

Competition, regulation and institutional framework in telecommunications: implications for NGN in Mexico

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Abstract—when analyzing competition in telecommunication markets it is fundamental to take into account their specific characteristics. Moreover, it is important to understand the temporal evolution of competition as a result of multiple contextual factors. For these reasons the present study analyzes competition in mobile telecommunications, measured through the Lerner Index, and explains its evolution through the influence of regulation and the institutional framework. Mexico is used as a case study, because it is a noteworthy example given its recent efforts to promote competition in telecommunications services. The results show an improvement in competition associated with recent regulatory reforms. Based on them the paper discusses how the level of competition could be affected by key regulatory and public policy aspects that will take place as a result of the development of NGN.

I. INTRODUCTION

In the telecommunications sector, a degree of competition is possible and desirable under certain circumstances. Although this has been recently acknowledged in Mexico, its telecommunications market used to be characterized by the presence of a single company owned by the state, which was then privatized, maintaining its dominant position for many years (only recently have both this company, America Movil (AMX), and the television network Televisa, been defined as “preponderant” economic agents, in terms of their large market share in their corresponding sectors [1]). A context in which the existence of such enterprises was justified was usually based on the theoretical framework of natural monopolies, and on arguments such as the existence of network externalities and cross subsidies. However, this type of arguments was gradually questioned and refuted, in addition to the fact that the production and size of the telecommunications markets grew, leading to greater competition. Technological change reduced the scope of natural monopolies and it was pointed out that if dominant firms were allowed to exploit their market power, there could be a series of negative consequences, such as: high prices and low quality levels, resulting in reduced consumer welfare; the use of profits

not transferred to consumers by companies to consolidate their dominant position; and the lack of incentives to innovate and operate efficiently [2], [3]. Even so, it is now recognized that in markets such as telecommunications there are economies of scale and scope, which cannot be exploited if a company is very small. In other words, there is a minimum efficient scale. Therefore, while competition is desirable in this type of market, it is so up to a certain degree [4]. That is, on the one hand, there are cases where it is argued that effective competition may not exert sufficient competitive pressure on telecommunication operators [3] each company can respond differently to a certain competitive environment [5]. On the other hand, there is consensus on the benefits derived from the pressure exerted by competition, for it motivates companies to be efficient, innovative and customer oriented. Among these benefits are lower prices, higher productivity, more service options and greater connectivity [6], [7]. In summary, this discussion shows that an analysis of competition in telecommunications, that can adequately guide decision making and regulation, needs to go beyond simply looking at concentration levels at a given point of time, and requires analyzing different factors. A case in point is Mexico, where the mobile telephony market continues to be highly concentrated (there is a company with a market share of more than 50 per cent), yet prices have fallen and penetration levels have increased in recent times. In this case, it should be noted that the fall in the price level could be associated with a downward trend observed worldwide, especially considering that prices in a given country are correlated with those of other countries because they have common cost determinants [8]. This suggests the need for a more in-depth analysis of competition and its determinants from a historical perspective. In fact, the Mexican context is characterized by a series of recent measures to foster competition and the development of the telecommunications sector (mainly the Constitutional Reform in Telecommunications and Broadcasting that took

place in 2013). Since these measures are expected to have a direct impact on the institutional characteristics of the country, this is a relevant case study to analyze the effect of regulation and the institutional framework on the degree of competition in telecommunications. With this analysis it will be possible to assess whether the regulation has contributed to fulfill the objectives for which it was originally designed, and to identify which existing and potential measures will play a key role in sustaining positive competition levels in the future. For such purpose, the present study calculates the Lerner Index (LI) to measure the degree of competition, and explains its evolution through a series of explanatory variables, which

include the degree of concentration and focus on institutional characteristics and regulation. The results provide evidence

of an improvement in competition associated with the set of recent reforms in Mexico. Based on them, the paper identifies key challenges posed by the development of Next Generation Networks (NGN), and discusses how competition could be affected by the way these challenges might be addressed by future public policy and regulatory measures.

II. LITERATURE REVIEW

A. Lerner Index

Historically the measurement of competition has been characterized by the difficulty of reconciling empirical efforts with the corresponding theoretical support. Hence, to this date the debate remains open and it cannot be said that there is only one universally accepted approach. Even so, two main approaches have been clearly identified. The first one is known as structural because it consists of the estimation of systems of equations. Its use has not been very widespread due to its sensitiveness to the specification of the model and the difficulty to obtain enough data for its estimation [9] [10]. It is precisely this type of disadvantages that led to the development of the second approach as a popular alternative. This second approach is based on the use of reduced-form equations [11] that are analyzed in comparative statics [9]. It was initially developed under the Structure-Conduct-Performance paradigm (SCP). In this case it is said that performance can be inferred from characteristics of the structure of the industry. However, behavior cannot be observed [12]. That is why these models have been referred to simply as structure-performance. As suggested by their name, they are usually based on some indicator of the structure, such as the level of market concentration. Their main drawback is ignoring that a single market structure can lead to alternative behavioral models, which in turn can translate into different performance outcomes [13]. Therefore, although the concentration of an industry and the market share of firms are often correlated with market power, this is not always the case. In addition, there are other factors that affect the degree of competition in an industry. Considering the above, the "New Empirical

Industrial Organization" (NEIO) approach was developed, also within the framework of reduced form models. In contrast to the SCP approach, NEIO models explicitly consider behavior [Ibid]. The latter includes popular options, such as the Panzar and Rosse statistic and the Hall and Lerner indexes [10], [14], [15]. As noted in the introduction, the indicator used in the present study is the latter, whose advantages are emphasized in the literature review by [16]. According to [17], to whom the index owes its name, the theory suggests that competition can be directly inferred from price-cost margins [18]. This is represented by the following formula:

$$LI = \frac{(p - mc)}{p} \quad (1)$$

Where p is the price and mc is the marginal cost [19]. With perfect competition price equals marginal cost and the index will be equal to zero. When prices exceed marginal cost, the Lerner index becomes positive and varies between zero and unity. The greater the index, the greater the degree of monopoly power [15]. This is explained by the fact that collusion activities are more likely to occur in a concentrated industry, and the costs of detecting and punishing cheating on a collusive agreement are presumed to increase as concentration falls. This type of considerations, that is, the relationship between market share and performance, can be analyzed using non-cooperative behavior models that include a conjectural variation through which behavior is considered [20]. The model that is usually employed is the Cournot model, with which it is possible to address a case such as the one presented here, in which a price-accepting behavior assumption is not expected to provide a good approximation of the real world. Instead, one would expect to observe an oligopolistic behavior [21]. The model is based on a firm's profit maximization problem, and considers a series of factors including the conjecture about the reaction that other companies would have to an increase in its output. A criticism that has been made regarding the use of the LI high price-cost margins may not reflect abuse of market power but may simply result from differences in costs across firms. That is why [2] perform an empirical exercise in which they estimate one equation for price-cost margins and another one for prices, both with the same set of explanatory variables. They show that since prices and margins are responsive in similar fashion to the same variables, this suggests that much of the variation in margins is price-driven.

B. Determinants of competition in telecommunications

In accordance with the relevant literature, the level of competition depends on several variables. Firstly, while the use of concentration as a direct measure of competition has been questioned, it is also true that the former is a key determinant of the latter. In fact, a typical model would establish the price cost margin as the dependent variable with concentration indexes

and other variables as explanatory variables [19]. Besides concentration, it is important to take into account the level of contestability; in other words, having low barriers to entry and exit. For practical purposes, this implies that if a firm in a barrier-free market raises its prices above the marginal cost and begins to earn abnormal profits, potential rivals will enter the market to take advantage of these profits [22], [23]. It is also necessary to consider the sensitivity of demand to changes in prices (elasticity), because in markets where customers can easily choose not to consume a product, or to consume a substitute instead, producers cannot raise prices far above costs without significantly reducing sales [5]. In regard to this variable, it is necessary to note that, according to [21], in equilibrium the perceived marginal revenues of the industry are equal to the marginal costs of industry and, therefore, the same for all companies (this does not mean that perceived marginal revenue curves are necessarily the same for all firms). What this implies is that equilibrium entails equality in the perceived marginal incomes and, therefore, the same conjectural elasticities. In addition, it is essential to consider the institutional framework of the country in which companies operate [2] [22]. In the case of telecommunications there are specific rules and institutions that play a crucial role. Institutions may be either antitrust authorities or telecommunications regulatory agencies, and rules can also be antitrust rules and telecommunications-specific rules [3]. For the telecommunications sector, the policies aimed at avoiding anticompetitive practices that have played a central role are the following:

- Interconnection. Although in perfect competitive conditions, interconnection charges should correspond to the cost structure of the operator offering access to its network. Instead, there is evidence that they usually correspond to the strategic and competitive behavior of the companies. For this reason, the relevant research stresses the importance of regulating interconnection rates as a mechanism to increase the levels of competition in the mobile telephony markets [24].
- Infrastructure sharing. This obstacle to competition was identified by [25] as a crucial problem in Mexico. For the mobile case, it was pointed out that operators were not required to share their own passive infrastructure. Also with respect to mobile services, the organization suggested that facilitating the entry of Mobile Virtual Network Operators (MVNOs), through national roaming obligations, could be a way to boost competition.
- Foreign ownership in companies operating in the country. This factor was used as an explanatory variable in the empirical exercise for the banking sector by [22]. For telecommunications, in 2012 the OECD pointed out that Mexico should eliminate restrictions on foreign direct investment in fixed segments of the telecommunications

sector. This was considered to be a barrier to effective competition, leading to a lower return on local investment, reducing the efficiency of competition and slowing down the penetration of new technologies.

As for the institutions [25] emphasized that in Mexico the regulatory authority should have greater independence and autonomy in its responsibilities, as well as greater budgetary independence and a clearly identified source of funding, responding to its needs. It also considered that the regulatory authority should be empowered to impose fines high enough to be dissuasive and to ensure compliance with current regulations and with its objectives. It was also pointed out that the regulator had to be able to require information from companies in order to fulfill its obligations. In addition, transparency was identified as a key element in regulatory decision-making processes, including the need to publish the motivation for decisions, and to give stakeholders the opportunity to emit their opinion, which should be taken into account.

Other variables that have been used in similar empirical exercises are income [2], [16], the number of companies competing in the market and the size of the population [16].

III. METHOD, VARIABLES AND RESULTS

The empirical application presented here consists of calculating the LI for later use as a dependent variable in a regression model. Even though this index presents the problem of requiring cost information that is difficult to obtain, there are valid approximations to calculate it. The one that is used as a proxy in the present study results from dividing Earnings before Income, Taxes, Debt and Amortization (EBITDA), by the Revenues from the corresponding economic activity. This variable has been previously used in studies such as [26], although in this case it is used as an explanatory variable, whereas [2] use the EBITDA as a dependent variable. In the present study, the said measure used is calculated for the three main mobile voice and broadband operators in Mexico. From the values obtained for each of them, a weighted average is calculated in order to calculate an index for the mobile services market. This is done for a sample of time series observations, spanning from the first quarter of 2006 to the last quarter of 2016. Based on the theoretical basis provided in the previous section, the variables that are considered to explain the variation in the LI can be seen in the following:

$$LI_t = a_0 + b_1 * HHI_t + b_2 * Pop_t + b_3 * Inc_t + b_4 * RI_t + u_t \quad (2)$$

Where a is the intercept of the regression, u is a random error term and the subscript t means that the observations vary over time. HHI is the Herfindahl-Hirschman index, which measures market concentration; Pop is the number of inhabitants of the country; Inc is the income, which in this application is

	Coefficient	Standard Error
Constant	-0.0259835	0.4013735
RI	-.1531119***	0.0582178
Market concentration (HHI)	0.0367406	0.116147
GDP per capita	-4.42x10 ⁻⁵ ***	6.48x10 ⁻⁷
Change in GDP	0.0628557	0.066008
Population	5.88x10 ⁻⁹ **	3.88x10 ⁻⁹
***, ** y * represent the statistical significance level: 1%, 5% and 10%, respectively.		
R squared	0.89	
Number of observations	39	
Method	2 Stages Least Squares	
Instruments		
For the RI	Linear trend	
For the GDP	GDP in t-1	

Figure 1. Table 1. Estimation Results.

measured by the per capita Gross Domestic Product; and *RI* is a regulation index. Higher values of this indicator will denote a higher degree of regulatory adequacy. For its the construction, and in order to consider the regulatory and institutional framework, the following aspects were considered [27] [28]: the regulator has autonomy in decision making, accounting separation is required, and there is a convergent license regime since the reform (2013); since 2010, LRIC is the model used to calculate interconnection rates, and since 2009 interconnection agreements are made public; the main operator (the incumbent) is not State-owned; there is regulated network access for mobile virtual network operators (MVNOs) since 2014; there are time-bound regulatory cycles mandating periodic market analysis in order to reassess sector-specific regulations; the regulator does not restrict spectrum trade in secondary markets; and even though universal service considerations are included in operators licenses and spectrum auctions, there are no specific 3G network coverage obligations. An additional note regarding the estimations is required. It is the need to use an instrumental variables model, estimated with two stages least squares. This has to do with the simultaneity exhibited by some of the variables of the model, which means that they are determined jointly within a system of equations. These variables are the HHI and the RI, and the specific problem consists of a double causality relationship. This means that the regulatory framework is a key determinant of the degree of competition while, at the same time, telecommunications regulation has been implemented and designed in response to the perceived lack of competition [29], [30], [19], [22]. Based on these considerations, the estimation results are presented in Table 1. It can be seen that *RI* is a statistically significant determinant of the level of competition. This variable has a negative sign, which means that the LI decreases (the level of competition increases) as the regulatory adequacy increases. Note that

adequacy is interpreted as the presence of more measures that are deemed favorable to competition, according to the bibliography and previous international experience. As for the rest of the variables, the HHI is not statistically significant; nor are the changes in per capita income and the intercept. On the other hand, the population is a significant determinant with positive sign, which is consistent with [16], while the income is significant but with negative sign. In the latter case, it is important to note that according to the relevant literature, the expected sign is ambiguous [22].

IV. DISCUSSION AND CONCLUSIONS

The results of this study showed that both the regulatory measures and the evolution of the institutional framework have positively influenced the level of competition. In view of this, there are key challenges due to both, the need to sustain the results achieved thus far, and the imminent transition to a digital economy and a convergent NGN ecosystem. A first challenge is that, although efforts have been made to increase service coverage, Mexico needs to keep working to achieve goals of equal access to the expected benefits of present and future technologies. One possibility proposed by [31] consists of operator contributions to a universal service fund and the use of market mechanisms to achieve the objectives for which such resources are allocated. This would entail higher costs to the operators that would lead to a reduction of price-cost margins. However, it would be necessary to analyze the overall effect through the balance between such cost reductions and the effect on prices. Regarding the latter it would be crucial to consider the possibility that the cost increase could be passed on, from the operators to their high income users, whereby the latter would be subsidizing adoption among low income sectors of the population. Also with respect to coverage objectives, Mexican authorities have mandated the development of a wholesale network that will use a substantial portion of spectrum in the 700 MHz band. The geographic coverage target that it is bound to meet is 92 per cent of the national territory. This can be very useful for diverse business and local development opportunities, especially in primary economic activities, with the use of IoT. Since the project is expected to benefit from cost savings (related to spectrum costs and diminished regulatory burden), mobile operators using these wholesale services as an input should pass the benefits on to consumers, thus reducing prices and competition as measured by price-cost margins. Another recommendation that has been made in relation to further adoption and affordability is to reduce special taxes on telecommunication services [32]. The justification and macroeconomic impact of these taxes are beyond the scope of this paper. However, their expected impact is of interest, as it would entail a reduction in the LI as long as it translates into proportional reductions to consumer

prices. One of the most representative issues of the recent Mexican reform, that has set an international precedent, is the way of regulating MTRs. As a “preponderant” economic agent, the dominant operator, AMX, was not allowed to charge other companies for terminating voice calls on its network. This was initially established by law. However, the relevant authorities decided that from 2018 on, the responsibility of determining the appropriate MTR level will be vested upon the telecommunications regulator. This means that it can either allow AMX to charge a specific amount, different from zero, or establish a glide-path, gradually reducing the MTRs charged by the other operators, toward bill and keep. In the first case, AMX would benefit from a reduction in its costs, derived from the balance between what it pays and what it charges other companies for interconnection, thus contributing to broaden the gap between costs and revenues. Meanwhile, its competitors would contribute to a reduction in the price-cost margin, caused by the increase in their costs. In addition, AMX could lower its prices to final users, further squeezing its competitors’ margins. While the overall effect is unknown, the key point to bear in mind is that even though a reduction in market prices would contribute to lowering the LI, in the long run this could harm competition through the aforementioned margin squeeze of AMX’s competitors. Furthermore, the results could be higher prices in the long run, as a result of diminished competition. In the second case, AMX’s costs would be reduced, thus broadening the company’s margin, whereas the revenues of the other operators would diminish, hence reducing their margin. If the gliding path evolves in accordance with a trajectory toward more competition, AMX’s contribution to the average market LI would gradually diminish as its competitors’ market share increases. Another aspect in which interconnection is crucial for the development of NGN in Mexico has to do with Internet Exchange Points (IXPs). Regarding this topic, the corresponding guidelines, which provide specificity in the application of the relevant laws, have been recently published [33]. As long as they result in the effective implementation of the obligation of the preponderant economic agent (AMX) to exchange traffic under the IPV6 protocol [34], a positive impact on competition could be expected. Specifically, it could be due to the effect on the LI of reducing AMX’s margins, by increasing its costs, and if its competitors translate their reduced interconnection costs into price reductions for their users (which they are incentivized to do in order to gain market share). Another cost component that will play a key role in the future is radio spectrum. In its recent study, [31] has suggested that the price for this essential input could be lower in Mexico. It is important to note here that it would be necessary to determine if spectrum is indeed more expensive in Mexico than in other regions. In case it is, and the recommendation of lowering it is adopted, this would allow different companies to

increase and diversify their spectral resources to become more competitive. If such scenario leads to price reductions for final users, this would contribute to more competition in terms of the LI. Even so, for future auctions it will be important to consider that larger operators can allocate the cost of spectrum among more users. Therefore, if they are to pay the same price per Megahertz as smaller operators at spectrum auctions, they will be at an advantage.

In addition to the previous topics, a concern that has gained significant attention recently, in relation to new technologies, is the emergence of new business models. In this sense, services like the so called Over-the-Top (OTT) entail the need to redefine relevant markets and/or the regulatory scope of the relevant authorities. For Mexico, a recent case that illustrates the challenges of a convergent environment is the proposed merger between ATT and Time Warner. For the purpose of this paper, an implication is that this type of recently consolidated company is expected to benefit from economies of scope. The inherent outcome is the reduction of relative costs and the possibility to compete more aggressively by reducing prices, with an overall effect on the LI that is unknown. Finally, it was pointed out that among the main barriers to competition have been those related to municipal regulations, which have promoted economic inefficiencies and inhibited the deployment of infrastructure [35]. In spite of this it should be noted that, according to [36], Mexican authorities have already included, within their Medium-term strategies, deregulation measures for the deployment of telecommunications infrastructure in states and municipalities. The resulting outcome will combine the effect of reduced costs for the operators and lower average prices as more segments of the population are able to use the service. In summary, given the relationship observed in the empirical exercise, and the key regulatory and public policy measures that are expected to take place, two main conclusions can be drawn. First, most of the measures that were discussed can have cost reductions as a main outcome. Their success will depend on the extent to which cost savings are passed on to the final users. Second, the overall net effects are not straightforward in many cases, in terms of the LI, which constitutes an important area of future research.

V. DISCLAIMER

The views and conclusions presented in this article are the exclusive responsibility of the author and do not represent those of the IFT.

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