{d}^E$ but, rather, on the relative prices of the two delivery technologies. A competitive entrant chooses access if $d^E \geq a(0)$ and bypass otherwise. The consequence is excessive bypass by the entrant if the regulator applies the welfare maximizing prices. In other words, the entrant does not always choose the welfare maximizing delivery technology and bypasses too often.

Result 2: *For* $d^E \in [\tilde{d}^E, a(0)]$, *the entrant bypasses while access is socially efficient* .

Efficient access prices are associated with an excessive amount of bypass. The consequences on welfare are illustrated in figure 1. For a delivery cost d^E in the interval $[\tilde{d}^E, a(0)]$, welfare is higher with access but this welfare level is not achievable because the entrant chooses to bypass.

[4] For a formal proof see Bloch and Gautier (2006).

Figure 1: Excessive Bypass at the Efficient Prices



2.3 Constrained Access

Welfare is reduced because of the noted mismatch between the efficient delivery method and the choice of the entrant. But, the regulator can use prices to modify the choice of the entrant. In particular, lowering the access price below a(0) modifies the delivery technology adopted by the entrant. We then compute a constrained access solution where the regulator's objective is welfare maximization with the additional constraint that the entrant does not choose the bypass option. For that, the access price must not be larger than the delivery cost of the entrant. In this constrained problem, the solution is to set the access price equal to d^E when d^E is smaller than a(0).

But lowering the access price below its efficient level to prevent excessive bypass has a cost. Access receipts decline and, to finance the USO, the regulator must increase the stamp price of the incumbent's letter. With this constrained access solution, the financial burden of the USO is mainly supported by the customers that do not have the possibility to pre-sort their mail and buy direct access nor the possibility to switch to an alternative provider. Clearly households will be charged a higher stamp price if the regulator wishes to prevent inefficient bypass by the entrant.[5] Moreover, preventing bypass is more costly in welfare terms when the entrant has a relatively more efficient delivery technology.

We can show that preventing bypass is not desirable in all circumstances. In other words, the regulator should continue to allow a certain amount of excessive bypass. The reason is that a) W(1) decreases in d^E, b) the welfare level under constrained access increases in d^E and c) setting $a = d^E$ reduces welfare compared to W(0). The following result is derived from these three facts.

Result 3: *(i) There exists a cut-off point d^* such that welfare with constrained access ($a=d^E$) equals W(1). (ii) $d^* \geq \tilde{d}^E$.*

This result implies that the required modifications in prices to achieve the socially efficient delivery method may be too costly in term of welfare. Therefore, the excessive bypass result continues to hold even if the regulator reduces its importance.

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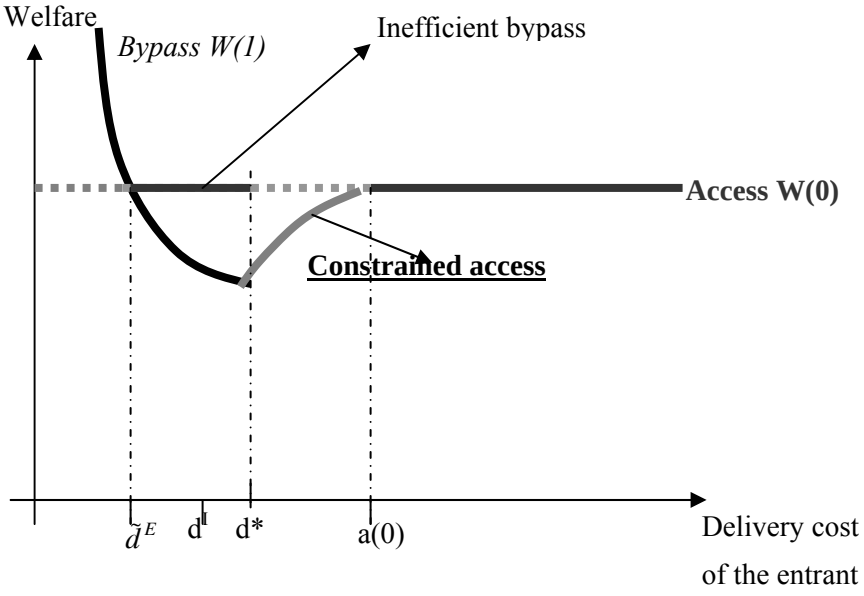
[5] De Donder et al. (2006) and Panzar (2005) consider that the minimization of the letter price could be an objective for the regulator.

Figure 2 illustrates the welfare levels that the regulator can achieve when it takes into account the impact of prices on the entrant's access vs. bypass decision.

As it is illustrated in the figure and in the numerical example developed hereafter, it is when the two firms have similar delivery cost that most of the welfare losses occur. The reason is that, for similar delivery costs, there is a mismatch between the choice of the entrant and the socially efficient choice. Conversely, if the two firms have dissimilar costs there is no mismatch of this kind. If the entrant is a lot more cost effective than the entrant, welfare is maximized with bypass and the entrant effectively chooses that option. When the entrant is a lot less cost effective, it prefers access and that option gives the highest welfare.

Figure 2: Welfare Levels



2.4 A numerical example

We calibrate a linear demand model to illustrate our results. The parameters of the demand function are chosen to have mailing volumes of x^I = 1 billion, x^D = 0.5 billion and x^E = 0.2 billion at the efficient prices under access. In this scenario, the incumbent has a delivery cost of 0.2€, an upstream cost of 0.1€ and the total cost of the USO is 0.3 billion €. The entrant has a 20 per cent lower upstream cost and we consider three cases for the entrant's delivery cost: a) d^E = 0.4 (twice the unit cost of the incumbent), b) d^E = 0.25 (25 per cent higher than d^I) and c) d^E = 0.15 (25 per cent lower than d^I).

Table 1 contains the results of this calibration exercise. The prices charged by the incumbent are calculated to maximize the welfare. Consider first case a) where the entrant's delivery cost is 0.4€. Clearly at that cost, access is the preferred solution. Note that under bypass the access price a(1) is too low and it induces the firm to choose access. Therefore, the bypass scenario is feasible only if a increases up to 0.4€ causing further losses in welfare.

In case b) with a delivery cost d^E = 0.25, the efficient access price a(0) = 0.36 does not induce access. Therefore, to prevent bypass, the regulator must apply a constrained access solution where the access price is equal to the entrant's delivery cost. This 0.11€ decrease in the access price reduces the access receipts and, to compensate, the letter price increases. But, even with this fall in access receipts, welfare is higher under access than under bypass, though the welfare levels are very close.

Finally, in case c) when d^E = 0.15, if the constrained access solution applies, the incumbent looses 0.05€ per access mail. Therefore, the price p^I must increase even more to finance the 0.3 billion € USO fixed cost. In this case, welfare is higher under bypass but the welfare gains compared to the unconstrained access solution are extremely small.

Table 1: Calibration Results

Delivery costs, €						
Firm I	0.2		0.2		0.2	
Firm E	0.4		0.25		0.15	
Upstream costs, €						
Firm I	0.1					
Firm E	0.08					
Fixed cost, bn €	0.3					
Delivery method of E	**Access**	**Bypass**	**Access**[1]	**Bypass**	**Access**[1]	**Bypass**
Prices, €						
p^I	0.48	0.51	0.58	0.52	0.85	0.53
a	0.36	0.37	0.25	0.37	0.15	0.38
p^E	0.44	0.48	0.33	0.33	0.23	0.23
Mail volumes, bn items	1	1	0.88	0.96	0.63	0.93
x^I	0.49	0.49	0.56	0.46	0.67	0.44
x^D	0.2	0.18	0.28	0.29	0.38	0.36
x^E	1.68	1.67	1.72	1.71	1.68	1.73
Total						
Market shares, %						
x^I	60%	60%	51%	56%	37%	54%
x^D	28%	29%	33%	27%	39%	25%
x^E	12%	11%	16%	17%	23%	21%
% of F covered by						
x^I	60%	70%	82%	70%	115%	71%
x^D	27%	29%	12%	28%	-10%	28%
x^E	12%	0	6%	0%	-5%	0%
Welfare	1.554	1.501	1.530	1.524	1.423	1.547
Welfare (indices)	100	96	98	98	91	99

[1] The regulator must apply the constrained access solution

In our example, we assumed that the incumbent continues to have some reserved area since, even with a large cost advantage, the entrant has at most a market share close to 25 per cent. In this context, the highest possible welfare is achieved with access or with bypass if the cost advantage of the entrant in the delivery activity is more than 25 per cent. However, there are constraints that limit what could be actually implemented. When the entrant's cost is below a(0) = 0.36, the access solution is no longer possible since at that price the entrant chooses to bypass. Then, the constrained access solution must be applied and this causes a decrease in the welfare. When this solution is compared with bypass, it appears that bypass is preferred whenever the entrant's cost is lower or equal to 0.24€. So, even if the entrant is less efficient in the delivery activity, bypass is preferred, because inducing access is too costly.

To conclude, the first part of the analysis, we can say that welfare-maximizing prices do not necessarily induce an efficient choice of a delivery method by the entrant. Thus, the regulator must take into account the impact

of prices on the induced choice of a delivery method and modify the prices appropriately. If the regulator wishes to favor access rather than bypass, the access price must be lowered compared to its optimal level and the price of E2E mail must increase to cover the incumbent's fixed cost. This results in the entrant's having a higher market share in the E2E mail market.

3. THE CHOICE BETWEEN ACCESS AND BYPASS IN A DYNAMIC CONTEXT

In the previous section, we developed a formal model of the postal sector where access price influences the delivery method of the entrant. In this section, we perform a similar exercise in a dynamic context. We concentrate on two questions: (a) what is the influence of the access price on the timing of entry by new competitors? And (b) what is the influence of the access price on the delivery technology of the entrant? We particularly concentrate on the conditions that guarantee that an access-to-bypass equilibrium exists in the postal sector. That is, an equilibrium where a new postal operator starts its business by buying access from the incumbent and later switches to bypass.

The postal market is ahead of many changes. First, by the end of 2006, the third postal directive will decide whether or not full market liberalization will be imposed on Member States in 2009. Second, e-substitution has an impact on the short and medium term demand for mail (Trinkner and Grossmann, 2006). Therefore, economic activity (or GDP) is no longer a strong determinant of mail demand and some postal operators already face a decline in mail volumes. Third, despite a slow growing (or declining) total demand, there are new opportunities for development in the bulk mail market segment. Since the entrant mainly targets this segment, the consequence of these joint evolutions is that a newcomer potentially faces a growing demand for its products, especially if full market liberalization is decided for 2009.

The evolution of the environment has an impact on the choice of a delivery method by the entrant and it is the focus of this section. Before, we briefly review the dynamics of entry in other network industries

3.1 Dynamic of entry in network industries

In the context of telecommunication, Bourreau and Dogan (2005) develop a dynamic model of technology adoption. In their model, the incumbent operator decides first whether or not to provide access to its local loop. If it does so, it sets a rental price. Then, at each period t, the competitor has two options: it can either lease the local loop of the incumbent operator and compete for the provision of telecommunication services or it can build up its own infrastructure and the firms are then engaged in facility-based competition. The first option is, of course, available only if the incumbent operator has decided to lease its local loop. The model has two key features: first, the new infrastructure is more efficient than the incumbent's older one. Second, the cost of the investment declines over time. The main result is that by giving access and by setting a *too low* rental price for the local loop, the incumbent operator can delay the investment of its competitor and the technology is adopted *too late* from a welfare point of view. The reason is that at each period the competitor compares the value of the two options. Hence, a low rental price increases the value of the access option and causes a delay in the adoption of the new technology.

Hori and Mizuno (2006) consider a dynamic model in which there is no existing network facility. They consider an environment with a stochastically growing demand. In this context, a monopolist would delay the infrastructure building until demand is sufficiently high to cover investment costs. In a duopoly, the firms have incentives to invest earlier and pre-empt the market to become a leader. But, once a leader has entered the market, the follower can either bypass and compete with its network facility or buy access to the leader's network. In their model, under some circumstances, an access-to-bypass equilibrium exists, that is an equilibrium in which the follower buys access before building up its own network facility.

What is the impact of the access price on the access-to-bypass equilibrium? The authors show that a decrease in the access charge induces three changes in the timing of technology adoption. First, the leader invests later, second the follower enters the market earlier and finally, the follower bypasses later. The second and third points are explained by the fact that a decrease in the access price makes the access profit larger and, therefore, it increases the incentives to enter the market and decreases the incentives to bypass. At the limit, bypass never occurs if the access price is low enough. There are two reasons that explain why the leader invests later following a decrease in the access price: it has lower access receipts and, since the

follower enters earlier with access, it enjoys monopoly profits for a shorter time period.

3.2 Dynamic of entry in the postal sector

We will consider a situation similar to Hori and Mizuno (2006) where the mail demand faced by the entrant is growing over time. Thus, with a given price differential, the market share of the entrant increases over time. At each period t, the entrant has three options: no entry, access and bypass. Unlike the previous section, we consider that the entrant has market power and realizes a positive profit as a result. To each of these three options, we can associate a discounted profit flow: $\Pi(0, t, a)$ for access, $\Pi(1, t)$ for bypass and 0 for no entry. At each period t, the entrant chooses the option with the highest discounted profit flow. With a growing demand, both $\Pi(0, t, a)$ and $\Pi(1, t)$ are increasing with t. Under bypass, the profits are independent of the access price. Under access, the per-period profit and the profit flow both decrease with a.

In the postal context, entry with access is immediate (at period 0) if there is no entry cost and if the upstream operations are performed under constant return to scale. Otherwise, entry could be delayed to the period t^* where $\Pi(0, t^*, a) - \phi = 0$ where ϕ is the entry cost. Entry is delayed up to the period where the demand is high enough to cover the entry cost. It is then obvious that a lower access price increases the profit flow $\Pi(0, t, a)$ and favors earlier entry.

With constant return to scale in the delivery activity, our key findings of section 2 continue to apply. In this case, if a lower delivery cost increases the profit flow, the entrant chooses the cheapest delivery method. Then, if $d^E < a$, the firm is active from period t^*, defined as $\Pi(1, t^*) - \phi=0$, and the firm always bypass. Clearly, lowering a below d^E implies i) earlier entry and ii) that the entrant chooses the access option. But, with constant return to scale in the delivery activity, depending on a and d^E, the entrant chooses either access or bypass and there is no possible switch from one to the other.

This reasoning is no longer true if the per-unit delivery cost of the entrant declines with the mail volumes. With scales economies in the delivery activity, bypass is unprofitable when the demand is too low. It becomes profitable only when the demand faced by the entrant is sufficiently large. Therefore in this case, there exists a cut-off period t^{**}, defined as $\Pi(1, t^{**}) = 0$, at which bypass starts to become profitable. Does it mean that the entrant starts to bypass at t^{**}? The answer is negative because if at that period $\Pi(0, t^{**}, a) > 0$, the entrant will continue to use the incumbent network to deliver

mails. The entrant switches to bypass only if it manages to realize future economies of scale i.e. at a period $t > t^{**}$.

There could exist an access-to-bypass equilibrium in the postal sector only if i) the demand is growing and ii) the entrant has scale economies in the delivery activity. In this case, the delivery decision differs from the static case and a switch from one technology to another must be considered. But, as in Bourreau and Dogan (2005) and Hori and Mizuno (2006), a low access price delays and eventually prevents the switch from access to bypass.

The existence of switching costs could reverse the previous argument. When customers have brand loyalty, the profit flow with the bypass option depends on i) the period t through the growing demand and scale economies assumptions and ii) the number of consumers in the previous period. In this case, lowering the access price increases the market share of an entrant that chooses the access option. It therefore increases the profit flow with access but also the profit flow with bypass since a larger base of consumers reduces the per-unit delivery cost. The existence of switching cost thus increases the value of the bypass option. Therefore, a low access price can accelerate the switch from access to bypass because it allows the entrant to achieve a sufficient mail volume earlier.

4. CONCLUSION

In this paper, we have shown that access price to the postal delivery network plays an important role on the choice of a delivery technology by the entrant. By contrast with most of the previous work on access pricing, we do not consider as given the delivery method of the entrant. In a static context, we have shown that the efficient access price induces too much bypass, which is not without consequences on welfare. This excessive bypass can be partially prevented by lowering the access price and simultaneously increasing the letter price. Of course, there are limitations and welfare consequences of these policy responses as well, and we have provided some results on these consequences.

These results show that efficient access prices do not create problems when the entrant is either much more or much less efficient in the delivery activity than the incumbent. When the entrant is sufficiently less efficient, it buys access and firms compete only in the upstream segments of the market. If the entrant is more efficient, it chooses the bypass option and this 'facility-based' competition enhances welfare. Efficient access prices are problematic when the incumbent and the entrant have similar delivery costs. The maximization of welfare requires a mark-up above the marginal cost for the access price and no-bypass by the entrant. Both firms then contribute to

the USO financing. But, because the entrant does not contribute to the USO if it bypasses, this option is relatively cheaper than access even if the entrant's delivery cost is higher. Therefore, the access price should be lowered to induce the entrant to choose the access option. As a result, the financial burden of the USO is mainly financed by the customers that send E2E letters with the incumbent. By contrast, the contribution of the customers that pre-sort their mails and those who switch to the entrant is lower.[6]

In a dynamic context, we observe a switch from access to bypass by the entrant if the demand faced by the entrant is growing and, if there are scale economies in the delivery activity. While economies of scale in delivery are commonly accepted for the incumbent who must deliver mail 5 or 6 times a week as part of the USO, such economies of scale are less obvious for the entrant. For example, De Donder (2006) assumes that the entrant operates under constant return to scale. It is beyond the scope of this article to discuss the consequences of the existence of scale economies for the entrant. We just note that without such scale economies, the entrant's delivery technology will not change over time. Of course, scale economies per se do not guarantee a switch to bypass because the regulator (or the incumbent) can set a sufficiently low access price to preclude that move.

In this paper, we used a simplified model to show the influence of prices on delivery choices and the consequences on welfare. By doing so we neglected important dimensions that are worth being investigated. In particular, if the regulator prevents bypass with appropriate prices, the incumbent remains de facto a monopolist for the delivery activity. The absence of competition in delivery does not provide incentives to engage in cost-reducing activities in delivery. Conversely, bypass could stimulate the incumbent to lower the costs of delivery and, as in other network industries, facility-based competition can further promote innovative and cost-saving practices in the downstream activity. Clearly, we have neglected these effects in our welfare analysis. Likewise, we did not investigate the welfare consequences of other types of competition like the entrant providing downstream access to customers or the incumbent sub-contracting delivery to a more cost effective entrant. Panzar (2005) shows that the first type of competition hurts welfare while the other is not in conflict with the pursuit of public policies objectives. Integrating these new dimensions within the present analytic framework could yield a number of promising avenues for future research.

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[6] Panzar (2005) suggests that the minimization of the incumbent's letter price can be an appropriate objective for the regulator. Clearly in our model, this objective is not met when the regulator must lower the access price to prevent an inefficient bypass.

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