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Telecommunications Markets**

Jason Percy
Tulane University

Scott J. Savage
University of Colorado at Boulder

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**The Effects of International Simple Resale on Prices in International
Telecommunications Markets¹**

Jason Percy

Tulane University

Department of Economics

207 Tilton Hall, New Orleans, LA 70118

Phone: 504-862-8354; Fax: 504-865-5869

Email: jason.a.pearcy@gmail.com

Scott J. Savage

University of Colorado at Boulder

Department of Economics

Campus Box 256, Boulder, CO, 80309-0256

Phone: 303-735-1165; Fax: 303-492-8960

Email: scott.savage@colorado.edu.

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Abstract

This paper empirically investigates the effect of international simple resale (ISR) authorization on the prices for international message telephone service (IMTS). We compile a firm-level panel data set for over 200 United States-foreign country bilateral markets from 1995 to 2004. These data provide detailed information on prices, variable costs, fixed costs and market shares for 75 firms for each bilateral market, as well as the timing of ISR authorization by the Federal Communications Commission for each bilateral market. Estimates from a difference-in-differences model show that ISR authorization, and the associated lowering of barriers to entry, almost always results in lower prices for all markets. Additionally, we find evidence that ISR authorization alters the relationship between market concentration and price. Prior to ISR authorization more concentrated markets have higher prices. ISR authorization dampens this effect and in some cases reverses the relationship so that market concentration is negatively correlated with IMTS prices set by incumbent firms.

Key words: barriers to entry, competition, international message telephone prices, international simple resale, prices

JEL Classification: L1, L13, L96

1. Introduction

In 1994 the Federal Communications Commission (FCC) approved the practice of routing international telephone traffic over private lines, hereafter “international simple resale.” International simple resale (ISR) reduces barriers to entry by allowing carriers to provide service over leased private lines instead of requiring outright ownership. The FCC authorized ISR, on a country by country basis intending to encourage market entry, promote competition and increase service options for consumers. This research project uses annual firm-level data from 1995 to 2004 to estimate the effect of ISR authorization on the prices for international message telephone service (IMTS).

The unbundling of IMTS network elements, made possible with ISR authorization, has allowed potential new entrants to avoid the large sunk costs from investment in the network infrastructure typically required by incumbent facilities-based (FB) carriers. New entrants can use ISR to provide IMTS by acquiring an international private line, and paying an access charge to connect this line with the networks of the originating and terminating countries. While new entrants have initial start-up costs for marketing and billing infrastructure, and must purchase an exchange facility to connect individual network elements, these costs are relatively small compared to the fixed costs incurred with full FB entry. Given mobile production factors, *i.e.*, network access, and relatively costless entry and exit conditions, ISR authorization should be associated with relatively more entry in IMTS markets.

IMTS provision is a classic example of markets where consumers have switching costs. Economic models with switching costs indicate that market entry may influence the pricing decisions of incumbent firms by leading to either higher or lower prices.

The conventional result is that entry makes markets more competitive thus lowering incumbent prices. Contrary to the conventional result Klemperer (1987), Farrell and Shapiro (1988) and Farrell and Klemperer (2007) show that incumbent firms may behave as fat-cats and increase their price in response to entry. In addition incumbent firms may strategically respond to the threat of potential entry or future entry by limit pricing or limit over-pricing (Klemperer 1987). With a limit pricing strategy, incumbent firms strategically lower their price to deter entry. Once entry occurs the limit price is not maintained and the effect of entry is to increase the incumbent's price. With limit over-pricing the effect of entry may be to decrease the incumbent's price.

This paper empirically investigates the effects of ISR authorization on IMTS prices. We compile a firm-level panel data set for over 200 United States-foreign country bilateral markets from 1995 to 2004. These data provide detailed information on prices, variable costs, fixed costs and market shares for 75 carriers, as well as the timing of FCC ISR authorization across all bilateral markets.² We estimate a difference-in-differences (DID) model with these data to identify the price effects of ISR authorization in US-foreign country IMTS markets.

We find that ISR authorization, and the associated lowering of barriers to entry, resulted in lower prices in almost all markets. Additionally, we find evidence that ISR authorization alters the relationship between market concentration and price. Prior to ISR authorization more concentrated markets have higher prices. ISR authorization dampens this effect and in some cases reverses the relationship so that market concentration is

² Among other things, the FCC considers the market-opening conditions of foreign telecommunications markets on a country by country basis, and whether they reciprocate conditions in United States markets, when deciding to authorize ISR. The FCC made its first two ISR authorizations, Canada and the United Kingdom, in 1994. At the end of 2003, there were 91 ISR-approved countries. In 2004 the FCC eliminated its ISR policy effectively granting ISR authorization in all markets.

negatively correlated with IMTS prices set by incumbent firms. For example, when evaluated at the sample's 90th percentile value for the Herfindahl-Hirschman Index (*HHI*), the average price in markets with ISR authorization is about 13 cents per minute below the average price in markets without ISR. When evaluated at the sample's 10th percentile value for *HHI*, the average price in markets with ISR is about five cents per minute below the average price in markets without ISR. These results suggest that in markets where ISR is permitted, the typical relationship between market concentration and price is altered and in some cases market concentration is negatively correlated with the IMTS prices set by incumbent firms.

Several recent papers have also studied pricing in IMTS markets (See Madden and Savage, 2000; Ennis, 2006; and Ju and Tan, 2008). Our paper differs from these by using a richer source of firm-level data for more foreign country markets and years. Other studies have also found that market entry and a lower level of market concentration are sometimes correlated with higher prices (See Bresnahan and Reiss, 1991; Ward et. al., 2002; Perloff et. al., 2005; Goolsbee and Syverson, 2008; and Chen and Savage, 2009). Our paper contributes to this “competition increasing price” literature by offering new evidence from telephony markets, and by documenting price differences between ISR and non-ISR markets that vary systematically with the extent of market concentration. The evaluation of ISR is also important to policy makers. Recently, the price of IMTS has declined. However, the cost of international private lines used to provide IMTS service has significantly decreased as well, which means the overall effect of entry on prices is ambiguous.

The paper is organized as follows. Section 2 discusses the theoretical background motivating our empirical analysis. Section 3 briefly describes some recent trends in United States IMTS markets and describes the data used in estimation. Section 4 presents the empirical model. Section 5 reports the estimation results and Section 6 concludes.

2. Theoretical Background

This section provides theoretical justification for why entry may increase or decrease incumbent's prices in markets with consumer switching costs. Incumbent firms may strategically respond to entry in the future or to the threat of potential entry. Klemperer's (1987) model is adapted to show how incumbent firms respond to entry in the future. To some extent, Klemperer's (1987) model is similar to the models of Bulow et.al. (1985), Fudenberg and Tirole (1984), and Klemperer (1988). Similarities and differences between these models are discussed.

In the basic model, there are two firms: an incumbent (I); and an entrant (E). In the first period (1), the incumbent chooses a strategic variable, quantity or price, S_1^I , and then in the second period (2) both the incumbent and entrant choose strategic variables, S_2^I and S_2^E , respectively. A larger strategic variable indicates more aggressive behavior such that the strategic variable could be indicative of the firm's quantity or the inverse of the firm's price. The incumbent's discounted sum of profits is:

$$\pi^I = \pi_1^I(S_1^I) + \delta \left(\pi_2^I(S_2^I(S_1^I), S_2^E(S_1^I)) \right)$$

where δ is the discount rate. In the first period, the incumbent chooses S_1^I to maximize the discounted sum of profits and the first-order condition is as follows.

$$0 = \frac{d\pi^f}{ds_1^f} = \frac{\partial \pi^f}{\partial s_1^f} + \delta \left(\frac{\partial \pi^f}{\partial s_2^f} \frac{ds_2^f}{ds_1^f} + \frac{\partial \pi^f}{\partial s_2^E} \frac{ds_2^E}{ds_1^f} \right) \quad (1)$$

If firms do not behave strategically in the first period to entry in period 2, $\frac{ds_2^E}{ds_1^f} = 0$ (Klemperer 1987). If firms behave strategically in the first period, then $\frac{ds_2^E}{ds_1^f} \neq 0$ and either incumbent firms use a limit pricing strategy or limit over-pricing to deter future entry. An incumbent firm may use a limit pricing strategy when $\frac{ds_2^E}{ds_1^f} < 0$. With a limit pricing strategy, the incumbent firm is overly aggressive in period 1 (S_1^1 is large) which leads to lower profits in the first period and makes the entrant less aggressive in the second period. Alternatively when $\frac{ds_2^E}{ds_1^f} > 0$, an incumbent firm may use a limit over-pricing strategy where the incumbent is less aggressive in period 1 (S_1^1 is small). Being less aggressive in the first period, forces the incumbent to be more aggressive in the second period and the entrant knowing the incumbent will be aggressive is less aggressive otherwise. Klemperer (1987) shows that when switching costs are sufficiently large a limit over-pricing strategy is not an equilibrium.

Besides responding strategically to entry in the future, an incumbent firm will respond to actual entry once it occurs. The conventional result is that entry makes markets more competitive and thus lowers the price. In contrast to the conventional result, Rosenthal (1980) develops a model where entry causes the price to increase. Entry increases the price when an incumbent cannot price discriminate between previous consumers who are locked-in and consumers with no lock-in. As firms enter in Rosenthal's model, the incumbent firm finds it more profitable to increase its price and tailor to consumers who are locked-in.

Farrell and Shapiro (1988) and Klemperer (1987) find the same result of entry increasing price with a switching costs model where new consumers enter the market each period. New consumers are not locked-in to an incumbent while a firm's previous consumers are locked-in. With entry, incumbent firms concede new consumers to the entrant while raising prices and exploiting the lock-in of their previous consumers. Incumbents behaving in this fashion are referred to as "fat-cats" (Farrell and Klemperer 2007).

Whether or not firms are responding to entry in the future or entry as it occurs, entry may either increase or decrease an incumbent's price. If incumbent firms limit price to deter entry or act as fat-cats, the effect of entry will be to increase an incumbent's price. With limit pricing incumbent firms set an artificially low price to deter entry and once entry actually occurs the incentives to maintaining a limit price are eliminated. If incumbent firms limit over-price or markets become more competitive with entry, then entry will decrease the price.

For IMTS markets, ISR authorization both increases the probability of entry in the future and causes actual entry to occur. The effect of ISR authorization may be to either increase or decrease an incumbent's price. ISR authorization will increase an incumbent's price if incumbents behave as fat-cats or use a limit pricing strategy. ISR authorization will decrease an incumbent's price if markets become more competitive with entry. When estimating the effect of ISR on incumbent prices in IMTS markets, a positive effect could be attributed to either a limit pricing strategy or fat-cat behavior. A negative effect of ISR indicates that markets become more competitive with entry.

3. Data

3.1 *IMTS market trends*

Figures 1 through Figure 3 provide a recent overview of United States IMTS markets. Figure 1 shows that over time the average revenue per minute of IMTS decreases while the number of minutes increases. It is important to note that the price of IMTS is not necessarily decreasing because of ISR authorization, although the dramatic decrease in price after 1994 tends to be associated with the FCC's first ISR authorizations for Canada and the United Kingdom. Figure 2 shows that the average revenue received by carriers for providing private line capacity has also decreased over time which indicates that the cost of providing IMTS is decreasing. The decline in the price of IMTS could just as easily be explained by a reduction in costs as it could be attributed to ISR authorization. Note that in Figure 2, the average revenue for private lines to Canada and Mexico are not decreasing over time as these lines are mostly terrestrial unlike the other categories. Figure 3 shows substantial growth in international capacity since 1995.

3.2 *Data sources*

We use the *Section 43.61 International Traffic Data Reports* published by the FCC to develop a firm-level panel data set for over 200 United States-foreign country bilateral markets from 1995 to 2004. Our panel starts with 1995 because this was the first year the FCC published the number of voice equivalent circuits along with private line revenues which is used to approximate the upper bound of a carriers fixed cost. While *Section 43.61 International Traffic Data Reports* are available for years after 2004, many carriers requested and were granted confidential treatment of their Section 43.61

filings after 2004. This results in about 35% of the reported revenues being censored from the 2005 report while less than 3.6% of the reported revenues were censored from the 2004 report. Appendix A of the published reports from the FCC indicates the number of phone calls, number of minutes, carrier revenues and interconnection costs for each firm in each market. Appendix B indicates the number of voice equivalent international circuits leased for each firm in each market and the associated revenues. We use these data to calculate the price, variable cost, market share and fixed cost for all FB firms and facilities-resale (FR) firms in each market for each year. We also use the FCC's *International Bureau International Simple Resale* web site to measure the timing of FCC ISR authorization for each bilateral market.

3.3 *Sample*

The initial dataset is comprised of 28,090 annual firm observations for IMTS service between the United States and 239 "international points." 17 of these international points are within the United States and associated territories and were removed from the sample. The remaining 222 US-foreign country bilateral markets were served by 75 carriers, ranging from one carrier serving North Korea at 1995 in 27 carriers serving the United Kingdom in 1997. Because carriers sometimes misreport their revenue and telephone traffic, which we use to construct our price variable, we also removed the highest five percent of price values from the sample. The net sample of data therefore comprised of 25,777 annual price observations by 75 firms across 218 bilateral markets from 1995 to 2004.

3.4 Variables and summary statistics

Table 1 describes the variables used in the empirical analysis and Table 2 presents summary statistics for these variables. The average per minute price for an IMTS call between 1995 and 2004 is 58 cents per minute. The average cost of terminating a call at the foreign destination was 31 cents per minute. In 1995, two countries had obtained ISR authorization from the FCC: Canada and the United Kingdom. By the end of 2003, 91 countries had obtained FCC authorization.³ In 2004 the FCC eliminated its ISR policy effectively granting ISR authorization in all markets. The average value of the Herfindahl-Hirschman Index (multiplied by 100) over the sample period is 33.25 indicating a high degree of average concentration.

4 Empirical Model

4.1 Model

We estimate the effects of ISR with a DID model that compares the prices of incumbent facilities-based firms operating in bilateral markets with ISR authorization to the prices of incumbents operating in markets without ISR. The model for firm i in market j at year t is:

$$PRICE_{ijt} = \beta ISR_{jt} + \delta HHI_{jt} + \theta COST_{ijt} + \alpha_i + \eta_t + \varepsilon_{ijt} \quad (2)$$

where $PRICE$ is the real price per minute for a call from the United States to foreign country j . ISR equals one if the FCC authorized international simple resale and zero otherwise. HHI is the Herfindahl Hirschman Index of market concentration. $COST$ is the

³ Note that the Philippines is an exception as the FCC authorized ISR in this market in 2000 and then revoked ISR authorization in 2003.

real cost per minute for terminating a call from the United States to foreign country j . The α 's are firm fixed effects, the η 's are year fixed effects and ε is an error.

The parameter of interest is $\partial PRICE_{ijt} / \partial ISR = \beta$. All other things being equal, the estimate of β shows the difference in incumbent's prices due to ISR authorization. A finding of $\beta < 0$ indicates that low-cost market entry, as measured by ISR authorization, decreases the incumbent's prices. This result is consistent with the notion that lower barriers to entry make IMTS markets more competitive. Conversely, a finding of $\beta > 0$ indicates that ISR authorization increases an incumbent's price. This result is consistent with competition increasing the price whereby a strategic incumbent raises prices with entry because it has been practicing limit pricing or the incumbent is a fat-cat. Additional insight into potential competition increasing the price effect can be gleaned from an alternative specification of the price equation that includes an interaction term, so that:

$$PRICE_{ijt} = \beta ISR_{jt} + \delta HHI_{jt} + \psi (ISR_{jt} \times HHI_{jt}) + \theta COST_{ijt} + \alpha_i + \eta_t + \varepsilon_{ijt}$$

For example, an estimate of $\psi < 0$ would suggest that in markets where ISR is permitted, increased competition, as measured by a decrease in market concentration, can actually raise IMTS prices. An estimate of $\psi < 0$ would also suggest that in markets where ISR is permitted, a greater degree of market concentration may lead to a lower price.

The DID estimate(s) of β (and ψ) is (are) consistent when ISR authorization is randomly assigned between bilateral markets. Policy endogeneity can arise when unobserved time varying market factors affect the timing of the FCC's ISR authorization decision. One way to minimize this bias is with instrumental variables. However, finding market-level economic and political instruments that are significant determinants of ISR authorization, but are not correlated with prices is difficult. Alternatively, it is

possible to decompose the error term into observed and unobserved market-time components that may be correlated with *PRICE* and *ISR* so that:

$$\varepsilon_{ijt} = Z_{jt}\lambda + TREND_{jt}\tau + e_{ijt}$$

where Z is a vector of observed market-time variables that control for regulatory and political-economy factors that may be correlated with *ISR* authorization,, $TREND$ is a vector of market-specific time trends that control for unobserved foreign country market effects that vary through time and e is an error term.

5. Estimation Results

The empirical model and data described above are used to empirically examine the effects of *ISR* authorization on United States *IMTS* prices. We estimate several alternative model specifications of the price equations (2) and (3). First, we estimate the full sample of the data and secondly, on a sub-sample of “high income”/“high revenue” markets.

5.1 Full sample estimates

DID model estimates on the full sample of 218 US-foreign country markets are presented in Table 3. Because our observations represent firms in bilateral markets, it is possible that there are shocks that are common or correlated across firms within markets. While this does not affect the consistency of our estimator, it does impact the standard error. To address this issue, we allow correlations in the residuals across firms in the same market when computing these standard errors. This is reasonable, for example, if some unobservable characteristics of firm pricing behavior are determined at the market level.

The first column shows the coefficient estimates and standard errors for model (i), the baseline specification (2) without the interaction term. As expected, the estimated coefficients on *COST* and *HHI* are both positive and significant at least the five percent level. The estimated coefficient on *ISR* is negative ($\beta = -0.1956$) and significant at the one percent level. This finding indicates that, all other things being equal *ISR* authorization, and the resulting lower barriers to market entry, decrease the incumbent's prices by about 20 cents per minute. Given that the average price per minute for the full sample of foreign country markets is 51 cents, this represents about a 40 percent difference in prices.

The results above may mask differences in prices due to the combination of *ISR* authorization and the extent of competition within each foreign country market, as measured by the index of market concentration (*HHI*). Model (ii) estimates, reported in column two, measure this interaction effect by including *ISR*×*HHI* in the specification of *IMTS* prices. We first observe that the estimated coefficients on *COST* and *HHI* are similar to those reported for model (i). We also continue to observe a negative and statistically significant coefficient of $\beta = -0.1446$ on *ISR*. Interestingly, the estimated coefficient on the interaction term *ISR*×*HHI* is also negative ($\psi = -0.0018$) and significant at the one percent level.

Specification's (iii) and (iv) include additional controls for the potential policy endogeneity of the FCC's decision to permit *ISR* authorization. Model (iii) controls for observed market-time factors that may be correlated with prices and *ISR* with *PLINE* (real private line revenue per 64 kbps voice equivalent circuit), which is an upper-bound proxy for the cost of renting private line capacity between the United states and foreign

countries.⁴ The results, reported in column three, show a positive and significant relationship between *PLINE* and *PRICE*. Moreover, the estimated coefficients for *COST*, *HHI* and *ISR* are qualitatively similar to those reported for model (ii).

Model (iv) adds a vector of country-specific time trends to (iii) to control for unobserved foreign country market effects that vary through time. In this model specification, we observe a noticeable change in both the sign and magnitude of the estimated coefficient on *ISR*. The estimated individual effect of international simple resale is now positive and close to zero ($\beta = 0.0015$), and is not significantly different from zero. However, the estimate of $ISR \times HHI$ is negative and significant at the one percent level. Taken together, these estimates give rise to $\partial PRICE / \partial ISR = 0.0015 - 0.0027 HHI$. This result suggests that the effect of *ISR* on firm prices becomes more positive with greater facilities-based competition, as measured by a decrease in the Herfindahl-Hirschman Index of market concentration. When evaluated at the sample's 90th percentile value for *HHI* (*i.e.*, 48.46), the average price in markets with *ISR* authorization is about 13 cents per minute below the average price in markets without *ISR*. When evaluated at the sample's 10th percentile value for *HHI* (*i.e.*, 20), the average price in markets with *ISR* is about five cents per minute below the average price in markets without *ISR*. These results suggest that in markets where *ISR* is permitted, competitive markets with a lower degree of market concentration are characterized by higher *IMTS* prices than more concentrated markets.

⁴ To control for demand-side effects that vary across countries and through time, we are currently augmenting our firm data with information on gross domestic product, number of telephone lines and international trade, obtained at the foreign country level from the World Bank (2009) and the International Telecommunications Union (2009). *GDP* is the real gross domestic product per capita of foreign country *j*, *LINES* is the number of telephone lines in foreign country *j*, and *TRADE* is the sum of exports and imports between the United States and foreign country *j*. We are also constructing an additional cost control that varies across countries and through time, *CAP*, which is the capacity in bits per second between the United States and foreign country *j*.

An alternative way to interpret these results is to examine the sign of $\partial PRICE/\partial HHI$, where $\partial PRICE/\partial HHI = 0.0024 - 0.0039ISR$ from Model (iv). The expected sign of $\partial PRICE/\partial HHI$ is positive so that prices are higher in markets which are more concentrated. In markets where ISR is not permitted, $\partial PRICE/\partial HHI$ is positive as expected, but this result is reversed for markets where ISR is authorized. Even in Model (ii) and Model (iii), the sign of ψ is negative indicating that ISR authorization fundamentally changes the relationship between market concentration and price.

5.2 Sub sample estimates

Economic theory suggests that the effect of competition on prices may vary across high and low-revenue markets. To account for this source of heterogeneity, we estimate the DID model on a sub sample of 99 US-foreign country “high income” markets. A market is classified as high income when the gross national income per capita of the foreign country is greater than \$3,856, as defined by the World Bank (2009).

Sub sample estimates are reported in columns one through four in Table 4. Overall, the estimates have a similar a qualitative flavor to those reported for the full sample in Table 3. Focusing on the results for model (iv), we observe that estimated coefficients on ISR and $ISR \times HHI$ give rise to $\partial PRICE/\partial ISR = 0.0025 - 0.0039HHI$. When evaluated at the sample’s 90th percentile value for HHI (*i.e.*, 44.52), the average price in markets with ISR authorization is about 17 cents per minute below the average price in markets without ISR. When evaluated at the sample’s 10th percentile value for HHI (*i.e.*, 20.95), the average price in markets with ISR is about eight cents per minute above the average price in markets without ISR. Similar to the full sample estimates,

these results suggest that in markets where ISR is permitted, competition in high-revenue markets is positively correlated with IMTS prices for incumbent firms. These results also suggest that ISR authorization changes the expected relationship between market concentration and price.

6. Conclusions

This paper has empirically examined the effects of ISR authorization on IMTS prices for the United States. We find that ISR authorization, and the associated lowering of barriers to entry, resulted in lower prices in almost all markets. Additionally, we find evidence that ISR authorization alters the relationship between market concentration and price. Prior to ISR authorization more concentrated markets have higher prices. ISR authorization dampens this effect and in some cases reverses the relationship so that market concentration is negatively correlated with IMTS prices set by incumbent firms. In summary, our preliminary results provide some additional evidence for the competition increasing price literature by showing that in some markets where ISR is permitted, competition is positively correlated with IMTS prices. Future work will consider additional controls for the potential endogeneity of ISR authorization and appropriate robustness checks. More insight would also be obtained by linking the empirical results more tightly to the theoretical literature.

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Table 1. Price equations variables

Variable	Description and data source
<i>PRICE</i>	Real price per minute for an IMTS call from the U.S. to foreign country j ; (outgoing revenue / outgoing minutes) / GNP deflator. Source: FCC <i>Section 43.61 International Traffic Data Reports</i> .
<i>ISR</i>	One when foreign country j has obtained ISR authorization from the FCC and zero otherwise. Source: FCC <i>International Bureau International Simple Resale</i> .
<i>HHI</i>	Herfindahl-Hirschman Index for traffic from the U.S. to foreign country j multiplied by 100. Source: FCC <i>Section 43.61 International Traffic Data Reports</i> .
<i>COST</i>	Real cost per minute for terminating an IMTS call from the U.S. to foreign country j ; (outgoing payments / outgoing minutes) / GNP deflator. Source: FCC <i>Section 43.61 International Traffic Data Reports</i> .
<i>PLINE</i>	Real cost of private line voice equivalent circuit from the U.S. to foreign country j ; (total private line revenue for all firms / number of 64 kbps voice equivalent circuits) / GNP deflator. Source: FCC <i>Section 43.61 International Traffic Data Reports</i> .

Table 2. Summary statistics

	Observations	Mean	Standard deviation	Minimum	Maximum
<i>PRICE</i> (\$)	25,777	0.5830	0.5095	9.26e-07	2.2845
<i>ISR</i>	25,777	0.2635	0.4125	0	1
<i>HHI</i>	25,777	33.355	13.512	0.5749	100
<i>COST</i> (\$)	25,777	0.3052	0.6013	0	55.17
<i>PLINE</i> (\$)	19,727	16,354	41,819	21.305	1,074,458

Table 3. DID model estimates with full sample of countries 1995-2004

	Model (i)	Model (ii)	Model (iii)	Model (iv)
	Coefficient	Coefficient	Coefficient	Coefficient
<i>ISR</i>	-0.1956 ^{***} (0.0205)	-0.1446 ^{***} (0.0221)	-0.1474 ^{***} (0.0257)	0.0015 (0.0285)
<i>HHI</i>	0.0018 ^{***} (0.0004)	0.0020 ^{***} (0.0004)	0.0030 ^{***} (0.0005)	0.0018 ^{***} (0.0004)
<i>ISR</i> × <i>HHI</i>		-0.0018 ^{***} (0.0006)	-0.0013 [*] (0.0078)	-0.0027 ^{***} (0.0009)
<i>COST</i>	0.1435 ^{**} (0.0601)	0.1432 ^{**} (0.0601)	0.1259 ^{**} (0.0635)	0.1043 [*] (0.0581)
<i>PLINE (Z)</i>			5.39e-07 ^{***} (7.32e-08)	3.09e-07 ^{***} (8.47e-08)
<i>CONSTANT</i>	1.0051 ^{***} (0.0686)	0.9948 ^{***} (0.0694)	0.9295 ^{***} (0.0760)	1.0846 ^{***} (0.0862)
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Country specific trends	No	No	No	Yes
Within R ²	0.370	0.370	0.386	0.432
Number of firms	73	73	73	73
Number of countries	218	218	192	192
Number of observations	25,777	25,777	19,727	19,727

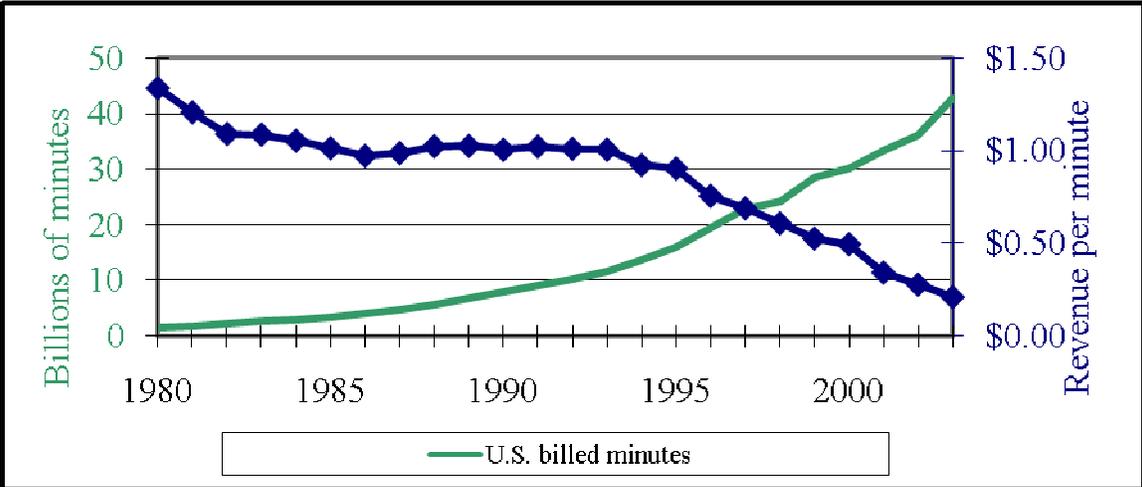
NOTES. Dependent variable is *PRICE*. *** significant at the 0.01 level; ** significant at the 0.05 level; * significant at the 0.1 level; Robust standard errors (s.e.) in parenthesis are clustered at the firm level. Estimates of fixed effects and trends not reported.

Table 4. DID model estimates with “high-income” countries 1995-2004

	Model (i)	Model (ii)	Model (iii)	Model (iv)
	Coefficient	Coefficient	Coefficient	Coefficient
<i>ISR</i>	-0.1496 ^{***} (0.0200)	-0.0879 ^{***} (0.0255)	-0.0803 ^{***} (0.0284)	0.0205 (0.0372)
<i>HHI</i>	0.0019 ^{***} (0.0006)	0.0024 ^{***} (0.0007)	0.0027 ^{***} (0.0009)	0.0024 ^{***} (0.0009)
<i>ISR</i> × <i>HHI</i>		-0.0021 ^{***} (0.0008)	-0.0024 ^{**} (0.0009)	-0.0039 ^{***} (0.0012)
<i>COST</i>	0.2248 ^{**} (0.1026)	0.2239 ^{**} (0.1025)	0.2078 ^{**} (0.1039)	0.1892 [*] (0.0971)
<i>PLINE (Z)</i>			5.85e-07 ^{***} (8.21e-08)	3.09e-07 ^{***} (8.47e-08)
<i>CONSTANT</i>	0.8540 ^{***} (0.0692)	0.8334 ^{***} (0.0689)	0.8178 ^{***} (0.0705)	0.9177 ^{***} (0.0777)
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Country specific trends	No	No	No	Yes
Within R ²	0.386	0.387	0.392	0.432
Number of firms	71	71	73	73
Number of countries	218	218	192	192
Number of observations	13,368	13,368	11,768	11,768
Number of observations	13,368	13,368	11,768	11,768

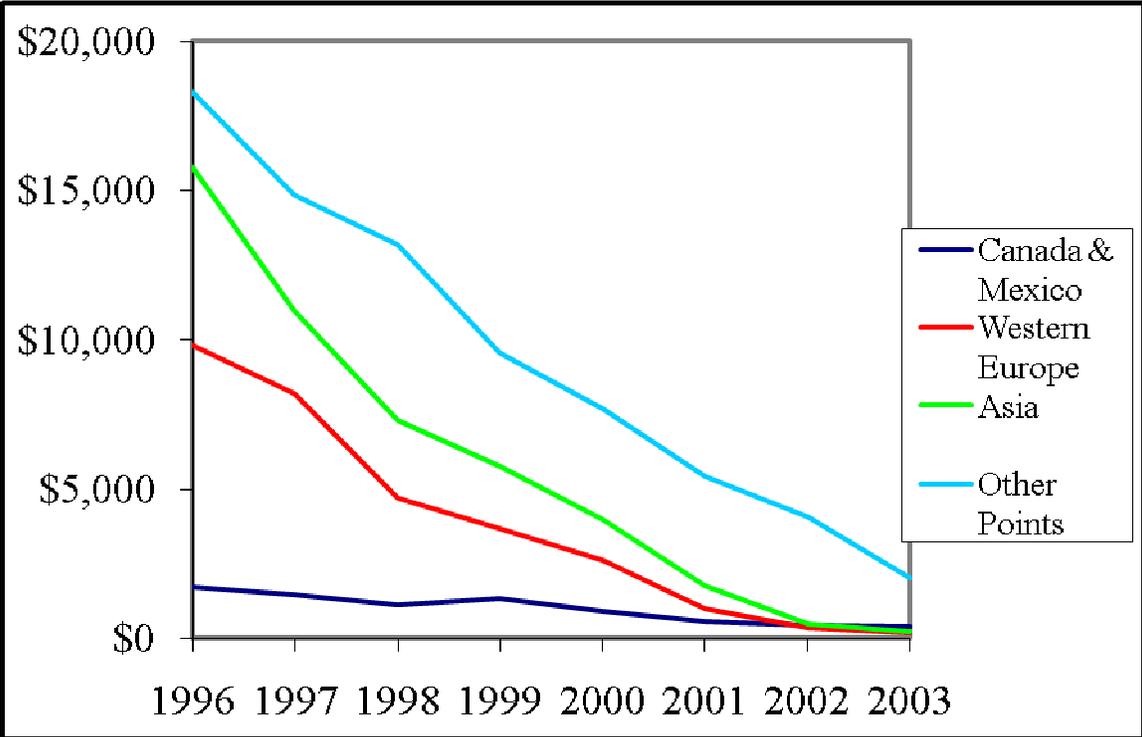
NOTES. Dependent variable is *PRICE*. *** significant at the 0.01 level; ** significant at the 0.05 level; * significant at the 0.1 level; Robust standard errors (s.e.) in parenthesis are clustered at the firm level. Estimates of fixed effects and trends not reported. Sub sample of upper middle and high income countries according to the World Bank (2009).

Figure 1. IMTS minutes and revenue 1980 to 2004



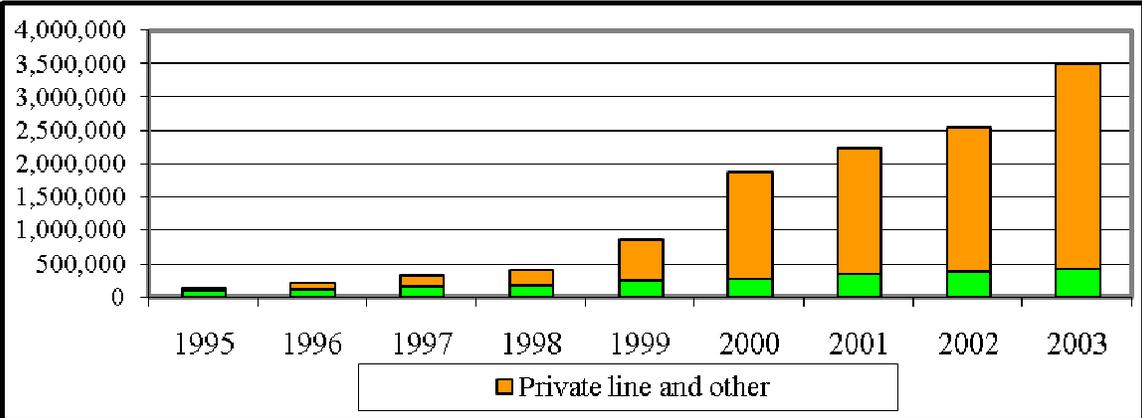
Source: FCC 2005

Figure 2. Average revenue per voice equivalent circuit



Source: FCC 2005

Figure 3. Voice equivalent international circuits by use of circuit



Source: FCC 2005