Welfare and Pricing of Mail
In a Communications Market

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1. Introduction

- In recent years, decline in volumes, both for single piece and bulk mail.

- A consequence of economic downturn, but also substitution to other communication media.

- Single piece mail: substitution to email.

- Bulk mail: two main categories:

  - Transactional mail (bank statements, utilities' invoices): substitution to email and Internet (download of pdf files).

  - Advertising mail: substitution to alternative media, including Internet.

- We look at welfare and pricing of mail in the presence of alternative media.

- Natural extension of existing literature on optimal pricing:

  - in a monopoly setting (Billette et al. 2002)

  - with worksharing discounts for clients (Billette et al. 2003)

  - with third-party access (De Donder et al. 2005)

  - with bypass (De Donder et al. 2006, 2008)

- We proceed as follows:

  - we build a formal model;

  - we solve analytically for the optimal prices;

  - we calibrate and provide numerical simulations.

2. The model

- 3 markets: single piece, non direct (i.e., transactional) mail and direct (i.e., advertising) mail.

- USP has (de facto) monopoly over single-piece and (may) face competition on the two bulk mail markets:

  - from postal entrants (using access) on the NDM market;

  - from postal entrants (using access) and from alternative medium on the DM market;

- There is a representative sender of mail and user of alternative medium.

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A little bit of notation

- p stands for prices of final goods.

- Subscripts denote the operator: I(ncumbent), E(ntrant) and A(lternative media).

- Superscripts denote the market: x for single-piece, y for NDM and z for DM.

- Costs:

  - constant marginal upstream (c) and downstream (d) costs, fixed cost for USP only,
  - same costs for DM and NDM,
  - low constant marginal cost for the alternative media.

Objective of firms

- Entrants and alternative medium firm behave as a competitive fringe,

- USP maximizes welfare subject to break-even (Ramsey problem, decentralized through global price cap).

Market situations studied

- We start with monopoly, and then introduce competition market per market

- Monopoly over three goods (SP x, NDM y, BM z)

$$\Pi_I^M = (p^x - c^x - d^x)x(p^x) + (p_I^z - c_I^{yz} - d_I^{yz})z_I^M(p_I^z)$$
$$+ (p_I^y - c_I^{yz} - d_I^{yz})y_I^M(p_I^y) - F,$$

and

$$W^M = u(x) + v^M(y_I^M) + w^M(z_I^M) - (c^x + d^x)x$$
$$- (c_I^{yz} + d_I^{yz})(z_I^M + y_I^M) + I.$$

$$\max_{p^x, p^y_I, p^z_I} W^M \text{ such that } \Pi^M_I \geq 0.$$

We obtain the following well known first-order conditions

$$\frac{p^x - c^x - d^x}{p^x} = \frac{\lambda}{1+\lambda}\frac{1}{\varepsilon^x},$$

$$\frac{p^y_I - c^{yz}_I - d^{yz}_I}{p^y_I} = \frac{\lambda}{1+\lambda}\frac{1}{\varepsilon^y},$$

$$\frac{p^z_I - c^{yz}_I - d^{yz}_I}{p^z_I} = \frac{\lambda}{1+\lambda}\frac{1}{\varepsilon^z},$$

where λ is the Lagrange multiplier of the non-negative profit constraint.

- $p_I^y \neq p_I^z$ even though costs are the same (c_I^{yz} and d_I^{yz}).

- If we impose a uniform bulk mail pricing constraint, we rather get

$$\frac{p^x - c^x - d^x}{p^x} = \frac{\lambda}{1+\lambda}\frac{1}{\varepsilon^x},$$

$$\frac{p_I^{yz} - c_I^{yz} - d_I^{yz}}{p_I^{yz}} = \frac{\lambda}{1+\lambda}\frac{1}{\varepsilon^{yz}},$$

where

$$\varepsilon^{yz} = -p_I^{yz}\frac{\partial \left[y_I^M(p_I^{yz}) + z_I^M(p_I^{yz})\right]/\partial p_I^{yz}}{y_I^M(p_I^{yz}) + z_I^M(p_I^{yz})}$$

is the demand price elasticity for the whole of bulk mail, or

$$\varepsilon^{yz} = \frac{y_I^M(p_I^{yz})\varepsilon^y + z_I^M(p_I^{yz})\varepsilon^z}{y_I^M(p_I^{yz}) + z_I^M(p_I^{yz})},$$

i.e., as a weighted average of the demand price elasticities for DM and NDM, with the weights being the market shares.

Calibration and Numerical Results

- Linear demands with direct price elasticity of -0.2 for SP, -1.0 for DM and -0.2 for NDM

- Marginal costs: USP unit upstream cost is 0.18€ for SP and 0.12€ for DM and NDM. The USP delivery cost is 0.12€ for all 3 products.

- Fixed cost such that USP breaks even under monopoly (1.68 billion €)

- Table 1

Introducing Alternative Medium

- Keep monopoly on SP (x) and NDM (y) markets, but introduce alternative medium in DM (z) market.

- We define one unit of medium as the amount necessary to obtain the same response than with one unit of mail.

- Optimal prices become

$$\frac{p^x - c^x - d^x}{p^x} = \frac{\lambda}{1 + \lambda} \frac{1}{\varepsilon^x},$$

$$\frac{p_I^y - c_I^{yz} - d_I^{yz}}{p_I^y} = \frac{\lambda}{1 + \lambda} \frac{1}{\varepsilon^y},$$

$$\frac{p_I^z - c_I^{yz} - d_I^{yz}}{p_I^z} = \frac{\lambda}{1 + \lambda} \frac{1}{\varepsilon_{PM}^z},$$

where

$$\varepsilon_{PM}^z = -p_I^z \frac{\partial z_I^{PM}(p_I^z, p_A^z)/\partial p_I^z}{z_I^{PM}(p_I^z, p_A^z)}.$$

- Observe that the cross-price elasticity of the alternative medium demand with respect to the USP's direct mail price does not appear in the formula because of our assumption that the alternative media firms behave like a competitive fringe.

- Table 2.

Competition on both bulk mail markets

- We now build on the previous section and we introduce access-based (postal) competition on both bulk mail markets (DM and NDM).

- Optimal prices are sum of three terms:

$$p^x = c^x + d^x + \frac{\lambda}{1+\lambda}\frac{p^x}{\varepsilon^x},$$

$$p_I^y = c_I^{yz} + d_I^{yz} + \frac{\lambda}{1+\lambda}\frac{p_I^y}{\varepsilon_I^y} + (a^y - d_I^{yz})\sigma_{EI}^y,$$

$$a^y = d_I^{yz} + \frac{\lambda}{1+\lambda}\frac{a^y}{\varepsilon_E^y} + (p_I^y - c_I^{yz} - d_I^{yz})\sigma_{IE}^y,$$

$$p_I^z = c_I^{yz} + d_I^{yz} + \frac{\lambda}{1+\lambda}\frac{p_I^z}{\varepsilon_I^z} + (a^z - d_I^{yz})\sigma_{EI}^z,$$

$$a^z = d_I^{yz} + \frac{\lambda}{1+\lambda}\frac{a^z}{\varepsilon_E^z} + (p_I^z - c_I^{yz} - d_I^{yz})\sigma_{IE}^z,$$

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where

$$\sigma^y_{EI} = -\frac{\partial y_E(p^y_I, p^y_E)/\partial p^y_I}{\partial y_I(p^y_I, p^y_E)/\partial p^y_I},$$

$$\sigma^y_{IE} = -\frac{\partial y_I(p^y_I, p^y_E)/\partial p^y_E}{\partial y_E(p^y_I, p^y_E)/\partial p^y_E},$$

$$\sigma^z_{EI} = -\frac{\partial z_E(p^z_I, p^z_E, p^z_A)/\partial p^z_I}{\partial z_I(p^z_I, p^z_E, p^z_A)/\partial p^z_I},$$

$$\sigma^z_{IE} = -\frac{\partial z_I(p^z_I, p^z_E, p^z_A)/\partial p^z_E}{\partial z_E(p^z_I, p^z_E, p^z_A)/\partial p^z_E},$$

are displacement ratios, in the spirit of Armstrong (2008) and De Donder (2006).

- This last term takes into account the fact that increasing one USP price displaces demand from that good to the postal substitute.

- This displacement effect is measured by the displacement ratio, and is weighted by the margin made selling this good (either directly in the case of an end-to-end product, or through access).

- Displacement to the alternative medium does not appear in the above formulas because

  - this good is offered at marginal cost and,

  - the provision of this good does not bring revenues to the USP, as no access is offered for that product.

- Table 2

Conclusions

- Uniform bulk mail pricing decreases welfare, also through increase in other (single piece) mail prices.

- Introduction of alternative medium competing with DM increases consumers choices and surplus, while still allowing the USP to break even (with our calibration).

- Same observation for introduction of postal competition through access in two bulk mail markets.

- If postal goods offered by USP and entrants are closer to each other (displacement ratio $0.75 => 0.9$), entrants are driven out of DM market.

Table 1: Calibrated results for the USP monopoly

Reference		Monopoly		
		Calibration	Different prices for NDM & DM	With same prices for NDM & DM
Prices (€):				
Single piece	p_I^x	0.500	0.532	0.609
NDM – USP	p_I^y	0.400	0.426	0.373
DM – USP	p_I^z	0.400	0.288	0.373
Quantities (bn):				
Single piece	x_I^x	2.000	1.974	1.913
NDM – USP	y_I	6.000	5.932	6.082
DM – USP	z_I	2.000	2.560	2.137
Total		10.000	10.457	10.133
Total profit (€bn):		0.000	0.000	0.000
Consumer surplus (€bn)				
Single piece		2.500	2.437	2.288
NDM		6.000	5.848	6.166
DM		0.400	0.655	0.457
Total		8.900	8.939	8.910
Lagrange multiplier			0.104	0.148

Table 2: Calibrated results with competition from an alternative medium

Reference		Monopoly	DM medium only	DM medium plus access entry
Assumptions				
Displacement ratio		-	0.75	0.75
Price elasticity (DM/NDM)		-1.0/-0.2	-1.0/-0.2	-1.0/-0.2
Medium share for 50% price reduction		-	25%	25%
Prices (€):				
Single piece	p_I^x	0.532	0.538	0.537
NDM – USP	p_I^y	0.426	0.430	0.430
NDM – access	a^y	-	-	0.265
NDM – entrants	p_E^y	-	-	0.415
DM – USP	p_I^z	0.288	0.276	0.276
DM – medium	p_A^z	-	0.200	0.200
DM – access	a^z	-	-	0.150
DM – entrants	p_E^z	-	-	0.300
Quantities (bn):				
Single piece	x_I^x	1.974	1.970	1.970
NDM – USP	y_I	5.932	5.909	5.249
NDM – entrants	y_E	-	-	0.882
DM – USP	z_I	2.560	2.380	2.012
DM – medium	z_A	-	0.317	0.295
DM – entrants	z_E	-	-	0.493
Total		10.457	10.576	10.900
Consumer surplus (€bn):				
Single piece		2.437	2.425	2.426
NDM		5.848	5.819	5.833
Advertising (DM and media)		0.655	0.707	0.714
Total		8.939	8.951	8.973
Lagrange multiplier		0.104	0.107	0.107