PO Box Access: Competition Issues in a Two-Sided Postal Market

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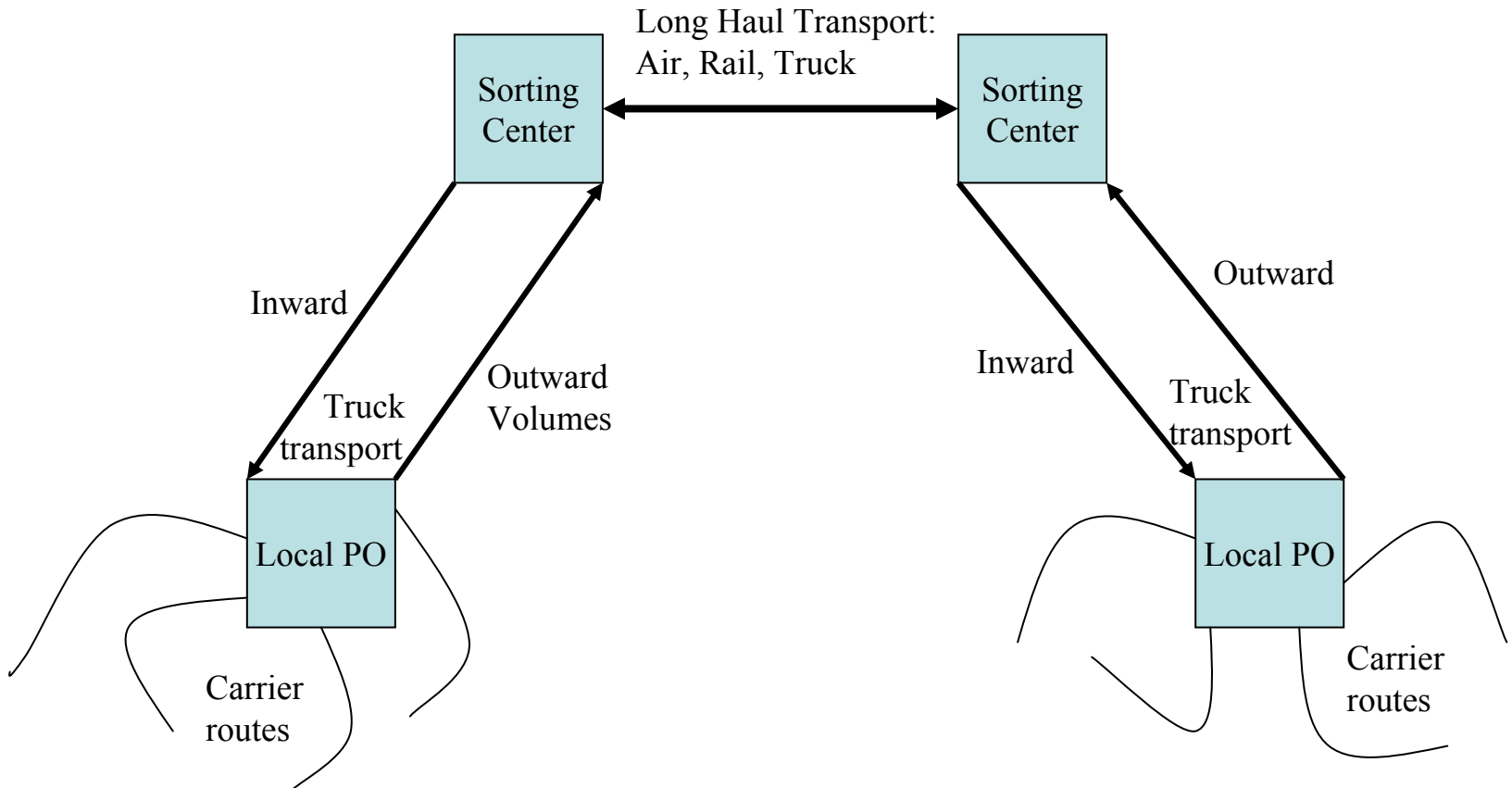HERMES Torino Conference – July 3, 2006

Introduction and Summary

- Goal of the analysis seemed rather simple:
  - Given access to incumbent's PO Box address is essential for delivery competitors
  - What is the appropriate access rate?
- Natural choices are "cost based" methodologies such as ECPR or Average Incremental Cost.
- But, those approaches treat PO Boxes as a fully integrated part of the incumbent's network.
- What if we treat PO Boxes and postal service as inter-related, potentially competitive markets?
- 2-sided market effects may make cost based rules inadequate.

Components of Postal Value Chain (Scale econ. in collection and delivery)

- Collection
  - Mail brought to Local PO from various collection points
- Short haul transport
  - Mail transported from Local PO to Mail Processing Center
- Outward Sortation
  - Mail routed to other MPCs using sorting machines
- Long haul transport
  - Mail transported to destination MPC

- Inward Sortation
  - Mail directed to destination Local PO
- Short haul transport
  - Mail transported to destination Local PO
- Delivery
  - Carriers pick up mail for their routes; sort in route walk order

Stylized postal network

Long Haul Transport:
Air, Rail, Truck

Sorting
Center

Sorting
Center

Inward

Outward

Outward
Volumes

Inward

Truck
transport

Truck
transport

Local PO

Local PO

Carrier
routes

Carrier
routes

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Postal Access Issues

- Is mandated access required for successful liberalization?
- Are there "monopoly bottlenecks" and essential facilities in postal networks?
- Pros of mandating access (by analogy to telecommunications):
  – Reduce sunk costs of entry
  – Allow entry at small scale
  – Improve network efficiency
- Cons
  – Little sunk costs in postal networks
  – May undermine Universal Service Obligation
- In any event, how should access be priced?

How should access be priced?

- Cost-based, but "Top Down" or "Bottom Up"?
  - E.g., EU (2002) Directive states
    - "…(special) tariffs shall take account of the avoided costs as compared to the standard service covering the complete range of features..."
    - "…any such tariffs shall be available to private customers who post under similar conditions…"

- US experience with work-sharing rates based upon ECPR
  - Work-sharing discounts based on avoided costs of USPS
  - (Set in absence of bypass competition.)

- UK cost-based, zoned delivery access rates

- Economic theory, based upon Ramsey-Boiteaux principles, usually comes out in between.

Post Office Boxes

- PO Boxes are facilities rented out to subscribers for the secure reception of mail.
  - Usually on the premises of the incumbent postal provider.
  - Mail Boxes, Etc. is a competitive provider of PO Box services in US.
- The share of PO Box addresses varies greatly by country, but accounts for a significant proportion of both businesses and individuals.
- Delivery entrants in any region find a significant volume of mail addressed to PO Boxes.
  - Delivering this mail may be their only contact with the incumbent.
  - Entrants offer to "do it themselves," but incumbents reluctant to "let them in."

Access to PO Boxes

- Even those (like me) skeptical of "essential facilities" arguments in postal networks agree that competitors should be granted to incumbent's PO Box addresses.
- But, again, how to price to ensure that there is no leveraging of "dominant position" in PO Box market to delivery market.
  - Incumbent's advocate ECPR
    - retains the incumbent's full contribution, even though entrant does nearly all of the work!
  - Entrants (and Postal Regulators) favor cost-based rates
    - which can be very low.
  - Notice that this comes up in the presence of *delivery* competition (bypass), so this is actually an *interconnection* issue.
    - suggests "Bill and Keep" as an option

PO Boxes as a 2-Sided Market

- PO Box operator provides services to:
  - Recipients of mail, who value secure, perhaps anonymous, delivery
  - Postal operators, who are obligated to deliver mail addressed to PO Box subscribers.
    - Postal operators "pass through" the demand of *senders of mail*, who, since Rolland Hill, pay for the volumes sent.

- PO Box operator can charge:
  - Recipients a monthly fee m and/or a per piece charge r
  - Postal operators an access fee a per piece delivered.

Heterogeneous mail recipients

- Mail recipients are indexed by two parameters (s,t) distributed according to joint density $f(s,t)$.
- $t \in [0,T]$ reflects preference for PO Box subscription.
- $s \in [0,1]$ indexes the amount mail he receives.
- The mail volume sent to recipient of type s, $v(p,s)$, also depends upon the price paid by mailers:
  - Mailers may pay different prices depending upon whether mail is addressed to PO Boxes (p_B) or street addresses (p_S).
  - Simplify analysis by assuming mailers have equal demand elasticities for each type of recipient: $v(p,s) = sv(p)$.
- Recipient *net* utility:
  - For PO Box subscribers $U_B = t + (\alpha\text{-}r)sv(p_B) - m$
  - For non subscribers $U_0 = \alpha_S sv(p_S)$

Recipients' subscription decisions determine mix of mail volumes

- The marginal recipient type t^* equates the net utility of subscribing and non subscribing: $t^* = m - (\alpha - r)sv(p_B) + \alpha_S sv(p_S)$
- Total number of PO Box subscribers is $B(m,r,p_B,p_S)$.
- Total mail volumes delivered to PO Box subscribers is $V(m,r,p_B,p_S)$.
- Total volume of mail delivered to street addresses is $V_S(m,r,p_B,p_S)$.

$$B(p_S, p_B, m, r) = \int_0^1 \int_{t^*}^T f(s,t)\,dt\,ds$$

$$V(p_S, p_B, m, r) = v(p_B)\int_0^1 \int_{t^*}^T sf(s,t)\,dt\,ds \equiv v(p_B)Z$$

$$V^S(p_S, p_B, m, r) = v(p_S)\int_0^1 \int_0^{t^*} sf(s,t)\,dt\,ds \equiv v(p_B)Z^S$$

Mailers' behavior and welfare

- The behavior of mailers sending mail to recipients of type s is assumed to be captured by their Marshallian demand functions
- Their utility functions are assumed to be quasi- linear, so that Mailer welfare M is captured by their Marshallian consumers' surplus: $sS(p)$.
  - Note that this specification assumes that the demands for mail sent to two different mailer types are *independent*.
- Recipient welfare R is summed over PO Box subscribers and non subscribers

$$M = S(p_S)\int_0^1 \int_0^{t^*} sf(s,t)dtds + S(p_B)\int_0^1 \int_{t^*}^T sf(s,t)dtds$$

$$R = \int_0^1 \int_0^{t^*} \alpha_S v(p_S)sf(s,t)dtds + \int_0^1 \int_{t^*}^T [(\alpha-r)sv(p_B)-m]f(s,t)dtds$$

Postal and PO Box services as integrated system of 2-sided markets

- Postal service not usually modeled as a 2-sided market under "sender pays".
  - As in telecom, explicit 2-sided modeling is not required with a single service provider.
  - Access and interconnection issues make 2-sided interactions explicit.
- Optimal pricing in integrated system provides useful benchmark for access pricing policy in multi-firm situations.
- <u>Cost assumptions (no "institutional" costs)</u>:
  - Postal costs of delivery to PO Box = c_B.
  - Postal costs of delivery to street address = c_S.
  - Fixed cost per PO Box = b
  - PO Box cost per piece received = c

Optimal pricing by integrated provider

- Profits of integrated provider:

$$\pi^I = (m\text{-}b)B + (p_B\text{-}c_B)V + (p_S\text{-}c_S)V^S$$

- Objective function of welfare maximizer:

$$W = \pi^I + R + M$$

Optimal pricing by integrated provider: mail rates reflect reception externality

- <u>Proposition 1</u>: The optimal mailing rates for both PO Box addressed and street addressed mail are equal to their respective end-to-end marginal costs *less* the associated reception benefit:

$$p_B^* = c_B + c - \alpha$$

$$p_S^* = c_S - \alpha_S$$

Optimal PO Box subscription charge is cost based, reception charge reflects externalities.

- <u>Proposition 2</u>: The optimal PO Box fixed subscription charge is set equal to the per subscriber fixed cost of operating and maintaining it: i.e., $m^* = b$.

- <u>Proposition 3</u>: The optimal PO Box acceptance charge is equal to the difference between the PO Box and non PO Box reception externalities plus an adjustment factor based on the difference between the prices of PO Box addressed and street addressed mail. This adjustment factor is positive, negative, or zero as the former is less than, greater than or equal to the latter.

$$r^* = \alpha - \alpha_S + \frac{\alpha_S [v(p_B) - v(p_S)] + x}{v(p_B)}$$

where $x = S(p_S) - S(p_B)$

Optimal pricing by integrated provider in simplified model – profit outcome

- Even under constant returns, the profits at the welfare optimum may be positive, negative or zero: $\pi^{I*} = x(c_S - \alpha_S, c_B + c - \alpha)Z - \alpha_S Z^S$.

- Outcome depends upon parameter values: i.e., whether $p_B^* = c_B + c - \alpha$ is less than, greater than, or equal to $p_S^* = c_S - \alpha_S$

- Intuitive explanation is that PO Box subscription decision imposes an *externality on mailers* whenever $p_B \neq p_S$.

Optimal access pricing by PO Box provider

- Can the optimal result be "decentralized"?
- Consider the case in which PO Box provider faces *competitive markets* for delivery.
- Sets subscriber charges m and r and access rate a.
- Then, under delivery competition, $p_B(a) = c_B + a$ and $p_S = c_S$.
  - Clearly, access pricing can never support 1st Best so long as $\alpha_S > 0$.
  - Therefore, assume $\alpha_S = 0$ to minimize 2nd Best issues.
- Profits of PO Box provider: $\pi^B = (m-b)B + (a+r-c)V$
- Welfare objective:

$$W = \pi^B(m,r,p_B(a)) + M(m,r,p_B(a)) + R(m,r,p_B(a))$$

Optimal access pricing by PO Box provider – decentralization results

- Solving the FONCs without any non negativity constraints yields $a = c - \alpha$; $r = \alpha + x/v_B$; and $m = b$.
- This establishes the expected decentralization result:
  $$p_B = c_B + c - \alpha = p_B{}^*$$
- Potential problem with decentralization is that "junk arbitrage" may require non negativity constraint on a that may be binding. In that case, resolving the FONC yields
  $$m^{**}=b; \quad a^{**}=\min\{0,c-\alpha\}; \text{ and } r^{**}=\min\{c,\alpha\} + x/v_B$$
- Decentralization no longer holds, as $p_B{}^{**}=\min\{c_B,c_B+c-\alpha\}$
  Note that, in the integrated market case, it is possible for
  $$0 < p_B{}^* = c_B + c - \alpha < c_B$$

Optimal access pricing by PO Box provider – profit implications

- The optimal access charge reflects reception externality as well as handling cost.
- As in the case of the integrated provider, profits of a welfare maximizing PO Box monopolist may be positive or negative.
- Again, due to external effect on mailers

$$\text{sgn } \pi^{B*} = \text{sgn } (p_S\text{-}p_B) = \text{sgn } (c_S - \max\{c_B\text{+}c\text{-}\alpha, c_B\})$$

- Therefore, it is not clear that this is a relevant benchmark for *competitive* PO Box markets.

Access pricing in "competitive" PO Box markets

- Competitive PO Box markets would presumably operate similarly to competitive mobile phone markets:
  - PO Box providers compete for subscribers, attempting to make money on postal access charges
    - I.e., by creating "competitive bottlenecks"
  - Unlikely to subsidize subscription
    - Receivers cannot guarantee access revenues
  - Reception subsidies likely
- Assume that free entry and exit of PO Box providers ensures zero profits:

$$m^c = b \text{ and } r^c = a^c - c.$$

Access pricing in competitive PO Box markets

- Following Armstrong and Vickers (2001), assume that this outcome maximizes receivers' utility
    - But, this means the access charge is set at the "monopoly" level!

$$\Rightarrow a^c = \arg\max\{(a+\alpha-c)sv(a+c_B)-b\}$$

$$a^c = c-\alpha-\frac{v(c_B+a^c)}{v'(c_B+a^c)} = a^c = c-\alpha+\frac{p_B}{\varepsilon} = c-\alpha+\frac{c_B+a^c}{\varepsilon}$$

For constant elasticity ε

$$a^c = \frac{c_B+\varepsilon(c-\alpha)}{\varepsilon-1}; \qquad r^c = \frac{\alpha\varepsilon-c-c_B}{\varepsilon-1}$$

Concluding Remarks: What's the appropriate benchmark for PO Box access policy?

- If benchmark is unconstrained welfare max
  - "Bill and Keep" looks pretty good, especially if $c \approx \alpha \approx 0$.
- If benchmark is outcome in *competitive*, *disintegrated* PO Box and postal markets
  - Access price might even exceed ECPR!
- Because of 2-sided market effects, cost based rules don't seem adequate.
- Additional models to explore:
  - Integrated dominate firm with postal service competitive fringe
  - PO Box duopolists facing competitive postal sector
  - Integrated duopoly