Competition and Price Dispersion in International Long Distance Calling

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Abstract

This paper examines the relationship between changes in telecommunications provider competition on international long distance routes and changes in prices on those routes. Overall, increased competition is associated with significantly lower prices to consumers of long distance services. However, the relationship between competition and price varies according to the type of long distance plan considered. For the international flagship plans frequently selected by more price-conscious consumers of international long distance, increased competition on a route is associated with lower prices. In contrast, for the basic international plans that are the default selection for consumers, increased competition on a route is actually associated with higher prices. Thus, somewhat surprisingly, price dispersion appears to increase as competition increases.

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1 Introduction

This paper seeks to better understand the relationship between competition to provide long distance service and rates charged for long distance service. Relatively little evidence exists about this relationship, despite the extensive and long-standing pursuit of competition by telecommunications regulators. The fundamental rationale for policy makers to encourage competition has been the belief that competition leads to lower prices. During an era in which the number of competitors and their capacity increased substantially, average US long distance rates have indeed fallen dramatically. However, we cannot infer that the reductions in the rates for long distance calls occurred as a result of increasing competition; instead, the rates may have fallen simply because the costs of providing service decreased.

The nature of the US long distance telecommunications market has changed considerably since MCI began providing switched long distance service in 1974. Prior to that time, AT&T was the primary provider of US long distance service. In the late 1970s, US regulators encouraged competition in long distance service by prompting AT&T to negotiate temporary access tariffs that allowed long distance carriers to interconnect with its local facilities on standard terms. Since that time, regulators have continued to encourage competition through various means, including separating AT&T's long distance division from its local divisions and setting mandatory conditions of interconnection between long distance and local companies. Between 1984 and 2000, US domestic long distance rates have fallen by as much as 80% and international long distance rates have fallen by even larger amounts.

The reason that price reductions could be so dramatic and yet

not indicate active competition is that costs themselves have fallen substantially. Domestic US long distance rates have been affected by regulatory actions that have led to considerable reductions in the per-minute access charges that are paid by US long distance carriers to local carriers for the origination and termination of a call. Access charges have fallen from 17.3 cents per minute in 1984 to 2.8 cents per minute in 2000 (Industry Analysis Division (2000), p. 1-4, nominal values).

A similar cost reducing phenomenon has occurred with international long distance. The most significant element of international costs consists of a country-specific access charge that is called the settlement rate and that is paid by the US carrier to the foreign carrier for delivering US-originated calls and by a foreign carrier to the US carrier for completing foreign-originated calls. For international long distance, the costs of sending a call overseas from the US have fallen by as much as 90%, primarily because of reduced settlement rates.

In the face of such large cost reductions, prices would likely decline even in the absence of competition. Thus the fact that long distance rates have fallen may simply reflect lower costs rather than increased competition.

The economic work analyzing the relationship between long distance competition and prices deals primarily with domestic US pricing (see Edelman (1997), MacAvoy (1995, 1996 and 1998), Taylor and Taylor (1993), Taylor and Zona (1997), and Ward (1999).) One prominent line of work, exemplified by MacAvoy (1995 and 1998) examines "basic rate" price changes between 1985 or 1987 and the early 1990s to show that prices have decreased less quickly than costs. MacAvoy had been instrumental in pointing out the possibility that lower costs, on their own, might explain all the price declines observed in long dis-

tance rates. MacAvoy argues that margins have increased while costs have fallen and concludes that domestic competitors are essentially operating as a cartel.

MacAvoy's work faces two primary limitations. The first limitation is that its measure of price typically focuses on the highest price plan (or "basic" plan.) This is the default rate received by a consumer who signs up for no special long distance plan. Focusing on the basic rate may seem reasonable because a high proportion of users are covered by the basic rate plan. However, the rationale for focusing on the basic rate is weakened by the fact that major long distance companies have customers on a variety of different plans, and a minority of calls are actually covered by a basic rate plan. Concentrating on the basic rate plan thus ignores the majority of usage that might be indicative of the most intense price competition. At any given time, long distance companies typically offer a flagship plan that provides much lower per-minute rates for calling than the basic plan.

The second limitation of the work is that it consists primarily of graphical analysis of trends, so its statistical strength is somewhat limited. The difficulty is inherent in the data and is not a criticism of the approach. Comparing basic rates to costs yields a simple time series of prices and costs that may be a complete characterization of the relationship between basic rates and costs. However, if claims are made that the results for basic rates apply more broadly, the extent to which behavior of basic rates mimics that of other plans becomes critical. Given that there is no reliable measurement that weights all the different domestic calling plans, and that there is limited variation in any measurement of the change in competition over time, an approach to the analysis of domestic competition that contains more statistical variation would be desirable.

In this paper, we suggest that variation between international long distance routes can be used to analyze whether price reductions are occurring solely as costs decline or whether price reductions are also related to other factors, such as declining concentration on routes. As with domestic long distance data, costs and prices are relatively clearly defined. However, the international data has a feature not found in available domestic data: significant variation in the levels of concentration between routes. To the extent that concentration is related to varying physical capacities to provide service, concentration may be considered a reasonable proxy for capacity-based competition. International data will then allow a direct test of the relationship between concentration and price.[1]

Previous work focusing on international pricing is relatively limited (see Acton and Vogelsang (1992), Bewley and Fiebig (1988), Cave and Donnelly (1996), and Madden and Savage (2000)) and has not focused on the impact of competition, except for Madden and Savage. They analyze a limited number of countries and focus primarily on the thesis that prices fall as markets become more symmetric in their levels of competition and private ownership.[2] Madden and Savage examine only one price for each market and do not analyze the plan-specific pricing of carriers. The current research is distinct because the interpretation of competitiveness variables will be clearer in this

[1]Unique institutional features of the international phone market reduce the power of the critiques of Demsetz (1973) and Peltzman (1977) that the relationship between concentration and profits (or price) may be driven by unobserved cost variables that differ between firms, so that concentration will be strongly associated with unobserved variables. Due to the institutional peculiarities of international long distance, firms essentially face the same cost structure, since international costs are primarily driven by settlement rates that are common across telecommunications providers.

[2]The interpretation of their competitiveness variables is somewhat unclear since they are all multiplied by the number of minutes of traffic even though the dependent variable of price is apparently not quantity-adjusted.

paper and price dispersion between different plans will be analyzed.

One of the two primary questions we ask is whether price decreases most on routes where concentration decreases the most. If so, then we do not reject the hypothesis that increased competition on routes is associated with lower prices on those routes. In particular, we examine how price changes varied depending on the change in concentration on country-pair routes between 1994 and 1998. This analysis allows for a statistical power that is absent from studies relying solely on changes in domestic interstate rates. There are more than 100 countries with annual data on prices, costs and other variables. Over this time period, prices, costs, and the number of competitors on many routes changed to different degrees on different routes.

The second primary question we consider is whether there is any relationship of the price dispersion between basic and flagship rates and the level of concentration on a route. The difference between rates in the low-price flagship plan and the high-price basic plan can be dramatic: calls made with a basic plan can easily cost as much as ten times more than calls made on a flagship plan. One might imagine this price dispersion is most likely to survive under monopolistic industry structure, but less likely to survive as the structure grows more competitive, since a competitor will likely have the incentive to offer a plan type that is, in some sense, intermediate between those of its competitors when its competitors attempt to segment the market into two or more customer types. However, an increasing body of theoretical work suggests that, for reasons related to information and search costs, price dispersion may have either an ambiguous relationship to concentration (see Tommasi (1993)) or price dispersion may actually increase as the number of products increases (see Anderlini and Ianni (1996).)

An increasing body of empirical literature suggests that markets subject to competition can contain significant price dispersion for reasons unrelated to product cost differences (see, for example, Borenstein (1985), Shepard (1991), Borenstein (1991), Borenstein and Rose (1994), and Sorenson (2000).) These papers analyze products that are relatively, but not perfectly, homogeneous and that contain multiple sellers, such as gasoline and air travel. A common theory underlying the work is that consumer search costs explain the price dispersion. As the expected gains from search grow, price dispersion will fall. In line with this theory, Sorenson (2000) finds that repeatedly purchased pharmaceutical prescriptions, for which one would expect the greatest benefit from search, have significantly lower price dispersion than other types of prescriptions.

While the empirical literature relating price dispersion to search costs has grown, little research has focused explicitly on the relation between price dispersion and concentration, though concentration may be related to the number of products available and, hence, to the costs of searching for the best product. Borenstein and Rose (1994) find a significant positive effect of competition on price dispersion. That is, on a more competitive airline route, prices on the route tend to exhibit more dispersion.[3] The finding is based on a cross-sectional analysis of airline fares in the second quarter of 1986. The result is particularly interesting because it suggests that price dispersion may not only exist in competitive markets but rather may on occasion be greater in competitive markets than in more monopolistic ones.

[3]Similarly, Walsh and Whelan (1999) find that price dispersion for a brand increases in Irish grocery stores as brands operate in more competitive product areas. Unfortunately, the interpretation of the empirical finding is difficult because the concentration measure of Walsh and Whelan (1999) yields the same value of concentration for a product category with a monopolist as for a product category with a fully atomistic structure of ownership.

The result of Borenstein and Rose (1994) could potentially arise from unmeasured market heterogeneity. One explanation of how the results could arise is that the more competitive markets may be located in large urban areas. Such areas may have a greater heterogeneity of income levels and wider variances in individuals' willingness to pay. This wider variance may yield high price dispersion, so that while there is an association between high price dispersion and more competitive markets, the association exists for reasons unrelated to competition.

A panel data analysis with market-specific fixed effects may resolve many of these potential heterogeneity problems by eliminating market-specific heterogeneity.[4] In this paper, we will take advantage of broad panel data to examine the relationship between price dispersion and concentration in international telecommunications. The international long distance market benefits from having similar cost structure for different carriers, extensive data on concentration and cost changes, and a relatively simple measure of dispersion, namely the difference between flagship and basic rates, since there are two main international long distance prices offered to residential customers by a typical long distance carrier. As a result, this analysis can provide a relatively crisp characterization of the relationship between dispersion and concentration.

The rest of this paper is organized as follows: Section 2 discusses the regulatory mechanisms that govern international long distance. Section 3 discusses the competitive model. Section 4 discusses the data that is used in this paper and presents descriptive statistics. Section 5 presents the empirical results. Section 6 then concludes.

[4]Evans, Froeb, and Werden (1993) show that a panel method considerably improves upon cross-sectional approaches in concentration-price studies.

2 Regulatory Framework

The sending and receiving of international long distance calls is governed by a distinct regulatory framework known as the international settlements process. It is important to understand this process in order to properly calculate the variable costs of sending a call overseas. Once the process is understood, variable costs can be measured with a relatively high degree of precision. Between 1994 and 1998, the long distance companies' costs of making international long distance calls have fallen dramatically in measurable ways.

The cost to a long distance company of completing a call to a foreign country is made up of three primary parts: a local access charge paid to the local US telephone company, the network cost of bringing the call to another country, and a per-minute settlement rate that is paid to the foreign carrier that completes the call. The settlement rate is typically a result of negotiations between AT&T and the primary foreign carrier under a regulatory framework that governs the rate paid and received by a provider for sending and receiving calls and governs the allocation of return calls between carriers. The rate negotiated by AT&T is then applied to all US carriers. From the perspective of a carrier besides AT&T, these rate changes can be viewed as exogenous cost shocks. Generally, the settlement charges constitute the vast majority of the cost of completing a call overseas.

The settlement mechanism requires symmetric rates and proportional returns. The symmetric interconnection requirement states that when traffic is sent to the US from a foreign carrier, the foreign carrier pays a per-minute settlement rate to the US carrier that is equivalent to the rate the US carrier pays for sending a call to the foreign carrier.

The proportional returns requirement states that a foreign carrier

must return traffic to US carriers in proportion to the number of minutes sent to that carrier by the US carrier. For example, if Sprint sends 25% of the traffic from the US to a foreign carrier, that foreign country's carrier must return 25% of its US-bound traffic through Sprint. While a long distance carrier incurs charges for completing a call to a foreign country, it generates counterbalancing revenue when it receives traffic from that foreign carrier. A marginal call generates a marginal increase in returned traffic. Thus from the US long distance carrier's perspective, the net cost of making calls overseas includes the settlement payments from both outgoing and incoming calls. Since the number of outgoing minutes from the US generally exceeds the number of incoming minutes, the US carriers generally face a positive per-minute cost per call, but a cost that is lower than the settlement rate.[5]

In the late 1990s, the rules governing the international settlement process changed to reflect the fact that in some countries there are now competing long distance carriers. In fact, rates from the US to some countries (e.g., Canada) can be lower than many domestic long-distance rates in the US. The Federal Communications Commission (FCC) has recently set target settlement rates for different countries which, when achieved, allow non-dominant carriers in those countries to opt out of the international settlement process. In addition, in 1994 the FCC introduced International Simple Resale (ISR) for countries that met certain competitiveness criteria within the country and

[5]This unusual mechanism of cost imposition was created to counterbalance the possibility that foreign carriers would charge high rates for traffic to their countries, and then negotiate low rates for return traffic with just one of the competing US carriers, leading to a higher telecom trade imbalance than already exists between the US and foreign countries (the trade imbalance for IMTS calls was about $4.8 billion in 1998 (Industry Analysis Division, 2000.) For a further discussion of the International Settlement Process, its distortions, and a proposal for a less distorted process, see Malueg and Schwartz (1998).

which had settlement rates below particular target rates. ISR service is the provision of international switched traffic services over international private lines. ISR service allows the US-originating carrier and end-country receiving carrier to avoid the traditional settlements system. The number of countries approved for ISR service increased substantially between 1994 and 1998.

There were significant changes in the international environment over the time period of analysis, in particular with the formation of the World Trade Organization (WTO) in 1995 and with the full or partial implementation of the WTO telecommunications agreement in selected WTO countries in 1998. Clearly it is of policy interest to see whether there have been price impacts from either type of WTO membership or agreements, so variables reflecting these changes will be considered in the models that follow.

3 Model

The first question we consider is whether increasing competition on a route is associated with reductions in prices on that route. The second question we consider is whether price dispersion increases or decreases as competition increases. These questions implicitly assume that pricing for different country pairs is largely governed by country-specific conditions. Given that international pricing plans typically provide a set of prices for all countries, it is not obvious that separating prices on a route-by-route basis is appropriate. If we find that concentration levels on a route are related to prices on that route, then the fact that prices for international calling are typically bundled together does not imply that international calls are in fact a bundled product. Particularly given that much international calling is generated by foreign-born

residents calling their relatives and friends in the nation of their birth, we might expect that demand for an international plan, with its bundle of prices, is frequently governed by considerations of solely one of those prices.

For both questions, the panel data set approach holds considerable promise, since there is high variation over time in the variables of interest. This work mitigates the standard endogeneity criticism of cross-sectional price-concentration studies by reporting results from the analysis of a panel data set with fixed effects. Price, costs and concentration are known with great precision because the vast majority of international long distance variable costs arise from observable, regulated settlements.

While examining the relationship between prices and concentration, we should also consider how prices will change when costs are also changing. That is, we might expect that, assuming constant costs, if competition increases (or concentration decreases), industry-wide prices will fall. For simplicity, we assume that this period is exemplified primarily by changes in supply conditions, as the average cost of calls fell by about 50% over the five years of analysis. This assumption is most reasonable when the time period of analysis is short, the number of foreign-born US residents from a given country is little changed, and the amount of US trade with a foreign country is little changed.[6]

The model relates route-specific prices to route-specific concentration levels, costs, and regulatory variables. We will estimate this

[6]In order to maintain our assumption that changes found in this data are primarily related to supply conditions, countries where we might expect that demand conditions have changed considerably over the time period of analysis are excluded from the data set. These include Vietnam and the formerly Soviet block Eastern European countries. Their exclusion, however, does not affect the results.

model in a panel framework with fixed effects for countries. That is,

$$p_{it} = \beta_0 + \beta_{1i} D_i + \beta_2 h_{it} + \beta_3 c_{it} + \beta_4 ISR_{it} + \beta_5 WTO_{it} + \beta_6 WTOtel_{it}$$

where

p_{it}: price in country i in period t

D_i: dummy set to 1 for country i

h_{it}: concentration in country i in period t

c_{it}: cost in country i in period t

ISR_{it}: ISR status dummy variable in country i in period t

WTO_{it}: WTO status dummy variables in country i in period t

$WTOtel_{it}$: WTO telecommunications agreement status dummy variables in country i in period t

The costs include the payment made by the U.S. carrier to overseas carriers for completing calls, the payments made to U.S. local carriers for originating or completing calls, and the actual physical cost to the carrier of carrying the call.

The model will be estimated for overall average prices by all US carriers, for provider-specific average prices, and for provider-specific plan prices for the period between 1994 and 1998.

In order to investigate the relationship between price dispersion and competition, we will estimate a second model that relates the degree of price dispersion to factors including the change in concentration. The model is:

$$pd_{it} = \beta_0 + \beta_{1i} D_i + \beta_2 h_{it} + \beta_3 c_{it} + \beta_4 ISR_{it} + \beta_5 WTO_{it} + \beta_6 WTOtel_{it}$$

where

pd_{it}: difference between basic rate in country i in period t for a given carrier and the flagship rate in country i in period t.

We will estimate this second model in a panel framework with fixed effects for countries, on a route-by-route basis from 1994 to 1998.

4 Data

In order to estimate the equations above, we use measures of price, cost, concentration, the WTO status of countries, and the FCC-determined ISR status of countries.

We measure price as either an average per-minute price or a plan-specific per-minute price. Average price to a country is calculated by taking the domestic revenue from international calling to a country and dividing by the number of minutes of calling to that country. Plan-specific prices detail the flagship rates of a carrier to a specific country or the basic rates charged by a carrier when consumers call a specific country.

The average price measures are calculated first jointly for all facilities-based carriers providing international telephone service and then separately for two of the primary individual carriers over this time period, MCI and Sprint.[7] The data necessary for these calculations is derived from international telecommunications data collected by the FCC under section 43.61 of FCC regulations (FCC 1995, 1996, 1997, 1998, 1999 and 2000).

International flagship and basic rates are calculated based on the lowest marginal rate available for calls to a foreign country.[8] These data are submitted to the FCC in regular tariff filings by each carrier.

[7]To the extent we estimate models for specific carriers, we will focus on Sprint and MCI. AT&T is excluded because it negotiated the settlement rates and thus, from its perspective, cost changes may be regarded as endogenous.

[8]Over this time period, MCI's flagship plan involved a $3.00 monthly charge and then a marginal rate per minute of usage, as did Sprint's flagship plan. The beginning of the time period is selected because 1994 is the first year for which the price data was easily available. The marginal rate is used here as the price indicator. For years when there was time-of-day pricing, the cheapest time period was selected. Adjustments to these prices for the monthly fee would be arbitrary and, to the extent that customers are selecting between plans with the same monthly fee, irrelevant, because their choice between long distance calling plans would then be influenced by the marginal rates.

The flagship rate is a per-minute rate. Basic rates are calculated as the rate charged to a customer for calls made to foreign countries when not signed up for any special foreign rate plans. Basic rates are typically at least 2-3 times higher than flagship rates to a country. All price measures are adjusted for inflation with the CPI-U index from the Bureau of Labor Statistics (Bureau of Labor Statistics, 2000.) They are then logged.

The primary data source for cost and concentration consists of the FCC section 43.62 international data. Between 1994 and 1998, all facilities-based carriers had to report figures related to traffic carried over their international facilities, including revenues, payments, and outgoing and incoming minutes on a route-by-route basis.

In order to calculate the costs of sending traffic to a given country, we begin with the net dollar amount paid by U.S. carriers to overseas carriers of a given country and received from the return traffic from that country. We can then calculate an average cost per minute, to which the further costs of originating, terminating, and carrying calls to the international meeting point are added. We have then calculated the per minute costs for Message Telephone Service (MTS) traffic to specific countries.

It is important to explain the process by which the net amount is calculated. The settlement costs between a carrier and the carriers of a foreign country are determined by a formula that returns traffic to the US-based carrier in proportion to the number of minutes that it sends of the total minutes sent from the US. Thus revenues derived from incoming minutes counterbalance some of the costs of sending outgoing minutes. Represent the total cost to carrier i of transmitting O_i outgoing minutes to a country as C_i. Then

$$C_i = s\left(O_i - \frac{O_i}{O}I\right)$$

where

O = the total number of outgoing minutes from the US

I = the total number of incoming minutes to the US

s = the settlement rate

The key point is that the variable cost from the US carrier's perspective will be significantly below the settlement rate. This is because when the US carrier sends an additional minute overseas, it automatically receives more traffic in return, by the proportionate returns rule. Thus the variable cost must take into account the revenue from return traffic as well as the cost of outgoing traffic.

The cost for originating and terminating access is derived from the FCC's table of originating charges, multiplied by the number of outgoing minutes (for the originating charge) and incoming minutes for the terminating charge. Transport costs are estimated as 1 cent per minute at the beginning of the period, falling to 0.5 cents per minute by 1998. These estimates are intended to capture a known trend whose impact on route costs varied by route according to the relative traffic ratio between the US and the country at the other end of the route. The assumption of transport cost decline does not affect the results. All financial variables are adjusted for inflation with the CPI-U and then logged.[9]

[9]There are inaccuracies in some of the data, suggesting, for instance, that rates to particular countries or territories may fluctuate by a factor of 20 from one year to the next and then back by a roughly inverse factor in the following year. Such a pattern certainly suggests misreporting. These inaccuracies occur almost exclusively with respect to the countries accounting for very small amounts of traffic. Such inaccuracies are inherently likely in cases when there are multiple reporters who generate reports specifically for a regulatory purpose and not for an ongoing business purpose. Consequently, results will

Concentration measures are calculated using the Hirschman-Herfindahl Index (HHI) and are based on minutes of traffic, as opposed to firm revenues and thus limit the direct impact of price on HHI.[10] This means the HHI is not calculated from revenue information. The HHI provides a good measure of facilities-based concentration but provides an imperfect view of firm shares in the end-consumer marketplace because the FCC reports are solely for facilities-based providers. The reports exclude resellers who might sell minutes to end-consumers, in order to avoid the double-counting of minutes. Thus, the HHI statistics provide a better measure of capacity concentration than retail concentration. In measuring potential competition between different facilities-based providers, focusing on capacity concentration may be preferable. Importantly, HHI values have exhibited substantial variation between 1994 and 1998. These values are shown in Table 1. For these 30 countries, the average HHI has fallen by more than 1200 points on a HHI scale of 10,000.

In order to reduce endogeneity in the relationship between price and concentration, an instrumental variable for HHI is calculated as a function of the prior period's HHI for a given route and of the average current-period HHI for other countries.

In addition, we include data on the competitiveness of the destination country's telecommunications market (as indicated by if and when the FCC grants ISR status), on the impact of international

be reported for only the 100 largest revenue countries. Limiting the number of countries considered does not alter the nature or significance of the results.

[10]The HHI is defined as the sum of the squared shares of firm output. If firm i is one of I firms and produces output q_i, then the HHI is defined by:

$$HHI = \sum_{i=1}^{I} \left(\frac{q_i}{\sum_{i=1}^{I} q_i}\right)^2.$$

WTO membership of the destination country, and on the impact of implementing the main WTO telecom provisions.[11] The time period saw the prevalence of ISR increase considerably, from 2 countries with approvals in 1994 to 16 in 1998.

The WTO began operation in 1995. Negotiations for the optional WTO telecommunications agreement were first completed in 1997 and implemented in 1998 by a relatively small set of WTO members. By 1998, 80 of the 100 countries in our analysis were WTO members and 20 had approved WTO telecommunications provisions, which went into effect in 1998.

The ISR, WTO, and WTO telecom agreement information is represented by dummy variables that are 0 in the period prior to change and 1 in the period of change and thereafter. For instance, if a country were among the original WTO signatories, WTO membership would be indicated by a dummy set to 1 in 1995, when the WTO agreement went into effect, 1 in later years, and 0 in the year prior to 1995. Summary statistics are provided in Table 2.

5 Results

We perform regressions with a fixed effect for each country on data covering the five year period from 1993 to 1998 for the largest 100 international routes. We separately estimate regressions with overall average price as the dependent variable, with firm-specific average prices as the dependent variable, with firm-specific flagship rates as the dependent variable and with firm-specific basic rates as the dependent

[11] Traffic that is carried under the ISR system is still reportable under section 43.61 of FCC regulations. Thus the data relied on for much of this analysis should reflect a complete record of reported minutes and accounting payments to foreign countries over the time period in question.

variable. The estimates are reported in Tables 3-9.

When considering average prices across carriers or for specific carriers, concentration has a positive and significant relationship to price, suggesting that reductions in concentration are associated with reductions in price. These results are consistent with the view that telecommunications competition leads to lower prices for consumers, even after adjusting for changes in the costs of making telephone calls.

Surprisingly, carriers appear to adjust their prices differently when setting their flagship rates and their basic rates. Lower flagship rates are associated with lower levels of concentration. However, basic rates are inversely related to levels of concentration. That is, as competition on a route increases, basic rates on that route typically increase.

These results are confirmed further by the regressions reported in Tables 10 and 11, which examine the extent of price dispersion between flagship and basic plans for MCI and for Sprint. These findings suggest that price dispersion *increases* as competition on a route increases. The relationship between concentration and price dispersion is statistically significant both for MCI and for Sprint. This result is somewhat surprising, given that one might intuitively expect that price dispersion would be largest under the most monopolistic route structures.

The finding that increasing price dispersion is related to increasing competition on routes is consistent with a carrier setting lower rates on its plan designed for the most price-elastic consumers as competition increases on a route, but at the same time raising the rates for the most inelastic consumers. The relationship between price and concentration could arise because increased competition at the low rate side of the spectrum, arising from pre-paid cards, leads to lower flagship rates. As flagship rates fall, the expected benefits of search increase, leading

the more price-sensitive basic rate consumers to leave for better plans. As the remaining group of basic rate consumers is more inelastic than before, it is most profitable to actually raise prices to that group at a time when concentration is generally decreasing. This suggests that at least one significant and relatively discrete set of consumers may suffer from increased levels of competition in international long distance.

Given the inverse movement of prices on the basic rate and flagship plans, it is important to consider whether, overall, increased competition hurts or helps consumers. Data limitations prevent us from knowing the quantity of minutes provided under the basic rates and under flagship plan rates. Thus, the simplest approach to answering the question of the overall impact of competition on consumers may be to examine the impact of changes in concentration on the average prices charged by a carrier. The fact that the lower average prices from providers are associated with lower concentration levels suggests that, on net, the negative impact on the basic rate consumers is outweighed by the beneficial impact on other consumers from decreased levels of concentration.

Costs, interestingly, enter the basic rate regressions with a negative sign rather than the positive sign that we expect and find in the other price regression. The cost coefficient in the basic rate regressions is generally small and not significantly different from 0. This may seem odd, but it is actually the case that, in a period of declining costs, the average basic rates rose substantially, from \$0.97 per minute to \$1.41 between 1994 and 1998 (see table 2, both for MCI and Sprint.)

Apart from cost and US-based concentration relationships, it is important to consider the impacts of regulatory variables. Because it is difficult to interpret the meaning of various regulatory and membership decisions, we must be cautious in the interpretation of the

coefficients relating to the ISR and WTO variables.

ISR designations are sometimes, though not systematically, associated with significantly lower prices. This may arise from the fact that ISR designations indicate a higher degree of competition in destination countries. Alternately, this might be an indication that freeing some negotiations from the strictures of the international settlements policies leads to lower costs of traffic exchange. The breadth of this conclusion is limited because ISR-designated countries are thought to have significant domestic long distance competition internally. In countries without such competition, eliminating the international settlements policies may not lead to lower rates and could, conceivably, lead to higher rates.

WTO membership appears to be associated with lower prices for international traffic over and above any effects that may arise from reduced accounting rates as a result of WTO membership, since accounting rates are included within the cost measure. This may reflect a general pro-competition bias on the part of governments that are WTO members relative to those that are not.

Countries' commitments to open their markets in accord with WTO telecom agreement principles do appear significantly related to lower prices in flagship plan rates, but not for overall average prices or for basic rates.

6 Conclusion

The results strongly suggest that international pricing varies on a country-by-country basis in a way that reflects the cost of sending traffic to a given country and the level of competition to that country. This finding is interesting because generally, when consumers purchase

international flagship plans, they sign up for a bundle of rates to all foreign countries. Thus one might consider that international traffic should be analyzed as a bundled product. However, the pricing relationships found here suggest that it is appropriate to consider each international route individually when evaluating competition. This is presumably because, while consumers face bundled prices, many people who make frequent international calls are foreign-born residents of the US calling their relatives and friends from the nation of their birth. They will likely direct their calling primarily to one country, and thus care primarily about just one of the prices in the bundle when selecting their menu of prices.

Given that international routes are best viewed as unbundled products, analysis of international long distance calling can help to evaluate the extent to which competitive forces are at work in a domestic setting. This is because domestic carriers are the ones competing to provide international long distance with each other, and they are competing for US-based customers.

An analysis of the data suggests that decreases in concentration are associated with lower average prices for international long distance and with lower prices in flagship plans. Curiously, though, increased competition is associated with higher prices in basic plans.

Pricing displays high and increasing price dispersion. As concentration decreases, the difference increases between flagship plan prices and basic plan prices.[12] The fact that prices can move in opposite directions in plans offered by the same carrier suggests the complex nature of the demand for telecommunications services. More generally, however, this increased dispersion may represent an interesting

[12]This result helps to explain MacAvoy's finding of basic rate increases during periods of cost and concentration reductions, while at the same time suggesting that, on average, lower levels of concentration are indeed associated with lower rates.

example of how offering a better deal for one plan, in response to competition, may shift the distribution of customers between the offered plans, so that raising prices for the other plan becomes profitable, as the consumers remaining in the other plan are, on average, less price-sensitive than before.

International long distance data holds great potential for measuring the relationship between telecommunications competition and prices. The reason is that international data allows for a panel data set analysis that involves far more variation than any purely domestic analysis could provide. The findings here suggest that telecommunications competition is highly beneficial to consumers. An increase from 3 equal-sized firms to 4, for instance, may be associated with a price decrease on the order of 11.7% when considering the most important markets for telecommunications providers. While these findings relate strictly to international telephone calling, they actually reflect competition between domestic US carriers to carry domestically-originated international calls and thus may be viewed more broadly as findings about domestic US competition. Overall, these results suggest that pro-competitive policies may have beneficial impacts, whether implemented by domestic policy makers or by international organizations such as the WTO.

Further theoretical research is needed to better understand the process by which increasing competition might be associated with greater price dispersion. Such a theory might focus on a changing distribution of consumers between plans when there is intense competition to provide one type of plan and limited competition to provide another. Further empirical work might focus on the increasingly significant long distance competition in countries besides the US that have opened up their markets to long distance competition. These extensions are be-

yond the scope of the current work, however, which is focused purely on improving our understanding of US-originated long distance calling.

The decrease in prices associated with decreased concentration does not necessarily mean that all consumers benefit from competition. Indeed, in this instance, competition may be associated with diverging effects, depending on the degree of the consumer's price-sensitivity, as indicated by the plan chosen by the consumers. The price-sensitive consumers appear to benefit the most from competition, and this benefit appears to outweigh the harm to the less price-sensitive consumers.

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Table 1: Concentration measures for International Long Distance Minutes to the Top 30 Countries

Country	1994 HHI	1998 HHI	Change
Mexico	4,769	3,594	-1,175
Canada	4,013	4,028	15
United Kingdom	4,246	2,345	-1,901
Germany	4,938	2,932	-2,006
Japan	3,832	2,565	-1,267
Philippines	4,478	2,644	-1,834
Korea, South	4,058	3,192	-866
India	4,155	3,251	-904
France	3,868	2,821	-1,047
Dominican Republic	3,057	1,839	-1,218
China	3,746	2,243	-1,502
Italy	5,053	3,581	-1,472
Taiwan	3,706	2,835	-871
Colombia	4,721	3,638	-1,084
Hong Kong	3,537	2,836	-701
Israel	3,694	3,220	-474
Brazil	4,426	3,515	-911
Jamaica	5,918	3,943	-1,975
El Salvador	5,397	2,300	-3,097
Pakistan	5,193	3,374	-1,819
Spain	4,373	3,272	-1,100
Guatemala	4,943	2,744	-2,199
Ecuador	4,545	4,226	-319
Switzerland	4,342	2,802	-1,539
Netherlands	3,859	2,336	-1,523
Argentina	3,985	2,868	-1,118
Peru	5,084	3,742	-1,342
Thailand	4,112	3,492	-620
Saudi Arabia	4,397	3,727	-670
Venezuela	4,508	3,581	-926

Source: Calculations from FCC 43.61 Data

Table 2: Summary Statistics for 1994 and 1998

Variable	Obs	Mean	Std. Dev.	Min	Max
hhi94	100	0.473	0.080	0.306	0.841
hhi98	100	0.333	0.082	0.176	0.716
isr94	100	0.020	0.141	0.000	1.000
isr98	100	0.160	0.368	0.000	1.000
wto94	100	0.000	0.000	0.000	0.000
wto98	100	0.820	0.386	0.000	1.000
wtotel94	100	0.000	0.000	0.000	0.000
wtotel98	100	0.200	0.402	0.000	1.000
pri94	100	0.806	0.235	0.240	2.078
pri98	100	0.477	0.152	0.189	1.198
costpm94	100	0.383	0.203	0.081	1.308
costpm98	100	0.223	0.118	0.032	0.507
MCI average price 94	100	0.700	0.216	0.243	1.690
MCI average price 98	100	0.472	0.209	0.162	1.234
MCI flagship price 94	82	0.509	0.160	0.115	1.119
MCI flagship price 98	83	0.387	0.195	0.074	0.969
MCI basic price 94	82	0.972	0.261	0.317	2.167
MCI basic price 98	83	1.416	1.242	0.331	11.831
MCI cost per minute 94	100	0.401	0.225	0.084	1.458
MCI cost per minute 98	100	0.217	0.129	0.007	0.696
Sprint average price 94	100	0.757	0.245	0.230	1.890
Sprint average price 98	100	0.467	0.241	0.124	1.839
Sprint flagship price 94	82	0.590	0.201	0.128	1.283
Sprint flagship price 98	83	0.389	0.186	0.061	0.938
Sprint basic price 94	82	0.972	0.261	0.317	2.167
Sprint basic price 98	83	1.416	1.242	0.331	11.831
Sprint cost per minute 94	100	0.393	0.195	0.030	1.027
Sprint cost per minute 98	100	0.221	0.174	-0.268	1.244

Dollar figures are nominal and not logged.

Table 3: All International Long Distance Average Price: 1994-1998

Dependent variable: average price of all long distance carriers

hhi	1.821*
	(8.262)
costpm	0.277*
	(5.922)
isr	-0.121
	(-1.594)
wto	-0.030
	(-1.077)
wtotel	-0.098
	(-1.501)
n	500
groups	100
R^2 within	0.4722

Average price to a country is calculated by taking the domestic revenue from all international calling to a country and dividing by the number of minutes of calling to that country.

Regression with fixed country effects. t-statistics in parentheses.

*Significant at 0.01 level

**Significant at 0.05 level

***Significant at 0.10 level

Table 4: MCI International Long Distance Average Price: 1994-1998

Dependent variable: MCI average price across all plans

hhi	1.970*	1.989*
	(7.754)	(7.895)
costpm	0.041	-
	(0.768)	
mcostpm	-	0.023
		(0.638)
isr	-0.321*	-0.329*
	(-3.659)	(-3.811)
wto	-0.014	-0.016
	(-0.433)	(-0.529)
wtotel	-0.074	-0.077
	(-0.985)	(-1.036)
n	500	500
groups	100	100
R^2 within	0.314	0.313

Average price to a country is calculated by taking the MCI domestic revenue from all international calling to a country and dividing by the number of MCI minutes of calling to that country.

Regression with fixed country effects. t-statistics in parentheses.

*Significant at 0.01 level

**Significant at 0.05 level

***Significant at 0.10 level

Table 5: MCI International Long Distance Flagship Plans: 1994-1998

Dependent variable: MCI flagship plan rates

hhi	1.137*	1.700*
	(5.151)	(7.407)
costpm	0.381*	-
	(8.406)	
mcostpm	-	0.110*
		(3.612)
isr	-0.114***	-0.204*
	(-1.650)	(-2.776)
wto	0.079*	0.049***
	(3.029)	(1.769)
wtotel	-0.226*	-0.285*
	(-3.853)	(-4.524)
n	414	414
groups	83	83
R^2 within	0.5358	0.457

Regression with fixed country effects. t-statistics in parentheses.
*Significant at 0.01 level
**Significant at 0.05 level
***Significant at 0.10 level

Table 6: MCI International Long Distance Basic Rates: 1994-1998

Dependent variable: MCI basic rates		
hhi	-0.748*	-0.756*
	(-4.004)	(-4.211)
costpm	-0.048	-
	(-1.244)	
mcostpm	-	-0.034*
		(-1.404)
isr	-0.054	-0.049
	(-0.933)	(-0.852)
wto	0.107*	0.110*
	(4.852)	(5.051)
wtotel	0.015	0.020
	(0.298)	(0.399)
n	414	414
groups	83	83
R^2 within	0.2482	0.2491

Regression with fixed country effects. t-statistics in parentheses.
*Significant at 0.01 level
**Significant at 0.05 level
***Significant at 0.10 level

Table 7: Sprint International Long Distance Average Price: 1994-1998

Dependent variable: Sprint average price across all plans

hhi	1.714*	2.181*
	(6.602)	(8.528)
costpm	0.309*	-
	(5.616)	
scostpm	-	0.096*
		(2.622)
isr	-0.108	-0.182**
	(-1.201)	(-2.00)
wto	-0.144*	-0.161*
	(-4.459)	(-4.815)
wtotel	-0.020	-0.057
	(-0.256)	(-0.727)
n	499	495
groups	100	100
R^2 within	0.446	0.413

Average price to a country is calculated by taking the Sprint domestic revenue from all international calling to a country and dividing by the number of Sprint minutes of calling to that country.

Regression with fixed country effects. t-statistics in parentheses.

*Significant at 0.01 level

**Significant at 0.05 level

***Significant at 0.10 level

Table 8: Sprint International Long Distance Flagship Plans: 1994-1998

Dependent variable: Sprint flagship plan rates

hhi	1.102*	1.418*
	(5.389)	(7.093)
costpm	0.314*	-
	(7.479)	
scostpm	-	0.149*
		(4.998)
isr	-0.002	-0.078
	(-0.037)	(-1.203)
wto	-0.081*	-0.099*
	(-3.368)	(-3.990)
wtotel	-0.224*	-0.241*
	(-4.107)	(-4.286)
n	414	411
groups	83	83
R^2 within	0.5695	0.5353

Regression with fixed country effects. t-statistics in parentheses.
*Significant at 0.01 level
**Significant at 0.05 level
***Significant at 0.10 level

Table 9: Sprint International Long Distance Basic Rates: 1994-1998

Dependent variable: Sprint basic rates		
hhi	-0.748*	-0.817*
	(-4.004)	(-4.580)
costpm	-0.048	-
	(-1.244)	
scostpm	-	-0.013
		(-0.475)
isr	-0.054	-0.041
	(-0.933)	(-0.719)
wto	0.107*	0.112*
	(4.852)	(5.065)
wtotel	0.015*	0.021
	(0.298)	(0.411)
n	414	411
groups	83	83
R^2 within	0.2482	0.2456

Regression with fixed country effects. t-statistics in parentheses.
*Significant at 0.01 level
**Significant at 0.05 level
***Significant at 0.10 level

Table 10: MCI International Long Distance: Basic-Flagship Price Dispersion 1994-1998

Dependent variable: MCI price dispersion

hhi	-1.885*	-2.456*
	(-6.843)	(-8.742)
costpm	-0.429*	-
	(7.578)	
mcostpm	-	-0.143*
		(-3.848)
isr	0.059	0.155*
	(0.689)	(1.723)
wto	0.028	0.061
	(0.864)	(1.783)
wtotel	0.241*	0.305*
	(3.289)	(3.951)
n	414	414
groups	83	83
R^2 within	0.570	0.517

Price dispersion for a given year is calculated by taking the basic rate charged by MCI for international calling to a country and subtracting MCI's flagship plan rate to that country.

Regression with fixed country effects. t-statistics in parentheses.

*Significant at 0.01 level

**Significant at 0.05 level

***Significant at 0.10 level

Table 11: Sprint International Long Distance: Basic-Flagship Price Dispersion 1994-1998

Dependent variable: Sprint price dispersion

hhi	-1.850*	-2.235*
	(-6.485)	(-8.021)
costpm	-0.362*	-
	(-6.175)	
scostpm	-	-0.161*
		(-3.890)
isr	-0.052	-0.036
	(-0.584)	(-0.403)
wto	0.187*	0.210*
	(5.592)	(6.106)
wtotel	0.238*	0.261*
	(3.139)	(3.337)
n	414	414
groups	83	83
R^2 within	0.575	0.548

Price dispersion for a given year is calculated by taking the basic rate charged by Sprint for international calling to a country and subtracting Sprint's flagship plan rate to that country.

Regression with fixed country effects. t-statistics in parentheses.

*Significant at 0.01 level

**Significant at 0.05 level

***Significant at 0.10 level