Line of research : modelling postal market liberalisation with universal service obligations (USO)

We use the same model to answer two questions :

1. What will happen to the USO provider under different liberalisation scenarii ?
2. How should we fund the cost of USO under liberalisation ?

Third set of questions with modified model :
Parcels market when entrants need access to incumbent's rural delivery network. What should be the access pricing ?
Paper developed for 10th CRRI Conference on Postal and Delivery Economics, Potsdam, June 5-8, 2002.

This presentation : methodological survey with hints at calibration results.

For more calibration results, see CRRI books :

- 2001 (Vancouver) for question 1
- 2002 (Sorrento) for question 2

Model's building blocks

- Each operator offers **one good** (letter) sent to **different areas** (with different costs) by **different senders** (with different demand elasticities)
- **Submarkets**

  Two geographical areas : urban and rural

  Two **types** of senders and recipients : households and firms

  Location of senders plays no role

  $\Rightarrow$ [households, firms] send letters to [urban, rural] X [households, firms] : **8 sub-markets**
- **Demand**

  No substitution between mail sent to different areas/recipients

  Demand more elastic for firms than for households
- **Cost**

  Cost function : four (constant) marginal costs according to recipient market

Incumbent has fixed cost (linked to USO)

How do we use this model to answer the two questions?

Starting case :
Monopoly-Uniform Price-max Welfare
↓
Entry while Inc.
does not move
COMUSOUL
↙ ↘

What happens?

- Duopoly, Uniform, Welfare
- Duopoly, Differentiated, Welfare
- Duopoly, Diffenciated, Profit

How to fund?

- Pricing flexibility
- Compensation fund
- Reserved Area + same
- Welfare analysis [who gains, who loses]

Sensitivity analysis
Extensions

Starting case : Monopoly – Uniform Price – maximises Welfare

- $U_i(p) = S\left(Q_i^h(p)\right) - pQ_i^h(p)$
  for market $i \in R = \{uh, rh, ub, rb\}$,

  $U(p) = \sum_{i \in R} U_i(p)$

- Same by analogy for businesses
  (using "indirect" production function)
  $\Pi(p)$ and $Q_i^b(p)$

- Incumbent's profit :
  $\Pi^I(p) = \sum_{i \in R}(p - C_i') \left(Q_i^h(p) + Q_i^b(p)\right) - F$

- Incumbent's objective :
  $\max_p \overbrace{U(p) + \Pi(p) + \Pi^I(p)}^{W(p)}$

  s.t. $\Pi^I(p) \geq 0$ [Lagrange multiplier λ]

- Assume $\lambda = 0$

  F.O.C.

  $(A) \sum_{i \in R} \frac{p - C_i'}{p} \left(\varepsilon_h \frac{q_i^h}{Q} + \varepsilon_b \cdot \frac{Q_i^b}{Q} \right) = 0$

  where ε_h : households demand elasticity
  ε_b : businesses demand elasticity
  $Q = \sum_i (Q_i^h + Q_i^b)$

- If $\lambda > 0$

F.O.C. : $\lambda Q + (1 + \lambda)(A) = 0$

Parameters calibrated on this situation

Introducing an entrant

Entrant offers 1 good (letter) seen as imperfect substitute to incumbent's good :

- **Households :**

$$\begin{aligned} U_i(p, p_i^h) &= S\left(Q_i^h(p, p_i^h), Q_i^{E,h}(p, p_i^h)\right) \\ &- pQ_i^h(p, p_i^h) - p_i^h Q_i^{E,h}(p, p_i^h) \\ i \in R &= \{uh, rh, ub, rb\} \end{aligned}$$

with $S(\cdot)$ not separable

$$U\left(p, p_{uh}^h, p_{rh}^h, p_{ub}^h, p_{rb}^h\right) = \sum_{i \in R} U_i(p, p_i^h)$$

- Same for **Business senders :**

$$\Pi\left(p, p_{uh}^h, p_{rh}^h, p_{ub}^h, p_{rb}^h\right),\ Q_i^{E,b}(p, p_i^b)$$

$$\text{and} \quad Q_i^b(p, p_i^b), \quad i \in R$$

- We have

$$Q_i^j(p, p_i^j) \text{ and } Q_i^{E,j}(p, p_i^j) \quad i \in R\,, \quad j \in \{h, b\}$$

- **Entrant's costs :**
  4 marginal costs but no fixed costs

- Incumbent is always maximising profit :

$$\max_{\{p_i^j\}} \Pi^E(p, \{p_i^j\}) = \sum_{(i,j)} (p_i^j - C_i^{E'}) Q_i^{E,j}(p, p_i^j)$$

  $\Rightarrow$ 8 F.O.C. (one by sub-market)

  On sub-market (i,j) :

$$\frac{p_i^j - C_i^{E'}}{p_i^j} = \frac{1}{\varepsilon_i^j(p_j^i)}$$

  where ε_i^j stands for demand direct-price elasticity in sub-market (i,j)

  $\Rightarrow$ Only link between sub-markets is through p which affects elasticities.

- Short term equilibrium : p unchanged
  $\Rightarrow$ Incumbent makes a loss (743 million euros)

1 First Question : Different scenarii

1.1 Duopoly, Uniform Price, Maximises Welfare

- **Entrant :** as previously

- **Incumbent :**

$$\max_p \quad U(p,\{p_i^j\}) + \Pi(p,\{p_i^j\}) + \Pi^E(p,\{p_i^j\}) + \Pi^I(p,\{p_i^j\})$$

$$\text{s.t.} \quad \Pi^I(p,\{p_i^j\}) \geq 0$$

- **Results**
  - We obtain one, "Ramsey like", F.O.C.
  - F.O.C. for entrant is unchanged
  - p increases to cover cost
  - entrant's prices also increase because goods are substitute
  - both profits increases

Remark : Bertrand - Nash equilibrium, so no collusion

1.2 Duopoly, Differentiated Prices, Maximises Welfare

F.O.C. entrant unchanged

F.O.C. incumbent : 1 by sub-market

- **If $\boldsymbol{\lambda = 0}$,** F.O.C. on sub-market (i, j) :

$$(p_i^j - C_i^{E'})\frac{\partial Q_i^{E,j}(\cdot)}{\partial p} + (p - C_i')\frac{\partial Q_i^j(\cdot)}{\partial p} = 0$$

$\Rightarrow \quad p > C_i'$ even without zero-profit constraint

Intuition : Increasing quantity sold by entrant, which is too low because entrant's price too high

- **If $\boldsymbol{\lambda > 0}$:** further increase of p

1.3 Duopoly, Differentiated Prices, Maximises Profit

F.O.C. entrant unchanged

F.O.C. incumbent : 1 on each sub-market

$$\frac{p_i^j - C_i'}{p_i^j} = \frac{1}{\varepsilon_i(p_i^j)}$$

$\Rightarrow$ usual inverse elasticity rule

1.4 Sensitivity analysis

- Variations in demands elasticities, degree of substitution, asymmetric demands
- Variations in marginal costs

1.5 Extensions

- Multiple entry
  Bertrand competition, competitive fringe
- Fixed costs for entrants
  Look at entry pattern

2 Second question : Funding the cost of USO under liberalisation

2.1 Keeping full opening to competition

2.1.1 Giving more price flexibility to entrant

- **Downward pricing flexibility**
  Bertrand-Nash competition on each sub-market
  Take min (equilibrium incumbent's price, pre-liberalisation uniform price)

  Result :
  - Not much profit gained
  - On one sub-market, incumbent's profit even decreases ! Illustrates **value of commitment,** to prevent a "price war"
- **Full pricing flexibility**
  Bertrand-Nash competition
- **Increasing Uniform Price**

Calibration results : does not generate enough profit for incumbent to break even

2.1.2 Establishing a compensation fund

Fund is financed by entrant, through an **excise** or a **proportional** tax on entrants

- Tax incidence literature tells us that part of tax/excise paid by consumer, part by suppliers

  $\Rightarrow$ Consumers and Entrant lose and Incumbent gains

- We show that **total welfare may increase !**

  Explanation :
  Take any sub-market (i, j)
  Total Welfare W :

$$S(Q_i^j(p, p_i^h), Q_i^{E,j}(p, p_i^h))$$

$$-C(Q_i^j(p, p_i^h)) - C^E(Q_i^{E,j}(p, p_i^h))$$

$$\frac{\partial W}{\partial p_i^h} = \frac{\partial Q_i^j(\cdot)}{\partial p_i^h}(p - C'(Q_i^j)) + \frac{\partial Q_i^j(\cdot)}{\partial p_i^h}(p_i^h - C^{E'}(Q_i^{Ej}))$$

Assume $p > C'(Q_i^j)$ and that goods are substitute

Then $\frac{\partial W}{\partial p_i^h} > 0$ if $p_i^h = C^{E'}(Q_i^{E,j})$

$\Rightarrow$ If p_i^h low enough, **taxing entrant's good improves welfare** because it increases the quantity of incumbent's good which is too low.

Corollary to the "Duopoly-Differentiated Prices-Maximises Welfare" scenario

- **calibrations :** taxing increases total welfare but does not generate enough proceeds to fund cost of USO for incumbent

2.2 Introducing a Reserved Area

- **"Across-the-board" :** same proportion r of each market
- Incumbent freely fixes its **uniform price on the reserved areas** so that its profit on reserved area exactly covers loss on opened area.
  $\Rightarrow$ Different values of r are possible.
- We choose **value of r that maximises total welfare**

$$\text{argmax}_r W(r) = V_R(p_{RA}(r), r) + \Pi^E(r) + V_{NR}(r)$$

where $p_{RA}(r)$ is much that

$$\Pi_R(p_{RA}(r), r) + \Pi_{RN}(r) - F = 0$$

Remark 1 : With linear demands, value of r does not affect equilibrium prices in non reserved area.

Remark 2 : We allow incumbent to increase uniform price selectively in reserved area.

Reason is it is much easier to raise profit on reserved area. The break-even price may then be **lower if price increases only on reserved area.**

Remark 3 : We investigate, for non reserved area, same scenarii as before

- **Calibration results :**
  - Different ways to fund cost of USO
  - Even though total welfare increases, **consumers welfare nearly always decreases !**

Results similar to Estrin-de Meza (JPubE, 1995) : Competition prevents incumbent from fully exploiting returns to scale : prices increase because average cost increases.

2.3 Extensions and Sensitivity Analysis

– fixed costs for entrants
– competitive fringe
– more efficient entrants

2.4 Increased Efficiency

Classical argument in favour of liberalisation. Difficult to model. Arbitrarinesss of “black box” approach

Question : By how much should marginal costs decrease following opening to competition

– to fully compensate incumbent ? : 2/3
– for consumers as a whole to gain with optimal reserved area ? : 1/3