EconoQuantum
ISSN: 1870-6622
equantum@cucea.udg.mx
Universidad de Guadalajara
México

TIRADO, J. ALEJANDRO
The Mexican fixed national long distance market: evidence of monopoly power
EconoQuantum, vol. 1, núm. 2, 2005, pp. 104-123
Universidad de Guadalajara
Zapopan, Jalisco, México

Suplemento / Supplement

The Mexican fixed national long distance market: evidence of monopoly power

J. Alejandro Tirado[1]

■ *Distortions within the telecommunications sector of Mexico*

It has been fourteen years since the telecommunications sector of Mexico experienced an important change in its structure. The industry formerly was a public monopoly and was changed in 1990 to a private one. This change was a result of a privatization process around the world. In the case of telecommunications, one of the most cited examples was the re-structure of AT&T, ordered by the Department of Justice in 1982. This affected the regulatory framework of the telecommunications market of the United States. It also served as the pattern for the rest of the Americas.

The privatization process of telecommunications continued in Chile, in 1988. Two years later, in December of 1990 during the presidency of Carlos Salinas, the Mexican government sold Teléfonos de México (Telmex), the Mexican telephone company, to Carso Group. The selling price was nearly to $5.5 billion USD. This figure represented approximately 25% of the total revenue received for the 250 public firms sold by the government between 1988 and 1994.[2] The sale of Telmex in 1990 is acknowledged as the most important privatization both in the country and in Latin America that year.

The government decided to create a private monopoly, arguing that only in this way could it accomplish the goal of growing the telecom-

---

[1] Department of Special Studies, Direction of Planning, Guadalajara's Town Hall, Jalisco, México. I am grateful to Christian Andersen (*The Princeton Review*), for his interesting questions and his editorial assistance. However, the views expressed in this paper are completely my own.

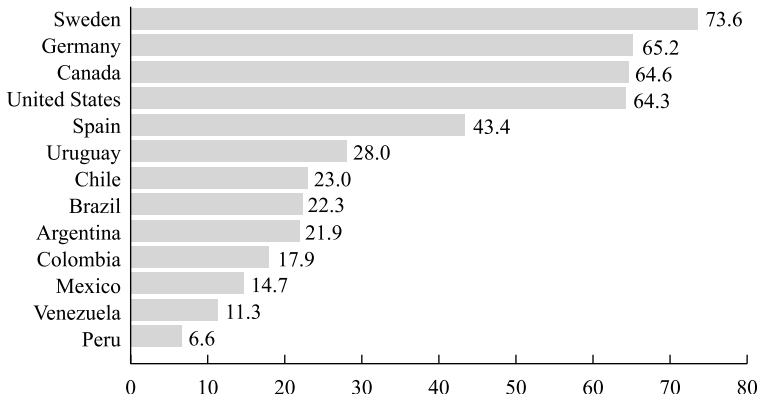
[2] Data taken from Serrano (2000).

munication sector. The government thought that a six year period of exclusivity would be long enough to allow the company (Telmex) to modernize the network free of competition.

At first, the effects of privatization were positive. From 1990 to 1996, the average growth of the telecommunications sector was seven times larger than that of the economy as a whole. Telmex had made a significant investment to modernize and to expand the telecommunication network, to replace the analogical system by a digital one, and to increase telephone density.

Nevertheless, in coverage, the number of fixed lines for every 100 inhabitants in 2002 was still very low when compared to other countries (see Graph 1).[3] Domestically, we can also find significant lags when comparing regions. According to Dr. Fernando Sánchez Ugarte, ex-President of the Federal Competition Commission (CFC), "installed lines show a marked geographical concentration in urban areas. Oaxaca for example, has a density rate of 3.6 lines. In contrast, in the Federal District that figure rises to 29.6."[4] So the results were mixed.

Graph 1
International comparison for fixed telephone density
–Lines for every 100 inhabitants–



Source: Federal Telecommunications Commission

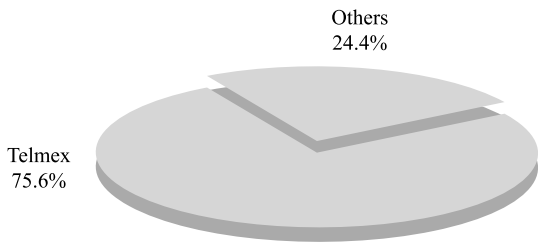
[3] It is interesting to note that Uruguay, with a telephone company owned by the government, has a greater level of telephone density than that of some other countries where the industry has been privatized.

[4] Taken from the conference "The Turning Point: Mexico's Choices in the Changing Global Economy", September 27, 2001.

The transition to a competitive market then began in 1997 with long distance telephony service. But this competition has been unfair since the very beginning. There are two reasons. One, Telmex was and still is the owner of most of the optical fiber network. Two, it offered other complementary services to attract customers and which new entrants could not do.[5] The first advantage gave incentives to Telmex to squeeze its competitors through high interconnection prices. After all, all the new firms had to use Telmex's local network to complete their calls.

The second advantage gave incentives to Telmex to practice cross-subsidies. Telmex could reduce the price in long distance service where it faced competition and could increase prices in local service, where there virtually was none (See graph 2).[6]

Graph 2
Average market share in the cities open to pre-subscription (Domestic long distance)



Source: Telmex annual report 2003

According to the previous graph (graph 2), it can be inferred that since 1997 competition still has not yet become consolidated. Sánchez

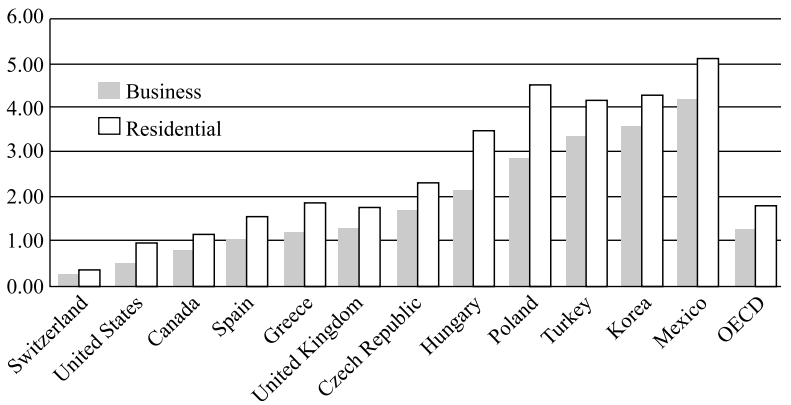
[5] Most of the privatization processes in Latin America are similar. There is a kind of "restricted competition" in order to protect the first entrants. The first firm is supposed to take most of the risk by being a pioneer in the market. An interesting point here is that the official period of protection for these firms was similar during the early 1990s. In return for this protection, governments required specific levels of investment to improve quality and coverage. These obligations are known as the Universal Service Obligation (USO). According to Estache, et al (2002), USOs are not effective since they are a second best way to redistribute the income.

[6] The Modification of the Title of Concession of Telmex prohibits these kinds of monopoly practices. Nevertheless, according to Estache (2002), the division of

Ugarte has said: "Competition is maintained through an agreement between private parties that has basically benefited only two of the new providers".[7] Of course, collusion is not competition.

One of the positive effects competition should bring is lower prices. But, if one makes a comparison of baskets for international telephone charges, the evidence suggests a great lag in the market (See graph 3). This graph means that, as a country, Mexico has the highest prices for residential and business telephone service in comparison with other members of the Organization for Economic Co-operation and Development (OECD).

Graph 3
OECD basket of international telephone charges, August 2002



Note: Average call charge for one single call, weighted by traffic.
Source: OECD, Communications Outlook 2003.

Since 1999, the law also allows competition for the local telephony service, but once again, there is a great lag in competition. This is because competition has taken place only in some cities and the eight new competitors in the local service area have a very small share of the market.

---

a network is a crucial aspect in terms of the level of competition that will be allowed. When there is a firm with an integrated multiple-service-network, and when the other firms do not have this advantage, the former will have great market power in the final market.

7 Taken from the conference "The Turning Point: Mexico's Choices in the Changing Global Economy", September 27, 2001.

Article 7 of the Federal Telecommunications Law establishes three objectives for this market. One is promoting efficient development of telecommunications. Second, is adequate social coverage. Last, is fostering healthy competition among the different service providers so that such services are provided with better prices, diversity and quality benefit consumers. According to the data showed above, there is a great lag in meeting these objectives.

In light of the statistics, anyone could question the role of the government in promoting competition within the market. The telecommunications sector in Mexico is regulated by two different agencies. One is the Federal Competition Commission (CFC) and the other is the Federal Telecommunications Commission (COFETEL).

Both of them are supposed to be complementary in promoting economic efficiency through competition. However, the roles and responsibilities of the CFC and COFETEL are independent. This independence sometimes causes confusion. For example, the CFC is allowed to determine through international measurements if a competitor has monopoly power that could damage competition. Or, the CFC can also sanction any firm with such power. The CFC can do this in any industry (see Chapter 1 of the Federal Law on Economic Competition), including telecommunications.

COFETEL was created by the Federal Telecommunications Law in 1996 with the specific objective of regulating and promoting an efficient development of the telecommunications sector. COFETEL is allowed to set tariffs for all of the different telecommunications services. COFETEL cannot give any concession or permits, and cannot authorize any merger without the CFC's approval. COFETEL also needs the approval of the CFC in order to set specific rules to promote healthy competition within the sector. For example, in December 1997, the CFC determined that Telmex had substantial market power in five relevant telephony markets: local service, access or interconnection, national long distance, inter-urban transportation, and international long distance. As a result, COFETEL issued regulations for these markets, but these regulations have not entered into force (See the Project of Specific Obligations published in the Official Federal Daily, September 12th 2000).[8] Even though this is an example of cooperation, they are not always in harmony because they have different agendas.

---

[8] As anyone can see, it took three years for COFETEL to consider the CFC's opinion about the monopoly power of Telmex. This can be evidence of a lag in the effective regulation.

It is clear that the telecommunications sector of Mexico urgently needs an effective reform of its regulatory framework. There are personal interests that could be damaged with this reform, but if one compares economic benefits with the opportunity costs, the costs can be by far greater than the benefits for the monopolist. Consumers of telephone services will suffer the consequences of a non-effective and untimely application of the Federal Law on Economic Competition and its regulations.

But, beneath all of this information there is a larger problem. This scenario behaves like a monopoly. As I mentioned above, the government made the commitment to protect Telmex against competition during the first six years of privatization. Currently, there is no legal or economic reason to continue with this protection. But Telmex is still protected. Basically, this is a problem of regulation. Thus, it is important to provide new empirical evidence that the current monopoly is not justified. In the next section I present a brief analysis of some analytical tools that will help clarify this issue.

■ *Previous analysis*

During my research, my main goal was to find serious published empirical research relating to Telmex and its monopoly power. There was not very much. So, given these poor results, I decided to review previous research about oligopoly industries, taking into account research into competition and regulation of the telecommunications market, hopefully understanding the Mexican market better.

In this research, I found evidence that suggests but does not prove that Telmex has monopoly power. My purpose is to try to prove it mathematically.

Telecommunications and Network Economics

The telecommunications industry is best modeled through the Economics of Networks.[9] For example, the structure of a network when competition began in the Mexican long distance market, can be represented in figure 1.

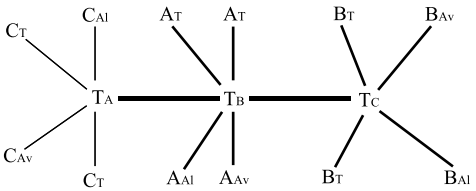
In figure 3, letters A, B and C represent consumers in three different cities (A, B and C). Subindexes Al, Av and T indicate the firm each consumer is subscribed to, to connect to the long distance services, Avantel, Alestra and Telmex respectively.[10] For example, consumer A_{Al} is in city

[9] For a detailed explanation of the economics of networks see Economides and Himmelberg (1994) and Economides (1996).

[10] I focused on Avantel and Alestra as Telmex's competitors because, according to Dr. Sánchez Ugarte, Telmex has 79.5% of the long distance market. Avantel

A and gets the long distance service from Alestra. In reality, the scheme is far more complex. However, it is clear that each firm needs to use Telmex's local network to provide its service.

Figure 1
Structure of a telephone network when long distance service is open to competition



In this type of network there are two interesting effects. According to Evans and Schmalensee (1996), the tipping and lock-in effects come out when there are two different technologies within a network. The forces of the market determine which one is better. However, when a firm has an initial advantage the market cannot choose efficiently. The fact that Telmex was the first player gave it an advantage to receive the tipping effect in the industry.

When a technology is chosen by the market, the lock-in effect results. This effect represents a barrier for the consumer to change to the other alternative. There are switching costs that need to be considered.[11] It is true that the switching cost for each consumer to change provider could be insignificant, but it is also true that in aggregate terms this cost can be relevant.[12] Clearly, Telmex benefits from both the tipping and lock-in effects.

---

and Alestra together have 18% of the market and the 2.5% remaining is divided among the other concessionaires (See CFC's PowerPoint presentation of Cuarta Conferencia Internacional: "El Reto de las Telecomunicaciones en el Marco de la Reforma del Estado Mexicano", Mesa 1: Diagnóstico de las Telecomunicaciones y Tecnologías de la Información en México, July 18, 2001 (Conference on "The Telecommunications Challenge in the Framework of the Mexican State Reform", subsequently "The Conference").

11 See Shapiro and Varian (1999).

12 The switching cost each Telmex's client faces could be the time spent dialing the proper number. The switching cost could also be measured by the time needed

By the way, the lock-in effect can be observed when there is a provider of an essential service and there is no way to find a substitute. Or, in the case of substitution, the process can be very expensive. Alestra and Avantel need the interconnection service of Telmex. This fact gives Telmex advantages that oblige Alestra and Avantel to adopt its technology, which is not necessarily the most efficient solution for them. It also forces Avantel and Alestra to find another way to provide the service without using Telmex's network.[13]

Economides (1998) considers that "[m]ultiproduct firms with market power in at least one product market are able to cross-subsidize some lines of business". Cross-subsidization has important effects under network dynamic competition. Telmex can use this to build-up its reputation and reinforce its leadership. For example, Telmex can create a strategic advantage for the long distance market by using its brand name and its customer recognition. Clearly, Telmex will be the only one that benefits from this advantage.

When there is a network with a dominant firm that practices cross-subsidization, there is no scope for competition. In adition, when the regulatory framework allows this behavior, the dominant firm will keep all from the network economy. In the long-run, consumers will pay the price of these unfair practices.[14]

Network economies are closely related to economies of scale.[15] This is because the industry has a very high fixed sunk cost (a cost that cannot be recoverable when a decision is made). According to Spulber (1995), sunk costs can be considered as a barrier to entry to potential competitors. This can be true if they need to make unrecoverable investment in their capacity.[16] Nevertheless, according to Kaserman and Mayo (2002), and Spulber (1995), this is no longer true for industries with significant technological change such as telecommunications.

---

to wait until a different provider can offer the service in a specific geographical location.

13 This could be the case of bypass.

14 It is important to mention that althouh I stated that Telmex has incentives to cross-subsidize, a mathetical test to prove it is required. But that would require another paper.

15 Some analysts consider that economies of scale may be a barrier to entry. But, as Posner (1976) said, they only represent a technological specification of efficient size.

16 The existing firms already faced these costs, so they do not take them into account for their activity.

Avantel and Alestra, the main Telmex's competitors, do not have to construct a new fiber-optic long distance network. They lease Telmex's transmission capacity and they entered the market trough joint ventures. Thus, with this strategies they minimized the sunk costs and in return they can operate under the economies of scale regime.[17]

It is well known that an industry with economies of scale will never reach a competitive equilibrium. Thus, the principal objective of any regulatory agency of such an industry is to set a price system as near as possible to the competitive market. According to Mitchell and Vogelsang (1991), there is not a general theory about pricing regulation of telecommunications. Current theories include different perspectives (systems) that have been modified through practice and evaluation, but are not generalized.

Price Cap System (RPI-X)

The most common price system adopted by Latin American countries to regulate the telecommunications industry is the price cap system, also known as the RPI-X system. Theoretically, RPI-X regulation gives incentives for efficiency, innovation and productivity. The system is based on the regulatory lag phenomenon. This means the general lag in the regulator's answer given the changes in cost and market conditions.

According to Baumol and Sidak (1994), the regulatory lag allows a firm to earn profits way above the competitive market outcome. They argue this is a temporary issue. When inflation is substantial, the regulatory lag delays the adjustment of the production prices to compensate for the inflationary increments in the nominal costs of inputs. This effect reduces the profits of the regulated firm. But it will also reduce significantly the incentives and the willingness to innovate.

Basically, the RPI-X system works as follows:

a) The regulator sets an initial price cap for each of the services based on the stand-alone cost or any other good proxy variable.
b) The regulator allows automatic price cap increments for a certain period.[18] The increments are equal to the rate of inflation measured by a widely accepted index.
c) The regulator estimates an X factor that is subtracted from the rate of inflation.

---

[17] Moreover, they are currently offseting their costs by offering new and specialized services.

[18] The period could be five or ten years. In Mexico, the RPI-X is reviewed every four years.

d) The X factor represents the rate of productivity growth of the industry or the rate of the expected productivity growth of the industry.

It can be inferred that all the firms with a productivity growth above the average of the industry will have greater profits than those below the average.

Bernstein and Sappington (2000) considered that the estimation of the X factor is not easy. The X factor might reflect the degree at which the industry is able to raise its productivity more rapidly than other sectors of the economy. It could also reflect that the prices of the inputs used within the regulated industry are growing at a lower rate than those used in other industries.

The RPI-X system requires some conditions to work perfectly. The first condition is that all the services offered by the regulated firm need to be based on the RPI-X regulation. Second, significant structural changes in the regulated industry should not be anticipated (e.g. stronger competitive forces). Third, the pricing decision of the regulated firm should not affect the rate of inflation outside the regulated sector. Fourth, all of the remaining sectors that are not regulated need to behave as competitive markets.

Two of the previous conditions could not be accomplished in the Mexican case. Inflation within the regulated sector is not exogenous with the rate of inflation of the economy as a whole. Moreover, it is not realistic to see perfect competition outside the telecommunications sector. According to Bernstein and Sappington (2000), inflation is more likely to be endogenous particularly in smaller developing economies. In these cases, the regulated output represents a significant fraction of the aggregated output of the economy. Nevertheless, when the inflation rate of the economy as a whole is 1% annually, the rate of inflation of the regulated industry does not need to be the same.

If we assume that the authorized inflation rate of the regulated sector grows at the same rate of the inflation in the economy, and if we also assume that greater inflation rates of the regulated sector cause greater rates of inflation of the economy, then, any price increment of the services of the regulated sector causes greater price increments within the regulated sector itself. This creates a sort of feedback that ends in a vicious circle. Under these circumstances, RPI-X regulation would not restrict the incremental increases of prices in a proper way.

In addition, in non-competitive industries the productivity gains are not necessarily shared with the consumer through prices reductions. In such cases, the observed rate of inflation could be greater than the same rate under the competitive market assumption. This could be counterbalanced with a greater value for factor X.

The Modification of the Title of Concession of Telmex imposes the RPI-X system. The system is based on the long run average incremental cost of a price per minute of a phone call using each service. The regulation includes all of the following services.

- Residential Local Service (includes the charges for installed line, basic rent per line, measured local service charges).
- Business Local Service (includes the charges for installed line, basic rent per line, measured local service charges).
- National Long Distance Service (includes the charges for residential long distance service, or charges for business long distance service).
- International Long Distance Service (includes the charges for residential long distance service, or charges for business long distance service).

The Title of Concession says that the value of the controlled basic services basket must be reduced in real terms according to the X factor. By doing this, productivity gains will be shared with a consumer. The value of the basket and the X factor are evaluated by the COFETEL every four years.

The X factor is used to help to set up a controlling factor. The controlling factor represents a method to analyze the maximum allowable percentage quarterly increase of the total income for Telmex. The previous quarter is analyzed through a controlled basic services basket.

The controlling factor can be figured out through the following formula.

$$F_t = (1 - X)\left[1 + \frac{NCPI_{t-1} - NCPI_{t-2}}{NCPI_{t-2}}\right]$$

where,

F_t = Controlling factor
t = Sub-index representing the corresponding period of each variable
X = Quarterly productivity adjustment factor of the sector
$NCPI$ = National Consumer Price Index, published by the Bank of Mexico

Since January 1st, 1997, Telmex has been able to increase or reduce prices of the controlled services each quarter on its own, with COFETEL's approval. The only constraint for Telmex is that the sum of the total adjusted revenues per service cannot exceed the total cap revenues allowed from the basket.

The cap revenues of the basic services basket are determined by applying the controlling factor to the sum of the revenues earned by Tel-

mex by the provision of the controlled services of the basket during the previous period. In other words:

$$\text{Cap Revenue of the Periodical Basket} = \sum_{i=1}^{n} P_{it} {}^{*}Q_{it-1} \leq F_t {}^{*}\sum_{i=1}^{n} P_{it-1} {}^{*}Q_{it-1}$$

where,

P_{it} = New price of the service
P_{it-1} = Price of the service during the previous period
Q_{it-1} = Quantity of the service provided during the previous period
n = Total number of services included under the Price Cap System
F_t = Controlling factor

Besides all of the disadvantages mentioned before, there are other risks with the use of the RPI-X system. According to Núñez (2000), hypothetically, this specific regulatory regime allows Telmex to employ cross subsides. Telmex could set high prices in the market segment where it does not face competition (local service), and set low prices (even under its average incremental cost) in the long distance service. The gains earned from the former can compensate for the losses of the latter.

With the Project of Specific Obligations for Telmex, COFETEL was trying to avoid any kind of monopolistic behavior. Among other things, the project allows Telmex to set weighted average prices for the long distance services with a floor limit equal to the average total cost. Telmex must recover all the costs associated with the service including the cost of capital. Thus, the long run average incremental cost is still the base of the system. But the project also allows Telmex to charge a price above this cost. COFETEL justified this measure by arguing that the long run average incremental cost does not include some costs like advanced technology improvement, optimum network designs and the full capacity plant use factors not included in the RPI-X regime.

Therefore, the average total cost is equal to the sum of the costs incurred by an efficient firm as a result the provision of its services, divided by the number of units of the service produced. This cost includes the opportunity cost of the investor, taking as a reference the return provided by the financial system. The average total cost can be greater or equal to the long run average incremental cost.

An example can give us a clearer idea of the new disposition. Let us assume that the price in peak hours is $2 pesos per minute, while the

price in non-peak hours is $1 peso per minute. Let us assume also that the total average cost of the long distance service is $1.50 pesos per minute. Let us say the average incremental cost of the same service is $1 peso per minute. In this case, the incremental cost is still the base to set prices because even in the case of the lower price, the cost is covered. Nevertheless, the weighted average of the two prices is $1.50 pesos, which is equal to the total average cost.

Thus, it is clear that the Project of Specific Obligations still allows Telmex to behave in an monopolistic way. But, by issuing these rules, COFETEL implicitly accepted the dominant power of Telmex in five relevant markets.[19] Although the Project of Specific Obligations is a proposal for an asymmetric regulation, the RPI-X system does not take into account the real structure of the market. This structure is a very important element in the design of a price system.

■ *Stackelberg competition*

The telecommunications industry is an oligopoly with Telmex, a firm that has significant power in five relevant markets, the major oligopolist. Although there are other firms competing against Telmex, they are limited because of Telmex's market power. According to the Stackelberg competition model, whenever there is an industry with a leader firm and other followers firms, one can use Game Theory to find a Nash Equilibrium and set a price that takes into account the market structure of the sector. [20]

---

[19] Although this asymmetric regulation has not entered into force, COFETEL must still look for an effective expression of healthy competition. According to Perrucci and Cimatoribus (1997), an excessive asymmetric regulation over the dominant firm may damage technological innovation. In addition, this kind of regulation gives incentives to the competitors to start imitation. In other words, if the dominant firm is obliged to reveal its investment plans, it could reduce its expenditure on research and development. By making public its plans for innovation, the dominant firm runs the risk of imitation by its competitors, with the diminished likelihood of getting all of the possible economic returns.

[20] According to Robson (1990), if the regulator guarantees free entrance the Stackelberg game will converge to the competitive equilibrium. But, as Geroski (1988) has said, free entry does not guarantee effective competition. Thus, the work of the regulator is not just liberalizing a sector, but to look for healthy competition.

In Mexico, it can be assumed that there are three firms offering a homogeneous product in a cooperative way. One of the firms, called "the leader", Telmex, has the strategic advantage of moving first (it decides its market share). One assumes also that (1) Telmex chose its level of output taking into account the reaction function of its competitors (Avantel-Alestra), and (2) both Avantel and Alestra, the followers, play together once they know the level of output of the leader. The second assumption does not imply that there is collusion between Avantel and Alestra. This is an assumption to simplify the analysis of competition in this market.

The Stackelberg model is a two-stage game. In the first stage, the leader firm chooses its level of output. This quantity cannot be changed in the second stage. In stage two, the follower chooses its level of output after the leader. Since this is a game with a finite horizon, the way to solve it is going backwards. This means, we have to analyze first the role of the follower in the last period. Here, one has to take for granted the strategy played in the first period.

Eventually, going one period back, we have to analyze the strategy of the leader, taking for granted the reaction of the follower. To simplify this analysis, we will assume (1) that all the firms have the same unitary cost, (2) this unitary cost is constant and, (3) the market demand function is linear $P(Q) = a - bQ$, where Q is the aggregated demand quantity, $Q = q_1 + q_2$.

Building a Demand Equation for Telmex

The first step to determine a Stackelberg equilibrium is to have an aggregate demand equation for the Mexican long distance market. Nevertheless, there is not much data available. Because of lack of consistent official data, I needed to construct and disaggregate public data. Research reveals that in 2001, Telmex had 79.5% of the national long distance market. Alestra and Avantel had 18% together, and the remaining competitors had 2.5%.[21] Recent data reveals that market share has not changed significantly: according to Telmex's financial report for the second quarter of 2004, Telmex has 75.6% of the national long distance market and the remainder is divided among the other firms.[22] So, it can be assumed that competition in national long distance telephony service is among those three companies.

---

[21] Statistics taken from "The Conference".

[22] According to COFETEL, there are eight firms currently competing with Telmex in the national long distance market.

I tried to make an econometric estimation of the demand for Telmex. After that, according to Shy (2001), I made an estimation of the residual demand for the competitors.[23] The sum of the consumer demand of the leader (Telmex) and the sum of the consumer demand on the joint followers (Avantel-Alestra) give the aggregated demand for the market.

$$Q_D^{NLD} = Q_D^{NLD}\ (P^{NLD})$$

where

Q_D^{NLD} = Millions of minutes of national long distance

P^{NLD} = Price per minute

The period of analysis was the first quarter of 1997 until the second quarter of 2004.[24] The data was taken from the financial and statistical reports of Telmex. It is worthwhile to noting that I took the price as the only explanatory variable because the original model only uses this one. Nevertheless, in my econometric work, I tested for consistency and the hypothesis of missing variables was rejected.

It was necessary to construct a proxy series for the variable price, because as I said before, there are not official quarterly data available. According to COFETEL, the price per minute of a national long distance call in 1997 was $2.27 pesos taking 2003 as the deflator year. I took the price in pesos of 1997 (approximately $4.14 per minute). Then, I took the National Consumer Price Index for the second quarter of 2004 as a standard to deflate each quarter of the original price. Also, this gave a quarterly price series to use to make an estimation of the national long distance demand for Telmex.

For the first econometric estimation I used Ordinary Least Squares and I obtained the following results:

---

[23] According to Shy (2001), it is possible to estimate a residual demand for the followers based on a well constructed leader's demand.

[24] As I pointed earlier, competition in the long distance market was allowed after a six year period o legal protection. Obviously, after this period the structure of the market changed. Since we are assuming maximizing firms, this change should be considered by Telmex and its competitors in order to set their strategies. However, there is not enough published data from that period. Thus, I cannot statistically test this structural change.

$$\begin{array}{lccc} Q_D^{NLD} = & 6{,}337.37 & - & 1146.11\mathrm{P}^{NLD} \\ t: & (27.92) & & (-14.67) \\ R^2: & 0.89 & & \end{array} \qquad (1)$$

At first glance the model seems good. It has the expected sign for every coefficient, these coefficients are individually significant, and there is good adjustment between variables. Nevertheless, I found serial correlation.[25] Thus, according to Ward (1995), I concluded that there is the possibility of a lagging P^{NLD} variable.[26] Using the Koyck approach, I found that the variable Q_D^{NLD} approximately assimilates the changes in variable P^{NLD} in six periods (quarters). Substituting Koyck, my findings suggest a different estimation.

In the second estimation I used Two Stages Least Squares and I obtained the following results:

$$\begin{array}{lcc} Q_D^{NLD} = & 6{,}359.75 - 1019.91\mathrm{P}^{\mathrm{NLD}} & \\ t: & (31.29) \quad (-14.90) & \\ R^2: & 0.94 & \end{array} \qquad (2)$$

In this econometric analysis I considered the series Consolidated Depreciation Expenditures as a proxy for technology expenditure. I included this variable as an instrument in order to have a well identified demand equation. This equation was tested with several approaches and all the results were satisfactory.[27] This implies that equation (2) can be used to continue the analysis.

Stackelberg Game Outcome

Equation (2) can be re-expressed to have an inverse demand equation for the leader, letting the price serve as a function of the quantity demanded:

---

25 The share results are available upon request.

26 In economics, it is well known that demand does not react immediately to changes in prices. It is quite common to find lags in time series analysis.

27 A graphical analysis of the data suggests the possibility of a structural change in the third quarter of 2001. I tested for that change with the Chow's approach. The null hypothesis of structural stability was rejected under this approach. The result of the test can be attributed to the small size of the sub-sample for the second equation. So, I decided to use the dummy's approach, which has some advantages over the Chow's approach. The null hypothesis could not be rejected under the dummy's test. I also tested for specification problems with the Ramsey test and I found none. Thus, a linear estimation is valid for the Mexican long distance demand.

Telmex: $$P_T^{NLD} = 6.236 - 0.001\ Q_{DT}^{NLD} \quad (3)$$

We already know Telmex has 75.6% of the market. The remainder 24.4%, is assumed to be divided between Alestra and Avantel. For this reason, equation (3) represents 75.65% of total demand. We need to make a homogenous transformation, multiplying (3) by 0.244 and then dividing it by 0.756 to obtain the demand equation of the follower (Avantel-Alestra):

Avantel-Alestra: $$P_A^{NLD} = 2.0125 - 0.0003\ Q_{DA}^{NLD} \quad (4)$$

Then, we need to make a demand equation for the market. This is the result of adding equations (3) and (4):

Market Demand: $$P_M^{NLD} = 8.248 - 0.001\ Q_{DM}^{NLD} \quad (5)$$

Considering that all players face the same cost function, we take as our reference the average incremental cost per minute of national long distance service calls. According to Tovar (2000), this is $0.10 Mexican cents.

Now, we calculate the reaction function of the follower:

$$\max \pi_A(Q_{DT}^{NLD}, Q_{DA}^{NLD})$$

$$= \max Q_{DA}^{NLD} [8.248 - 0.001\ Q_{DM}^{NLD} - 0.1] \quad (6)$$

$$= \max Q_{DA}^{NLD} \{8.248 - 0.001[Q_{DT}^{NLD} + Q_{DA}^{NLD}] - 0.1\}$$

This gives the result:

$$R_A(Q_{DT}^{NLD}) = 3{,}138.2 - 0.5\ Q_{DT}^{NLD} \quad (7)$$

After that, the leader computes its reaction function, taking into account the reaction function of the follower (7):

$$\max \pi_T[Q_{DT}^{NLD}, R_A(Q_{DT}^{NLD})]$$

$$= \max Q_{DT}^{NLD} \{8.248 - 0.001[Q_{DT}^{NLD} + R_A(Q_{DT}^{NLD})] - 0.1\} \quad (8)$$

$$= \max Q_{DT}^{NLD} \{8.248 - 0.001[Q_{DT}^{NLD} + (3{,}138.2 - 0.5\ Q_{DT}^{NLD})] - 0.1\}$$

After the maximization process, we have the quantity produced by the leader:

$$Q_{DT}^{NLD*} = 3{,}144.47 \tag{9}$$

And that of the follower:

$$Q_{DA}^{NLD*} = 1{,}565.95 \tag{10}$$

Hence, according to the Stackelberg model, the equilibrium quantity of the market should be:

$$\begin{gathered} Q_{DM}^{NLD*} = Q_{DT}^{NLD*} + Q_{DA}^{NLD*} \\ Q_{DM}^{NLD*} = 3{,}144.47 + 1{,}565.95 = 4{,}710.41 \end{gathered} \tag{11}$$

Thus, the Stackelberg equilibrium price of the market should be:

$$P_{MS}^{NLD*} = 8.248 - 0.001\ (4{,}710.41) = 2.14 \text{ pesos per minute.}^{28}$$

This result is approximately 50% of the average real price charged by Telmex (4.14 pesos per minute). The result shows that the current price system of the national long distance market is not consistent with the market structure of the industry. Moreover, if we maximize the demand function of the market considering a monopoly we get the following numbers:

$$\max \pi_M(Q_{DM}^{NLD}) = \max Q_{DM}^{NLD}\ [8.248 - 0.001\ Q_{DM}^{NLD} - 0.1]$$

$$Q_{DM}^{NLD} = 3{,}179.88$$

If we substitute this quantity into the market demand equation (5), we find the equilibrium price would be:

$$P_{MM}^{LDN*} = 8.248 - 0.001(3{,}179.88) = 4.12 \text{ pesos per minute.}$$

The above result seems to indicate that the current price is consistent with a monopoly industry.

---

[29] Results depend on the number of decimals used to solve the game. Nevertheless, the price equilibrium result does not change.

■ *Conclusions*

In conclusion, the Stackelberg model suggests that the Mexican long distance market behaves as a monopoly which is not consistent with the sale agreement. These results are very interesting because they are also a proof that the regulator (COFETEL) is not maximizing social welfare. By setting monopoly prices, the leader firm is the only one that benefits while the most efficient competitors are facing restrictions in gaining a larger market share. Thus, Telmex still has monopoly power.

However, it would be a mistake to take these results as definitive. It is important to take into account the limitations of the model:

1. It is a two-period dynamic game. In reality, games tend to be dynamic and played in more than two periods.
2. Econometric estimation of the parameters is based on the available data and on the construction of a price series due to lack of a reliable series. This implies that the value of the parameters can change as more reliable official data is available.
3. Most of the econometric tests indicate a good estimation. Nevertheless, there are tests with lackluster results. For example, the Granger test suggests that there is not causality among the variables. But, according to Núñez (1993), this test has its limits.

Considering these limitations, I believe this model provides concrete evidence that supports the social, political, and economic criticism that has been made about the Mexican telecommunications sector. The results also support the idea that the current regulatory framework urgently needs a change. This change must take into account the market structure of the sector to set prices to benefit consumers, not only businesses.

The consequences of continuing with this monopoly pricing could be very expensive for Mexican society. There is the possibility of a reduction in the growth rate of market demand. With this, it would be harder to accomplish the goal of universal service. Moreover, growth rate of telephony density could be lower when compared to a healthy competitive market.

It is worthwhile to note that if the regulator continues with the RPI-X system it will continue to give incentives to Telmex to commit monopolistic practices. This fact in turn could eliminate competitors from the market. This is possible according to the system, but better regulation would avoid this outcome.

The solution to the monopoly problem is not easy. There are important facts that need to be considered. First is the power of Carso Group owned by Carlos Slim, a crony of Carlos Salinas, the former president of Mexico.

Slim is the richest man in Latin America with an estimated fortune of $10.8 billion USD. Second, there is confusion among regulators, so there is not a single criterion to set rules for the market. Third, it is evident that there is a lack of national political will, since each major political party is concerned more with the next presidential election than with regulatory issues. Finally, consumers are totally disorganized, so they cannot apply pressure to change the current structure. Clearly, there will not be a change in the Mexican telecommunications sector in the short run.

However, I believe that regulation will gradually change. Little by little, Mexico will be forced to set and follow effective regulations for the telecommunications sector as it integrates into the world community and world economy. The arrival of a new party in the presidency could help to solve this. Or a change in legal decisions makers could countervail asymmetries in the telecommunications market. Meanwhile, consumers are suffering the consequences of having a telephone service with illegal monopoly power.

■ *References*

Baumol, W. and Sidak, G. (1994) *Toward Competition in Local Telephony*, Cambridge: MIT Press-AEI.

Bernstein, J. and Sappington, D. (2000) "How to determine the X in the RPI-X: a user's guide", *Telecommunications Policy*, Vol. 24, pp.63-68.

Economides, N. (1996) "The Economics of Networks", *International Journal of Industrial Organization*, Vol. 16, No. 4, pp. 673-699.

— and Himmelberg, Charles (1994) *Critical Mass and Network Evolution in Telecommunications*, mimeo.

Estache, Antonio et al. (2002) "Telecommunications reforms, access regulation, and internet adoption in Latin America". *Economia*, Vol. 2, No. 2, pp. 1-39

Evans, D. and Schmalensee, R. (1996) "A Guide to the Antitrust Economics of Networks", *Antitrust*, Vol. 10, No. 2, pp. 36-40.

Geroski, P. A. (1988) "In Pursuit of Monopoly Power: Recent Quantitative Work in Industrial Economics", *Journal of Applied Econometrics*, Vol. 3, pp. 107-123.

Kaserman, D. and Mayo, J. (2002) "Competition In The Long-Distance Market", *Handbook of Telecommunications Economics*, Volume 1, Elsevier Science, pp.510-561.

Mitchell, Bridger M. and Ingo Vogelsang (1991) *Telecommunications Pricing, Theory and Practice*, Cambridge: Cambridge University Press.

Núñez, J. (1993) *Análisis de Causalidad de la Relación Dinero-Producto para el caso de México 1967 – 1992 utilizando Vectores Autorregresivos*, Guadalajara: Universidad de Guadalajara.

— (2000) "Desarrollos recientes en la economía de redes. Implicaciones para la empresa y la regulación", *Carta Económica* Regional, Year 12, No. 71, pp. 37-45.

Perrucci, A. and Cimatoribus, M. (1997) "Competition, convergence and asymmetry in telecommunications regulation", *Telecommunications* Policy. Vol. 21, pp.453-512.

Posner, Richard A. (1976) *Antitrust law: an economic perspective-2*, Chicago: University of Chicago Press.

Robson, A. (1990) "Stackelberg and Marshall", *The American Economic Review*, Vol. 80, No. 1, pp. 69-82.

Serrano, A. (2000) *Las Telecomunicaciones en Latinoamérica, retos y perspectivas*, Mexico: Prentice Hall.

Shapiro, C. and Varian, H. (1999) *El Dominio de la Información, una guía estratégica para la economía de la red*, Madrid: Antoni Bosch.

Shy, Oz (2001) *The Economics of Networks Industries*, New York: Cambridge University Press.

Spulber, D. (1995), "Competition Policy In Telecommunications", *Handbook of Telecommunications Economics*, Volume 1, Elsevier Science, pp. 478-508.

Tovar, Ramiro (2000) "Incentivos para discriminar en redes dominantes: el caso de Telmex", *Lecturas en Regulación Económica y Política de Competencia*, México: Miguel Ángel Porrúa, pp. 123-140.

Ward, M. (1995) "Measurements of Market Power in Long Distance Telecommunications", *Bureau of Economics Staff Report*. Federal Trade Commission, pp. 1-62.