International Settlements: Rate Alternatives

Network Economics

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Agenda

- Overview
- Alternative Procedures
- Modelling Approach
- Summary & Conclusions


Overview

- Accounting/Settlement Rates
- Mechanics of Settlements
- Recent Activities
  - International Telecommunication Union
  - United States Government

Accounting/Settlement Rates

- Settlement Rate
  - Bilateral negotiation
  - One-half of accounting rate

Mechanics of Settlements

- US $, SDRs, or Gold Francs
- Based on traffic differences

Telephone Revenues

Source: FCC

James Alleman Columbia University & University of Colorado
Price Differences & Settlements


Price Differences & International Settlements

Price & Traffic Differences

% difference price
% difference traffic (negative)

Price & Traffic Differences

R-square = 0.704   # pts = 6
y = 0.611 + 0.266(lnx)

Alternative Procedures

- Interconnection Fees
- Sender-keeps-all
- Resale and Callback
- Negotiated/Flexibility
- Cost-based/Benchmarking

Observation

Accounting Rates are Intermediate/Interconnect Prices

Survey of the Literature

- Demand Analysis
- Asymmetry of Prices
- Models
- Policy Recommendations
Demand Analysis & Asymmetry

- Taylor, Lester, *Telecommunications Demand*
- Larsen, A. C. and Dale Lehman, Symmetrical Pricing and Arbitrage*
- Larsen, A. C., Dale E. Lehman, and Dennis L. Weisman, "A General Theory of Point-to-Point Long Distance Demand"

Models: Policy

- Johnson, L. L., *Competition, Pricing, and Regulatory Policy in the International Telephone Industry*
- Alleman, J. H., P.N. Rappoport, and K. B. Stanley, "Alternative Settlement procedures in International Telecommunications Service"*
- Ergas, Henry. and P. Paterson, "International Telecommunications Settlements Agreements"*
- Frieden, Robert., "International Toll Revenue: Tracking the Inequities and Inefficiency"

Models: Duopoly

- Hakim, S. R. a. and D. Lu, "Monopolistic Settlement Agreements in International Telecommunications Agreements"*
- Yun, Kyoung-Lim, Hyun-Woo Choi and Byong-Hun Ahn, "The Accounting Revenue Division in International telecommunications: Conflicts and Inefficiencies"
- Cheong, K. A.. and M. Mullins, "International Telecommunications Service Imbalances"

Models: Competitive

- Competitive
  - First-best
  - Cost-based prices
  - Fifty-fifty split
  - Sender-keeps-all (Bill-and-keep)

Models: Competitive

- *C1*Q1
- *C2*Q2
- *C0*Q
- *q1*: joint service (two-way) traffic
- *q2*: international service (one-way) traffic
- *Q* = *q1* + *q2*
- *C0*, *C1*, *C2*: average incremental costs and product specific (constant) marginal cost
Models: Competitive

Prices:
- $a_i$: settlement
- $p_i$: international (collection rate), country $i$, $i = 1, 2$

First-best prices are marginal costs:
- $p_1 = c_0 + c_1 + c_2$
- $p_2 = c_0 + c_1 + c_2$

Implies: $a_1 = c_0 + c_2$, $a_2 = c_0 + c_1$, & $p_1 = p_2$

Models: Competitive

- Cost-based Rates Efficient
- Benchmarking Improvement
- Inefficient
  - Divergence international rates
  - Fifty-fifty accounting rates
  - "Sender-keep-all" (Bill-and-keep)

Models: Competitive

- Competitive
  - First-best
  - Cost-based prices
  - Benchmark improvement
    - Fifty-fifty inappropriate
    - Sender-keep-all inappropriate
    - Bill-and-keep inappropriate

Models: Benchmark

$max \pi = D(q)q - C(q)$

thus

$\frac{d\pi}{dq} = [dD(q)/dq]q + D(q) - dC(q)/dq = 0$

or $D(q) [1 + 1/\eta] = dC(Q)/dq$

Models: Benchmark

Price greater than Marginal Cost Factor
Models

- Competitive
- Benchmark
- Monopoly/Competitive

Models: Monopoly/Competitive

Maximize:
\[ \pi = D_m(q_c, q_m) q_m + [D_c(q_c, q_m) - c_c - c_0](q_c - q_m) - C(Q) \]

Specify demand as:
\[ D_m(q_c, q_m) = \alpha - \beta q_m - \gamma q_c \]
\[ D_c(q_c, q_m) = \alpha - \gamma q_m - \beta q_c \]
\[ \alpha, \beta, \gamma > 0 \text{ and } \beta^2 > \gamma^2 \]

Substituting:
Maximize:
\[ \pi = (\alpha - \beta q_m - \gamma q_c) q_m + [(\alpha - \gamma q_m - \beta q_c) - c_c - c_0](q_c - q_m) - c_m q_m - c_m q_c - c_0 q_c \]

Solving for first order conditions, rearranging and collecting terms:
\[ 2(\gamma - \beta)q_m + (\beta - 2\gamma)q_c = c_m - c_c \]
\[ (\beta - 2\gamma)q_m - 2\beta q_c = c_c - \alpha \]
when \( c_0 = 0 \)

Solving using Cramer's rule:
Let:
\[ \Delta = 3\beta^2 - 4\gamma^2 \text{ then} \]
\[ q_m = [-2\beta c_m + (\beta + 2\gamma)c_c + a(\beta - 2\gamma)]/\Delta \]
\[ q_c = [(2\gamma - \beta)c_m - \beta c_c + 2a(\beta - \gamma)]/\Delta \]
Models: Monopoly/Competitive

The ratio of $\frac{\gamma^2}{\beta^2}$ measures the degree of arbitraging the prices. We would expect to see $\gamma^2 \to \beta^2$ over time. Initially $\gamma^2$ would be closer to zero since as $\gamma \to 0$, the differentiation of the services is high and when $\gamma^2 \to \beta^2$ the services become more substitutable namely, this ratio would measure the ease of arbitrage.

[Shy, 1995, pp. 136-7]

Models

- Competitive
- Benchmark
- Monopoly/Competitive
- Callback

Models: Callback

$p_m = \text{retail price or collection rate}$

$a_m = \text{the settlement rate}$

If $p_m - a_m < a_m$ or $p_m < 2a_m$,

monopoly gains from callback

Models: Callback

<table>
<thead>
<tr>
<th></th>
<th>No Callback</th>
<th>Callback</th>
</tr>
</thead>
<tbody>
<tr>
<td>price</td>
<td>$2.00</td>
<td></td>
</tr>
<tr>
<td>settlement</td>
<td>($1.06)</td>
<td>$1.06</td>
</tr>
<tr>
<td>net revenue</td>
<td>$0.94</td>
<td>$1.06</td>
</tr>
</tbody>
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</table>
Models: Callback, Monopoly

- No Incentive to Reduce Accounting Rate
- Settlement Improved
- Demand Stimulated
- Consumers/Producer Gain
- Trade Balance Deteriorates

Models: Callback, Competitive

- Neutral on Accounting Rate
- Settlement Exacerbated
- Demand Stimulated
- Consumers Gain (via trade effects)

Models

- Competitive
- Benchmark
- Monopoly/Competitive
- Callback

Policy Recommendations/Summary

- Cost-based Prices Confirmed
- Benchmarks - Improvement
  - Far from marginal costs
  - Could be tighten

Policy Recommendations/Summary

- Cost-based Prices Confirmed
- Benchmark - Improvement
- Callback Ineffective (in some cases)
- Inappropriate
  - Sender-keep-all (Bill-and-keep)
  - Fifty-fifty split
  - Value-based pricing

Future Research

- Refine Models
  - Estimation of demand functions
  - Inclusion of callback/benchmark
  - Ramsey pricing of settlements
- Estimation
  - Callback effects
  - Benefits of cost-based settlements
  - Developing country losses