

CHAPTER 1
THEORETICAL ASPECTS OF THE NEW INSTITUTIONAL ECONOMICS,
CONTRACTING AND REGULATORY GOVERNANCE

1.1 New Institutional Economics

Institutions matter. This is the main conjecture of the New Institutional Economics (NIE). The institutions of a society represent the rules of the game in the market of goods, services, investment and even in the political market. Institutions embody the rules that restrict the decisions of economic agents in all of these markets. They generate a pay-off structure or incentives that affect agents' decisions. Some analysts (see North and Thomas [1973], North and Weingast [1989] and North [1990]) have argued that institutions have a fundamental role in explaining levels of savings (private saving incentives), investment and technology.

North (1990) states that economic phenomena are founded in decisions of agents restrained by incentives that emerge from a set of institutional arrangements. The institutions provide the rules of the game and the economic agents and companies comprise the players. The existence of institutions minimizes uncertainties for economic agents, institutions also help determine the pattern of socially desirable behaviors. For instance, one function of the rules of the game is enforcement of the law and defense of property rights, thus creating the parameters for the establishment and execution of contracts and guaranteeing opportunities to earn a return on investments. North and Weingast (1989) demonstrate the role of institutions in economic growth and development. They show that the constitutional arrangements established in England after the Glorious Revolution (1688-89) guaranteed property rights on assets and reduced or eliminated the state's discretionary power to expropriate wealth. The basic argument is that these institutional reforms created a fertile ground for the flourishing of business.

Institutions are the formal and informal mechanisms present in a society. One feature that distinguishes the NIE is recognition of the role of the state. For example, property rights are essential for growth, and their enforcement must be a constitutive function of the state. The existence of institutional stability and credibility related to the institutions and contracts in general depend on the enforcement of the law and the incentive structures. However, as Weingast (1995, p. 225) states, "The fundamental political dilemma of an economic system is this: A government strong enough to protect property rights and enforce contracts is also strong enough to confiscate the wealth of its citizen. Thriving markets require not only appropriate system of property rights and a law of contracts, but a secure political foundation that limits the ability of the state to confiscate wealth."

The dilemma as stated by Weingast (1995) implies that understanding economic and investment growth requires attention to the question of what causes a state to behave responsibly or not. The key point, following Weingast, is to understand that markets and limited government are complementary aspects of economic development and reform. The potential conflict between government and private investors is at the heart of Levy and Spiller's (1996) analysis. For them, the regulatory design is composed of two components: regulatory governance and regulatory incentives. I will focus on regulatory governance because it is the first consideration in regulatory design. To understand the theoretical aspects of the regulatory governance, it is important, first, to understand contracting theory.

1.2 Contracting Theory

Individuals have their own motivation or interests and very rarely those interests are aligned with the interests of other individuals. This gives rise to rules of behaviour to control opportunistic self-interest. One way to reach agreement is to have parties state and recognise their potential mutual interest and agree to modify their behaviours. These agreements are what I mean by contracts, which can be implicit or explicit. Ideally, contracts should envisage the actions each

party will take, the payments each party will collect, the rules and procedures for action in foreseeable circumstances and so on. In transaction cost economics, the basic unit of analysis is a contract or a single transaction between two parties in an economic relationship. Such ideal contracts, however, are rare because the incentives and the degree of observability, at different points in time, and with different degrees of reversibility, are divergent between parties.

Williamson (1983, 1998) has stated that bounded rationality is one reason we cannot have complete contracts. Bounded rationality means that the limited foresight, imprecise language, costs of calculating solutions and so on lead to situations where not all contingencies are fully accounted for. When these situations arrive, parties tend to find ways to adapt the contract to include the unforeseen contingencies. Again, parties' incentives act (individually) sub-optimally because they now have incentives to behave opportunistically. Opportunism is the other real-life reason why contracts are incomplete.

1.3 Regulatory Governance

Building on the NIE and transaction cost economics, Levy and Spiller (1996a) argue that utility industries have special characteristics that make opportunism a more acute problem. A large portion of utility assets is sunk, utility technologies exhibit important economies of scale (and scope) and utility services are considered necessary goods and so are politically sensitive. In the case of the telecommunications industry, a telecom operator has to deploy networks of a chosen technology (optic fiber, copper, etc) and buy equipment (switches, etc) that is not easily redeployable in other industries. Governments can behave opportunistically once private (and foreign) investors undertake their investment. Government can expropriate or take over the investment.

If private investors are unaware about a government's degree of commitment, they may refrain from an optimal level of investment or make no investment at all. The government's lack of credibility creates hold-up problem. When a government cannot commit, investors know that it

may confiscate or behave opportunistically after they have undertaken investment. Anticipating that outcome and perhaps knowing the degree of political opportunism, private investors then will invest sub-optimally or not at all. The investment may be sub-optimal in the sense of investing in those kinds of assets that may have a higher value in a secondary industry. In the extreme case, if government opportunism is very high, investors will refrain from undertaking any investment.

The uncertainty regarding commitment has given rise to multiple theoretical approaches trying to find solutions. The studies by Dewatripont (1989) and Laffont and Tirole (1990) are a good reference. These show that a government's inability to commit increases the transaction costs of contracting. However, these higher transaction costs may be justified by the need for some flexibility to ensure that past (and current) regulators are not allowed to bind the future of society to a given regulation. The studies also show that we cannot think of a government as a unified entity. On the contrary, governments are composed of multiple hierarchies, which in turn increases the level of uncertainty, given the different incentives that each hierarchy may have.

The history of Latin America utility service is a good example of governments undertaking investment. As the study of Levy and Spiller (1996a) shows, in telecommunications, energy and water, the state undertook investment most of the time because of lack of commitment by government and the uncertainty of private investors.

But if that was the case in the past, how might current governments in developing countries, particularly in Latin America, attract new investment in the utility industries? The answer given by Levy and Spiller (1996a, p. 4) is regulatory governance. "Governance structure incorporates the mechanisms a society uses to restrain the discretionary scope of regulators and to resolve the conflicts to which these restraints give rise." In order to achieve credibility, governments should create or strengthen their regulatory governance. The regulatory governance specific for the telecommunications sector requires the creation or strengthening of a regulatory authority. Of course, as Levy and Spiller stress, every country needs a strong institutional

endowment. The overall institutional endowment is composed of a) the legislative and executive institutions, b) judicial institutions, c) custom and other informal norms of behaviour, and d) the country's administrative capabilities. A good regulatory authority may be effective in reducing investor uncertainty to the extent that the institutional endowment can support it.

1.4 Applications

In this dissertation, telecommunications reform is studied by using the theoretical framework of the NIE, contracting theory and regulatory governance.

In Chapter 2, I make an analytical study of regulatory development in telecommunications for twenty-four Latin American countries. I construct an index of regulatory governance in telecommunications and describe the development of the privatisation process and market liberalisation. I show how ownership reform was different from country to country. It is shown that, on average, countries that privatised their former state-owned telecom operator have higher rates and levels of main phone lines per 100 inhabitants. With respect to the market structure reform, I report how countries in the region that were the first to privatise gave away exclusivity periods willingly. The exclusivity period is nothing more than a way to keep monopoly markets. However, I also show that the latest privatisation transactions did not involve exclusivity periods. Lastly, I construct a regulatory framework index for telecommunications in Latin America and the Caribbean. This index is a re-building of a former index. The new index captures some main elements or attributes that a regulatory framework should have. Some of the attributes measure concepts like autonomy, clarity of roles and accountability. The index is then an effort to measure the importance of institutions like regulatory agencies.

In Chapter 3, using panel data econometric techniques, I analysed econometrically the relationship between two telecommunications performance variables: network deployment and efficiency. Network deployment is total main phone lines per 100 inhabitants. Efficiency is main lines per employee. I test the hypothesis that those countries that have deepened their regulatory

governance in telecommunications are more likely to have larger network deployment and a better level of efficiency. To run these regressions, I control for economic and demographic variables. I found that, on average, those Latin American countries that have better regulatory frameworks have larger levels of network deployment and a better level of efficiency. The other two factors of telecommunications reform, privatisation and liberalisation, happen to be positively associated with the performance variables. In general, I found that this hypothesis tend to be true for at least my sample of countries. The policy implication of the study is that governments in the region must keep strengthening the regulatory framework and opening the market to further competition.

In Chapter 4, one of the elements of the telecommunications reform is tested for a particular country. Using a very simple Cournot-competition model, I test how the opening of the long-distance telecommunications sector affects the overall welfare in Colombia. I define welfare as the sum of the consumer and producer surplus. Given the above assumption and adding the restriction usually imposed on firms integrated vertically, I found that the opening of the long-distance market has negative effects on the profits of the incumbent, Telecom. However, these negative effects are counter-balanced by the increase in the profits of the local exchange carrier that entered the long-distance market. More than that, I found that all the local exchange carriers will get positive benefits derived from the increase in the volume of long-distance traffic and hence the increase in the interconnection charges. Consumers, on the other hand, benefit from the opening of the sector. Lower prices will permit them to enjoy more calls.

In chapter 5, I present some general conclusions and draw the main links between the chapters.

CHAPTER 2
AN INDEX OF TELECOMMUNICATION REGULATORY FRAMEWORKS IN THE
CONTEXT OF PRIVATIZATION AND COMPETITION REFORM

2.1 Introduction

In the last two decades, economists have given more attention to institutional factors as part of the explanation for differences in countries' economic development. Institutional economics has a long tradition but not until recently has it been incorporated formally into theoretical economic models and empirical research¹.

Analysis of how the institutional environment affects economic growth rate has been expanded to include analysis of the impact of institutional features on investment, education and so on². The main indicators for capturing the institutional environment have been, among others, the Polity III index, the Gastil Liberty index and indexes developed by specialized country-risk agencies, like *ICRG* (International Country Risk Guide), *Institutional Investors* and *Euromoney*. The importance of institutional factors is acknowledged in studies by international lending agencies like the World Bank and the Inter-American Development Bank (IADB)³.

As the world economy becomes more integrated in the markets for goods, services and capital, recognition of the need for expanded and modernized telecommunications services has pervaded the plans and policies⁴ of most Latin American countries. Telecommunications reforms

¹ Specifically, growth models have made extensive use of institutional and political factors. See Barro (1996), Knack and Keefer (1995) and Keefer and Knack (1997) and Alesina et al. (1996), among others.

² See, for example, Henizs and Zelner (1998), Mauro (1998) and Campos and Nugent (1998).

³ For example, the World Bank has used the ICRG index to measure institutional developments in Latin American countries. See Burki and Perry (1998) for more details.

⁴ See Hudson (1997).

have been implemented in almost all the countries in the region, although the degree or depth of the reform has been different across countries.

This study examines the trends in the telecommunications sector in Latin America and the Caribbean. I consider the evolution of the privatization process in the main telecommunications services (local and long distance telephony), the liberalization of those markets, and, more importantly, the efforts to establish strong regulatory frameworks in the region. Among the overall results reported 15 Latin American and Caribbean countries have privatized completely or partially their former public telecommunications operators (PTOs). With regard to liberalization reform, most countries in the region still have monopoly providers of telecom services, but their markets are due to open with the end of exclusivity periods. Lastly, efforts toward building a sound regulatory environment for the telecommunications sector have been fruitful. The regulatory framework index shows that almost all countries studied have progressed considerably in this area.

This chapter has four more sections. The next section gives the reader the general context in which Latin American telecommunications reform took place. The third part deals with how telecommunications ownership reform was implemented in the region. The fourth section analyzes the liberalization reforms in some countries of the region. I then present a detailed explanation of the main theoretical aspects that a regulatory framework should encompass and the first estimates of the regulatory framework index. The last section contains some concluding observations.

2.2 Context of Latin American Telecommunications Reform

To many observers of the Latin America economy, the 1980s was the "lost decade". The debt crisis that hit almost all the countries in the region brought lower or negative economic growth rates, an increase in poverty, a broader gap in the distribution of income, and higher levels of unemployment. Many blamed the inward-looking development model that most countries in

the region had followed for more than four decades. To cope with all these problems, in the mid-1980s, international organizations like the World Bank, Inter American Development Bank and the International Monetary Fund (IMF) demanded that governments in the region undertake broad reforms. Some called this set of structural policies the "Washington Consensus"⁵.

Hence, from the mid-1980s, most of the governments embarked on implementing reforms in many areas. In trade policy, they lowered tariffs and eliminated controls on imports. In the financial arena, they liberalized financial markets. With regard to tax policy, there was a rationalization of the number and structure of taxes. In the area of labor legislation, labor markets were made more flexible; in privatization reform, most governments began divesting assets in some sectors⁶, leaving production decisions to private investors.

Although countries embarked on reform at different times, it is clear that overall economic conditions were not ideal. There were low growth economic rates, suggesting low demand for telecommunications. However, the region was experiencing greater levels of population density and urbanization, which reduce the cost of deploying telecom networks. Williamson (1998) states that the New Institutional Economics has two dimensions; the macro level consists of formal and informal rules (customs, constitutions, laws, etc). While the micro level deals with the institutions of governance referred to as polity. Latin American countries at the time of the telecommunications reforms were, (and still are) showing a steady increase in both dimensions.

In Table 2.1, two measures of the above structural reform for Latin American countries constructed by Latin American researchers are given: the structural policy index and the general

⁵ See Williamson (1990).

⁶ For a more detailed analysis of Latin America's structural reforms, see IADB (1997), Lora and Barrera (1997), Lora (1998), Morley et al. (1999), Easterly et al. (1997), and Fernandez and Montiel (1997).

reform index⁷. After the first index, the average indicator shows that the region expanded the reform index by about 37%, while by the second one, the increase was close to 28% between 1986/90 and 1991/95. Yet the economic growth performance of the region has been quite disappointing. In the last second half of the 1980s, the region suffered a negative growth in the income per capita; in the first half of the 1990s that growth was barely above 1%. Furthermore, while it is clear that the region deepened its integration into the world trade flow of goods, it is also apparent that the service sector as a percentage of GDP slightly declined in the first five years of the 1990s compared to the last second half of the 1980s.

Despite poor economic performance, the region was a winner at the macro level of polity and in the way international analysts perceived the region. The well-known indexes *ICRG*, *Euromoney* and *Institutional Investors* that may capture the institutional factors affecting the region, show increases that range from 11 to 27% when comparing the second half of the 1980s with the first half of the 1990s. The region, then, progressed remarkably in this regard. Another important indicator is related to the political headway Latin America has made in the last 15 years. The Govtype index⁸ shows the political stability or level of democratization, as shown in Table 2.1, in the first half of the 1990s, the governments of the region leaned toward more democratic processes reflecting a broader social consensus⁹.

In the telecommunications sector, the region as a whole achieved good results. In both mobile and fixed telephony progress is apparent. The indicator of main phone lines per 100 inhabitants (or teledensity) increased from 7 lines to almost 10 lines. Although this is still far

⁷ The first index was constructed by Lora (1998). Morley et al. (1999) elaborated the second one. More details are presented in Appendix A.

⁸ For more information about the way this index was constructed and the information contained in the Polity III database, see Appendix A.

⁹ For more about the social and economic development in Latin America, see Thorp (1998).

below the level of developed countries, Latin America rate is now twice that of Asia (without Japan, 5.1 in teledensity) and about five times the African average in teledensity (2.0 in 1997).

Table 2.1 Economic, Political and Demographic Indicators in Latin America

Latin and Caribbean Countries*	1986-1990	1991-1995	1996-1997
GDP per Capita (US\$1990)	2,630	2,694	2,989
Annual Growth Rate of GDP per capita	-.16	1.09	2.86
VSERGDP	51.01	50.87	51.00
TRADE	61.16	72.36	66.89
Democracy-GOVTYPE	1.27	1.93	NA
<i>Euromoney*/</i>	32.98	41.77	49.47
<i>Institutional InvestorB/</i>	22.94	27.18	33.33
ICRG	2.28	2.51	NA
Structural Policy Index	.425	.581	NA
General Reform Index	.614	.788	NA
Economic Freedom Index	4.61	5.89	NA
DENSITY	40.45	45.18	48.10
URBANGDP	60.28	62.79	63.12
Telecommunications Regulatory Framework Index*/	0.33	0.47	0.74
Cellular Subscribers per 100 inhabitants	0.01	0.31	1.14
Main Lines per 100 inhabitants*/	7.07	9.74	12.3
TELEDENSITY			

Source: See Appendix A for description of the variables.

These are Argentina, (The Bahamas), Barbados, Belize, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Guyana, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Trinidad and Tobago, Uruguay and Venezuela.

*/ Includes 24 countries

B/ Includes 20 countries

More recently (1996-97), the performance of some of the above indicators has improved.

Two important demand factors for main phone lines are the GDP per capita which has increased by almost 3.0%, and the added value of the service sector as a proportion of the GDP, which has rebounded to the average level of 1985-1990. In addition, *Euromoney* and *Institutional* investors indicators have kept improving, increasing between 18.4% and 22.6% when comparing to the

first half of 1990s. The telecommunications indicators increased greatly, especially the total cellular phones per 100 inhabitants. However, the 1998 exchange rate crisis of Brazil's currency (a depreciation of Brazilian currency by 40%) reminds us that the region seems to be extremely vulnerable to global market instability.

Thus, it seems that the overall progress of the region has been mixed. More recent economic and financial developments that followed the Mexican crisis of 1995 and Brazil's of 1998 threaten and blur the future of the region. Many factors keep Latin America's expectations low. A leading world economist has said, "That [Washington] consensus all too often confused means with ends: it took privatization and trade liberalization as ends in themselves, rather than as means to more sustainable, equitable, and democratic growth...It focused too much on price stability, rather than growth and the stability of output. It failed to recognize that strengthening financial institutions is every bit as important as controlling budget deficits and increasing the money supply. It focused on privatization, but paid too little attention to the institutional infrastructure that is required to make markets work, and especially to the importance of competition." (Stiglitz, 1998b, p.1)

2.3 Ownership Reform

Using more comprehensive quantitative analysis, I now explore the determinants of the deployment of main phone lines per 100 inhabitants and the efficiency in the sector. Here, the focus is on factors influencing reform and the creation of a regulatory reform index.

With increasing integration of Latin American countries into the global economy and the signing of the World Trade Organization (WTO) agreements in telecommunications, from the late 1980s some Latin American and Caribbean countries began a process of ownership reform¹⁰.

¹⁰ For ownership reform, we mean the transfer of capital and management control to private investors either nationals or foreigners. In this case, we do not include any kind of what Lee (1999) calls "non-traditional strategies of Privatization." As Adam et al. (1992, p. 8) state "BOT can be seen as a variant of the standard practice of public works contracting in the face of

The pace of the reform has been different from country to country but some general aspects are common to most of the countries.

As Table 2.2 shows, at least fifteen Latin American and Caribbean countries have privatized their former public telecommunications operators (PTOs). This would include three members of the Andean Pact (Bolivia, Peru and Venezuela), five Caribbean countries (Barbados, Belize, Guyana, Jamaica, and Trinidad and Tobago), four Central American countries (El Salvador, Guatemala, Panama and Mexico), and three members of the Mercosur common market (Argentina, Brazil and Chile). Thirteen of the fifteen countries involved chose to give up more than 50% of their stakes in the former public telecom operator. In Bolivia, the government kept its 50% but transferred it later to a pension fund scheme (See Graham [1997]). In the remaining case of Trinidad and Tobago, the government kept 51% of its share.

Although the privatization of telecommunications in Latin America and the Caribbean has been analyzed elsewhere¹¹, some important features bear emphasis. Starting in Chile in 1987-89, ownership reform has displayed a pattern apparent in Table 2.2. First, in all cases, foreign capital has been present in one way or another¹². Ownership reform in Latin America was based on the premise that foreign investors could bring not only capital but also the technology and expertise lacking in the region. With few exceptions (Mexico and Guatemala), the public telecom operator was bought by a consortium led by foreign investors.

financial resource constraints, by which the remuneration system for the contractor is switched from a certain lump-sum payment to a risk-bearing payment scheme spread out over time."

¹¹ See for instance, Beca (1993), Molano (1997), Petrazzini (1993 and 1996), Wellenius (1994), Walter and Sen9n (1998) and ITU (1998a and 1998b). Guti9rrez (1999) also makes an analysis in terms of the Andean Pact, Caribbean, Central America and Mercosur countries.

¹² See Petrazzini (1992) and Boeker (1992) for more detailed explanations about the inflow of foreign investment in Latin America in the late 80s and early 90s.

Table 2.2 Ownership Reforms in Latin American and the Caribbean					
Country	Year Of Privatization	Private %	Foreign Capital	Network Expansion	Public Offering
Argentina	1990-1991	100%	TASA-64.5% TCOM-60%	Yes	Yes
Barbados	1991	80% on average	C&W- BARTEL-76% BET-85%	-	Yes
Belize	1988-1992	97%	23.5%	Yes	No
Bolivia	1995	50%-100%*/	50%	Yes	Yes
Brazil	1998	100%	.24%	Yes	Yes
Chile	1985-1990	100%	CTC-63.5%** ENTEL-29%*	No	Yes
Colombia	Plan to privatize one local telco.	-	Allowed	-	-
Costa Rica	No plan.	-	-	-	-
Ecuador	Privatization efforts failed.	-	Allowed	-	-
El Salvador	1998	61%.So far	51%	Yes	Yes
Guatemala	1998	98%	-	Yes	Yes
Guyana	1991	80%	80%	Yes	Yes
Honduras	-	Expected 51%	Allowed	-	-
Jamaica	1989-1990	100%	C&W-82%	No	No
Mexico	1990-1994	100%	10.4%	Yes	Yes
Nicaragua	Abandoned.	40%	Allowed	-	-
Panama	1998	51%	C&W- 49%	Yes	Yes
Paraguay	No plans	-	-	-	-
Peru	1994-1996	98%	54.7%**	Yes	Yes
Suriname	No plans	-	-	-	-
Trinidad & Tobago	1989-1991	49%	C&W-49%	Yes	Yes
Uruguay	No plans	-	-	-	-
Venezuela	1991-1996	96%	65%**	Yes	Yes
*/ Large stake was sold to a foreign company. The rest was capitalized into Pension Fund Schemes.					
**/ It includes ADRs.					
Source: Pyramid Research (1998), Harper (1997), Petrazzini (1995), Ramamurti (1996a, 1996b, and 1996c), ITU 1997b, 1998a and 1998b and Primo and Ziegler (1998); supplemented by the author.					

Furthermore, only Mexico restricts the stake permitted to foreign capital in telecommunications. The remaining countries lack limits on foreign capital. Yet, while foreign capital has been decisive in the privatization process, domestic capital tends to be always present in consortia, although its share varied from country to country¹³.

Second, in every case, governments across the region demanded that consortia include a well-know international telecommunications strategic partner¹⁴ as the *main* stakeholder or at least as part of the deal. As mentioned before, governments in the region recognized that technology in their telecommunications sectors lagged at the time of privatization. There was no international telecommunications partner in Guatemala initially. However, some time after privatization, Telmex (from Mexico) filled that role.

Third, in most cases, the government sold or transferred a controlling package of the former PTO. These three features distinguish Latin American privatization from that carried out in Asia, where governments chose to allow entry by a new company¹⁵. Thus, the process in other regions has been different: as Lee (1999, p. 61) states "Asian-Pacific governments have kept a tight curb on foreign investment. State control is one of the key features that differentiates these [Asian-Pacific] sales from those in other parts of the world."

Fourth, with the exception of the most recent ownership reform cases (Guatemala, El Salvador and Brazil), governments across the region granted an exclusivity period for service provision. This feature is examined in more detail in section 2.4 below.

Fifth, except in Chile and Jamaica, network expansion targets and quality improvement were demanded from the new owners. For example, Argentina demanded an annual growth rate

¹³ In Mexico, domestic capital led the process. For more about Mexican participation in the overall privatization process, see Hoshino (1996). On this, see also Barrera (1995).

¹⁴ "The term strategic partner usually implies a foreign telecommunications carrier, often but not always from a developed country" (ITU 1997b, p. 48).

¹⁵ See also Petrazzini (1993) and Ure (1993).

of about 7%, Mexico 12%, Guyana 18%¹⁶. The Bolivian government requested to three of the main local telecom cooperatives increases in the total new lines installed of 80% to 115%. In Panama, the new operator is compelled to increase the number of main lines per 100 inhabitants to 25 by 2002. The Venezuelan government stipulated in Annex A of the concession contract that phone lines must increase from 2 million in 1991 to 4.5 million in 2000. In Peru, the contract with the new owner, Telefonica de EspaZa, mandated additional 631,000 lines between 1994 and 1998¹⁷. Governments in the region realized the need to expand the number of lines nationwide to fulfill social demands. Indeed, some analysts argue that the targets imposed on the new operators fell well short of the social needs¹⁸. However, such mandates and obligations also raise the capital requirements and lower the values of incumbent assets.

Sixth, in most cases, the transfer of a controlling interest of the PTO was done by private sale involving a public tender of a main package with options to former and current employees to buy shares of the newly privatized telecom. That was the case in Argentina, Peru, Mexico, Chile, Brazil, Venezuela, Guyana, Panama and El Salvador. State-owned shares were placed by public offerings on the domestic or New York's stock exchange. In Jamaica and Belize, the deals were private sales with no request for bids (ITU [1998a and 1998b]).

In other countries in the region, ownership reforms failed completely. In Uruguay and Paraguay (1992), people voted against privatization. In Colombia (1992), a strong strike forced

¹⁶ Regarding Mexico and Argentina, see Beca (1993), Celani (1998), Escobar de Medecigo (1999), Gonzalez et al. (1998), Mairal (1994), Petrecolli et al. (1993); for Guyana, see Hinds (1995) and Greenidge (1993, 1994, and 1997).

¹⁷ See Barja (1999) and Herrera (1996a) for the Bolivian case, Francis (1993 and 1996) for the Venezuela experience, Campodonico (1999) for the Peruvian process; for Panama, see ITU (1998a) and USDOC (1999).

¹⁸ As an analyst has pointed out, "most of Latin American governments are not requiring obligations as significant as those imposed on investors in Asian countries, such as Indonesia and the Philippines, to build out networks in rural areas. This missed opportunity to provide strong incentives for extending rural access could pose a potential problem in the long term" (Hudson 1997, p. 354).

the government to withdraw its privatization goal (Hooley [1998]). After three attempts to sell the state telco in Ecuador (1998-99), investors withdrew from the tender. Recently, we note the failing cases of Honduras and Nicaragua, where Telmex withdrew from the auction for a 40% share of the public telecom operator. Other countries like Costa Rica and Suriname seem not to be willing to undertake ownership reforms in the near future. The performance of the PTOs seems to be the main reason not to proceed to privatization. Both countries have network expansion well ahead of the Latin American average.

Lastly, as nowhere in the world, big worldwide telecommunications carriers participated in the ownership reform¹⁹. In basic telecommunications services²⁰, Telefonica, the Spanish carrier is the strategic partner in Argentina, Chile, Brazil, Peru and Venezuela, and it recently bought small telecommunications operators in El Salvador and Guatemala. Cable & Wireless has majority interests in Barbados, Panama, Jamaica and Trinidad and Tobago. MCI is the strategic operator in Belize and Mexico, and recently entered the long-distance market in Sao Paulo, Brazil. France Telecom is in El Salvador and Mexico. The Italian operator STET is the new owner of the long-distance carrier in Bolivia and co-owner in Argentina, Chile and Cuba. GTE from the United States operates in Venezuela and Mexico. In most cases, the carriers have formed alliances that may bring positive effects on the sector and Latin American customers will enjoy the latest technologies available worldwide. Prices may tend to decrease, and service will be enhanced. However, regulatory bodies will face greater challenges from the potential anticompetitive behavior of these very aggressive players and from the rapid pace of convergence among competing technologies²¹.

¹⁹ Sonnenschein and Yokopenic (1996) is a good source for the reasons multinational carriers were (are) so eager to invest in Latin American telecommunications sectors.

²⁰ For more information about the strategic partners and alliances in the sector see, Barbour (1997) and Arathoon (1999).

²¹ The main problems regulators may encounter are considered in Neal (1999).

Table 2.3 Comparisons of Pre and Post Privatization Reform↔/			
Countries that privatize their Former State-Owned Operators□/			
	Year*/ of Privatization	% Annual Growth Prior to Privatization	% Annual Growth From Privatization
Trinidad & Tobago	1990	15.0	5.0
Belize	1988	12.1	9.5
Barbados	1989	6.7	6.4
Chile	1987	5.7	13.7
Argentina	1990	5.2	8.2
Mexico	1991	5.1	5.6
Jamaica	1989	5.0	16.6
Peru	1994	4.2	23.7
Venezuela	1991	3.8	6.8
Bolivia	1995	2.4	29.0
Guyana	1991	-2.4	24.1
Simple Average		5.7	13.5
Countries that did not privatize their Former State-Owned Operators			
	%Annual Average Growth Rate		
	1981-1989	1990-1997	
Honduras	8.5	10.6	
Suriname	8.3	6.9	
Colombia	5.8	10.6	
Uruguay	5.5	8.4	
Ecuador	5.5	6.6	
Paraguay	5.1	7.3	
El Salvador	5.1	12.0	
Brazil	4.7	7.1	
Guatemala	4.5	11.3	
Costa Rica	3.3	7.9	
Panama	3.1	4.5	
Nicaragua	1.8	11.1	
Simple Average	5.1	8.7	
↔/The information in this table refers to those countries that privatized before 1998.			
□/This refers to the year where control of major state's stake was transfer to private hands			
Source: ITU Database Indicators 1997a.			

What overall effects may the privatization reform have had on the deployment of main phone lines per 100 inhabitants? Table 2.3 below shows the simple (not weighted) average growth rate of main lines per 100 inhabitants. Prior to privatization, the average growth rates were very close between those countries that privatized and those that did not. However, it seems that after privatization, the growth rate of teledensity for the countries that embarked on the

ownership reform did grow more rapidly than that of the countries that kept their (main) phone operators in public hands. This is still true even if we do not include the most recent privatization cases, (in the table, Perδ and Bolivia). The statistical evidence seems to show that the privatization process tends to improve that performance measure²². Here, I do not address which elements of the privatization process influenced the deployment of main lines per 100 inhabitants in the region.

2.4 Liberalization Reform?

Unfortunately, the speed of privatization of the former state-owned telecom operators often came with a price. It is worthwhile quoting Stiglitz (1998a, pp. 18-19) to illustrate what could have gone wrong. "The emphasis on privatization over the past decade has stemmed less from concern over lack of competition than from a focus on profit incentives. The idea was that if property rights could be created, the profit-maximizing behavior of the owners would eliminate waste and inefficiency. At the same time the sale of the enterprises would raise much -needed revenue. At the time privatizing quickly and comprehensively --and then fixing the problems later on-- seemed a reasonable gamble. From today's vantage point, the advocates of privatization may have overestimated the benefits of privatization and underestimated the costs, particularly the political costs of the process itself and the impediments it has posed to further reform...Even at the time many of us warned against hastily privatizing without creating the needed institutional infrastructure, including competitive markets and regulatory bodies. David Sappington and I showed in the fundamental theorem on privatization that the conditions under which privatization can achieve the public objectives of efficiency and equity are very limited and are very similar to the conditions under which competitive markets attain Pareto-efficient outcomes. If, for instance,

²² I say "*seem*" because a simple test of means difference shows that post-privatization averages are different at a 5% significance level (one tail) but failed at different significance levels.

competition is lacking, creating a private, unregulated monopoly, will likely result in even higher prices for consumers".

This critique applies to most of the country reforms. Some general observations can be made on the telecommunications market liberalization reform in the region, in *basic services*. First, Table 2.4 shows that most countries, especially the first ones that privatized, gave up easily and willingly exclusivity periods to the new telecom owners. The exclusivity period means that the (new) privately owned operators are the sole providers of basic telecommunications services, either local or long distance. In short, governments granted monopoly service rights to the new owners. The exclusivity period has varied from less than one year in the case of Brazil to 25 years for Jamaica and Barbados. Some commentators²³ on the ownership reforms have defended the strategy, saying that at the time of privatization, political and economic conditions were so fragile that they involved too much risk for the (new) private owners. Pisciotta (1997) referred to this process as privatization with phased-in competition.

Second, in the latest country reforms (Guatemala, El Salvador and Brazil) governments did not give up substantial market power to the new owners. In the case of Brazil, just six months after privatization, the government auctioned the so-called mirror licenses that allow a duopolistic competition in the main telecommunications services. Arguments for exclusivity periods were not so compelling in recent years. Brazil was in financial crisis, heavily indebted, and running dangerous fiscal deficits, yet was able to sell its telecom operators at good prices without sacrificing market structure reform. This will allow network expansion to grow faster in Brazil than it has in countries like Argentina or Mexico. This model of reform is called privatization with full competition.

Third, some governments in the region (e.g., Jamaica) are trying to renegotiate the exclusivity period conferred to the private operator. In Peru, the incumbent monopoly accepted

²³ See Ramamurti (1996a), Levy and Spiller (1996) and Petrazzini (1995)

the end of the exclusivity period, a year early in exchange for some changes in the productivity factor of the price-cap regulation. In Argentina, the government was in discussion with the two incumbents to open the market before the exclusivity period ended, but no changes occurred.

Table 2.4 Market Structure Reform			
Country	Year Starting Exclusivity	Exclusivity Period	<i>Basic</i> Telecommunications Services
Argentina	1990	7-extensive for two more years	Duopoly competition from 1999 on
Barbados	1988	25 years	Competition from 2012 on.
Belize	1988	15 years	Full competition from 2003 on
Bolivia	1995	6 years subject to meet some target.	Full competition from 2001 on
Brazil	1998	4 years in duopoly	Full competition from 2002 on
Chile	1988	-	Full competition from 1995 on
Colombia	-	-	Local opened to competition from 1994 on. Long distance (limited to three) from 1998 on
Costa Rica	-	-	Close to competition
Ecuador	-	-	Close to competition
El Salvador	-	None	Full competition from 1998 on.
Guatemala	-	None	Full competition from 1999 on.
Guyana	1990	20 years	Potentially open to competition from 2010 on.
Honduras	-	7 years when sold	From 2006 on if sold in 1999.
Jamaica	1987	25 years	2012
Mexico	1991	5-years in LD	Open to competition from 1997 on.
Nicaragua	-	4 years when sold	Not determined yet
Panama	1997	6 years	Full competition from 2003 on.
Paraguay	-	-	Close to competition
Peru	1994	5 years	Full competition from 1998 on.
Suriname	-	-	Close to competition
Trinidad & Tobago	1991	20 years	Limited Competition from 2010 on.
Uruguay	-	-	Close to competition
Venezuela	1991	9 years	Full competition from 2001 on

Source: Petrazzini (1995), Ramamurti (1996a), ITU (1998a and 1998b), Pyramid Research (1998), Harper (1997) and USDOC (1992 and 1999).

As the extensive study by Pyramid Research (1998, pp. 7) shows, the exclusivity period has given too much power and leverage to incumbents, giving them a first mover advantage in the market. For instance, it is said that the basic telecommunications service in Chile is quite competitive because there are more than twelve long-distance operators. Yet, two companies, CTC and Entel (former PTOs), dominate more than 75% of the long-distance market²⁴. Similar patterns seem to hold in Argentina, Perú, Venezuela and, in a lesser extension, México. The presence of multinational carriers in the region may make things harder for new entrants to compete and obtain greater market share.

Only Colombia followed the liberalisation without privatisation approach. In that country, local phone and long-distance services were open to full or limited competition without privatizing any PTO. Costa Rica and Uruguay may follow this model, given their reluctance to privatize their PTOs.

Lastly, as Table 2.4 shows, the early years of the next century will bring the opening of the basic service markets in most countries in the region. This has to be seen as a positive factor for competition that, without doubt, will step up network deployment and the efficiency in the telecommunications sector. However, the potential lack of well-designed rules of interconnection may create an ordeal for regulators, as the past experiences of some developed countries have shown.

In short, the liberalisation of (main) telecom markets in Latin America and the Caribbean is still a work in progress. Most governments in the region have their hands tied by the concessions contracts signed at the time of the privatization. The opening of the markets will bring other problems that will be better managed if the countries in the region have sound and

²⁴ See Moguillansky (1998). Pyramid Research (1998, p. 303) states, "There are nine operators holding local telephony services concessions, but the Compañía de Telecomunicaciones de Chile (CTC the former monopoly provider now controlled by Telefónica de España) still controls more than 90% of local lines in service."

strong regulatory frameworks for telecommunications and a good macro-institutional environment. The next section studies in more detail the development of the regulatory framework in telecommunications for 24 Latin American and Caribbean countries.

2.5 The Building of Regulatory Framework for Telecommunications

2.5.1 The Regulatory Mandate

Why regulate the telecommunications sector? Many responses stress market failure arguments. From the point of view of the positive political economy, it is said that the telecommunications sector is (was) a natural monopoly and that a single firm provides telecommunications service at lower cost. However, this gives rise to a privileged situation and dead-weight loss will appear if the market is left unregulated. Thus, regulation is justified.

A second explanation is that there may be imperfect information or asymmetric information regarding the quality of the service, that technologies used may not be easily compatible and so on. Regulation is said to improve the social outcome because regulators may supply information about provider's quality of the services or force them to provide a given minimum level of quality. Also, the regulator may set some technological standards for compatibility, improving the well-being of the society.

A third justification for regulation involves the public good and external effects. The use of the electromagnetic spectrum is controlled because, if left unregulated, people or operators will use them freely, interfering with each other's transmission and making communications impossible.

From a normative approach it is said that government should regulate because telecommunications services may be considered a necessary good. Pricing and subsidy policies are needed to achieve the goal of universal service by optimizing the social deployment of networks.

Without going into the details of the politics of regulation, it suffices to say that most of the positive arguments given above have been questioned. This has led some developed countries (New Zealand) to abolish regulatory institutions. In Australia the functions of telecom regulators have been partially absorbed by competition commissions. Paradoxically, while this kind of questioning is in fashion in developed countries, the opposite trend is on the rise in developing countries. Yet institutions like the World Bank and the Inter-American Development Bank keep urging the creation of regulatory bodies.

2.5.2 Design of Regulatory Institutions

2.5.2.1 Specific investment and opportunistic behavior

Utility sectors are said to have three distinctive characteristics. First, their technologies have important economies of scale and scope. Second, most of utilities' assets are highly specific and non-redeployable in other activities without great costs. Last, the services provided by these sectors are considered to necessary goods. Altogether, these three characteristics create problems that undercut the ability of ordinary market mechanisms to deliver first-best performance. What do these characteristics mean? The first one means that its is very likely that there will not be more than two or three providers of telecom services. Therefore, governments cannot rely on the operation of the competitive markets to prevent the abuse of market power. The second characteristic implies that a large proportion of the investment (fixed) can be considered as sunk, giving governments the incentive to behave opportunistically. And the third characteristic signals the fact that the pricing of utility services is likely to be very political. As Levy and Spiller (1994, p. 204) state, "The combination of significant investment in durable, specific assets with the high level of politicization of utilities has the following result: utilities are highly vulnerable to administrative expropriation of their vast quasi-rents."

These points partially answer the question regarding the need for an administrative agency insulated from political pressures. The remaining answer will be provided later. How does

the mechanism of expropriation work? Very simply, governments, knowing that the private investors' investment is very specific, will behave opportunistically once the investment is undertaken. In the extreme case, government can take over the operation of the firm. More likely, government may administratively expropriate value by setting prices below their long-run average incremental costs, or by imposing some specific technical conditions concerning the purchase of equipment, labor contract conditions and so on. Operators in that situation have no options. The operators will prefer staying in the market to the extent their returns from operating exceed their return from shutting down and deploying their assets elsewhere.

The most likely outcome is that operators will anticipate the opportunistic behavior by the government and will either, in the extreme case, refuse to participate in the projects or will invest sub-optimally, undertaking lower levels of specific investments. Thus, to encourage private sector participation in the project of increasing main lines per 100 inhabitants, governments in developing countries must assure private investors that they will not behave opportunistically.

2.5.2.2 Regulatory governance

Levy and Spiller (1994 and 1996a) look at regulation as a design mechanism. This design has two dimensions: the regulatory governance and the regulatory incentives. For those researchers, regulatory governance consists of all the mechanisms that a society has to constraint regulatory discretion and to resolve conflicts that arise regarding those constraints. Conversely, regulatory incentives are the mechanisms regarding pricing, subsidies and other operating policies. I consider regulatory governance as the *key element* in the creation of a regulatory framework in telecommunications. Regulatory incentives improve performance only if there is strong regulatory governance.

Regulatory governance in a country is determined basically by the institutional endowment of the nation. Institutions are the formal and informal rules present in a society. Briefly, formal rules are derived from the legislative and executive institutions, the country's

judiciary system and the bureaucracy (administrative capabilities) that make government work. Among the informal rules are customs, beliefs, ideologies, etc. Together, these formal and informal rules shape the incentives of individuals and limit or encourage opportunistic behavior.

In countries with strong regulatory governance, there are well-known check and balance procedures that limit the executive discretionary power. In those societies, explicit separation of powers between the legislative, executive and judicial organs of the state will be present. The stronger the regulatory governance, the stronger will be the constraints on executive and legislative discretion. However, as Levy and Spiller mention, strong checks and balances may also reduce flexibility, which is needed in utility sectors, more now than before, given the pace of technological developments and change, especially in the telecommunications sector.

For the telecommunications sector, the existence of a *specific* regulatory framework is important for sector development²⁵. Private investors will look at the overall regulatory governance within a country, but in developing countries, if they would like to invest in a specific utility sector, they also will look at whether there is a *specialized* regulatory authority that *credibly* safeguards the workings of that sector.

What attributes should be taken into account when creating a regulatory framework? The answer involves theoretical and practical considerations. These are documented below to provide the rationale for a regulatory index developed later in this chapter.

2.5.3 Approaches to the Regulatory Framework in Telecommunications

For Latin American governments, a way to attract investments in telecommunications is to have a sound regulatory framework that credibly limits government discretion. Some insights regarding this framework can be obtained from practitioners in the field. In addition, I will try to

²⁵ The level of specificity of the regulatory body may however reduce the degree of flexibility that the regulatory body may need. Technological development and what is called technological convergence will impact the tasks of regulators in the future. Unfortunately, our main focus is in basic telecommunications services. In the future the regulatory framework index must include all kind of telecommunications services.

link those criteria to recent theoretical work on organization design and internal organization of governments.

Practitioners have long been speaking out about the need for having regulatory bodies²⁶ for utility sectors²⁷ and have stipulated the attributes that such regulatory bodies should have. In this section, I will use their work to construct a regulatory framework index for telecommunications. I also provide short explanations and a theoretical background.

The regulatory framework can be thought of as two parts; structures and process. Structures include the distribution of regulatory tasks among different levels of the government, the objectives and empowerment given to each of these agencies and the procedures for choosing the regulatory agents. Process includes the mechanisms of communication governing the potential overlapping functions among the different levels of the government, the ways to overcome conflict and the length and span of control of different regulatory bodies.

In the initial design of the regulatory body, structure should matter more than process. The main features a regulatory body according to Stern and Holder (1999)²⁸ are: autonomy, accountability, clarity and transparency. The first three aspects relate to the structure of the regulatory framework, the last one to the process.

2.5.3.1 Autonomy/independence

Concerning the matter of the degree of independence/autonomy, ITU (1993) notes three distinct dimensions that may be temporally linked or not.

²⁶ Regulatory body is defined as whatever individual, board or administrative agency that makes decisions on regulatory matters.

²⁷ See ITU (1993), Tyler and Bednarczyk (1993), Miller (1994), Schultz (1994), Sinha (1995), Tenenbaum (1996), Petrazzini (1997), Armstrong and Vickers (1996), Cave (1997) and Melody (1997b).

²⁸ See Stern (1994) and Stern and Holder (1999).

- 1) independence from the operational activities. That is, the regulatory body must be a separate entity from the agency or unit that provides the telecommunications services.
- 2) independence from interested parties, such as industrial customers.
- 3) degree of independence from the executive branch of the government that sets broad policy for the sector.

However, the organizational structure for telecom regulation takes different forms depending on the overall regulatory governance and polity present in the country. In general, the world experience can be reduced to three cases of *interest* for Latin American telecommunications:

- 1) A regulatory authority within the government ministry responsible for telecommunications, as is Chile, France, Germany and some Asian countries.
- 2) A fully autonomous regulatory body empowered to make decisions not subject to review by ministers, as in the United States.
- 3) A semi-autonomous regulatory agency whose decisions are subject to review by ministers in some cases but which is generally autonomous.

Some Latin American countries began the first regulatory separation in the 1980s: Argentina, Brazil, Chile and Colombia, for instance. This first step toward the creation of the regulatory framework is the *first* element for constructing the regulatory framework index. In most cases in Latin America, the regulatory tasks were given to a unit within the Ministry of Post and Telecommunications and were subject to daily political interference and executive discretion. Still, it was a beginning and significant because regulation by an agency associated with the operating telecom activities cannot be impartial. Also, separation between the operating and regulating activities may create a separate body of bureaucracy more specialized in regulatory

matters²⁹. This bureaucracy could have been more willing to back up the privatization process or promote further liberalization, given its understanding of the sector and the fact that status and salary are no longer linked to operations. I use "may" cautiously because there were cases in which the opposite could have happened.

The degree of independence³⁰ is without any doubt an arguable aspect. What should we understand by independence? As a benchmark, we can think of the Federal Communications Commissions (FCC). It is a fully autonomous regulatory body empowered to make decisions not subject to review by any secretary or the executive branch, although the courts may challenge its decisions. However, one could argue that it would be impossible for any Latin American country to have such a regulatory body. Melody (1997a, p. 198, italics added) states that "an FCC-type independent regulatory agency is a unique product of the US constitutional system, with its elaborate division of powers among executive, legislative and judicial branches of governments. Some analysts view the public utility regulatory agencies in the US, including the FCC, as quasi-legislative and quasi-judicial organizations. They have broad mandates and significant freedom both to interpret and to enforce their mandates. Few countries have governmental structures that have permitted such a degree of independence, at least so far. *Some even view such degree of independence as an abdication of the political responsibility of elected officials.*"

No matter what level of independence exists in the letter of law, we can say that in Latin America, regulatory bodies for telecommunications can be considered as semi-autonomous in the sense that some of their decisions may be subject to review, either by members of the executive

²⁹ For instance, Saunders et al. (1994, p. 66) state that "Experience shows, however, that adequate autonomy can sometimes also be attained even when telecommunications entities are closely tied to government, such as being part of a government department, provided appropriate organizational and financial measures are implemented."

³⁰ For details regarding factors that may favor or discourage the three types of independence, see ITU (1993).

branch or by the legislative power³¹. To take one of the features of Levy and Spiller's (1994) analysis, we should expect different degrees of autonomy within the regulatory framework in different Latin American countries, according to their institutional endowments. In general, the degree of independence/autonomy will vary.

Table 2.5 Type of Telecom Regulatory Agency

Country	Name of Agency	Year of*/Creation	Created by
Argentina	Comisi . n Nacional de (Tele)Comunicaciones	1991 1996 1997	Executive Decree 1185/90; Decree 80/97;
Barbados	Public Utility Board	1978	Public Utility Act
Belize	Office of Telecommunications	1991	NA
Bolivia	Superintendencia de Telecomunicaciones	1994	Law 1600 of 1994
Brazil	AgAncia Nacional de TelecomunicaHtes	1997	Law 9.472/97 and Decree 2338/97
Chile	SubsecretarPa de Comunicaciones	1977-	Decree-Law 1762/77
Colombia	Comisi . n de Regulacion de Comunicaciones-	1992 1994-	Decree 2122/92 and Law 142/94
Costa Rica	Autoridad Reguladora de Servicios Pblicos	1996	Law 7593/96
Ecuador	Comisi . n Nacional de Telecomunicaciones SecretarPa Nacional de Telecomunicaciones Superintendencia de Telecomunicaciones	1992 1995	Special Law of Telecommunications - Reformation Law to the Law of Telecommunications
El Salvador	Superintendencia General de Telecomunicaciones	1996	Decree 142/97 or Telecommunications Law
Guatemala	Superintendencia de Telecomunicaciones	1996	Decree 94/97
Guyana	Public Utility Commission	1990	Public Utility Commission Act
Honduras	Comisi . n Nacional de Telecomunicaciones	1995	Decree 185/95
Jamaica	Office of Utilities Regulation	1995	Office of Utility Regulation Act
Mexico	Comisi . n Federal de Telecomunicaciones	1996	Presidential Decree

³¹ I use semi-independent in a broad sense that may be highly controversial. For instance, Tenenbaum (1996, p. 32) states that "What people really mean by an independent regulator entity is a government entity that does not have to get the approval of the prime minister or other high-level political authorities to raise (or lower) tariffs." This definition may be too restrictive.

Table 2.5--continued

Nicaragua	Instituto Nicaraguense de Telecomunicaciones y Correos	1995	Law 200/95
Panama	Ente Regulador de los Servicios PÙblicos	1997	Executive Decree 73/97
Paraguay	Comisi : n Nacional de Telecomunicaciones	1995	Law 642/95
Peru	Organismo Supervisor de la Inversi : n Privada en Telecomunicaciones	1991 1993	Supreme Decree 013/93
Dominican Republic	Instituto Dominicano de Telecomunicaciones	1998	Law 153/98
Suriname	Telesur	1980	Decree C-38
Trinidad & Tobago	Public Utility Commission	N.A.	N.A.
Uruguay	Administrati : n Nacional de Telecomunicaciones	1974	Decree-Law 14.235/74
Venezuela	Comisi : n Nacional de Telecomunicaciones	1991	Presidential Decree 1826/91

*/ First year shows the year of creation. The remaining the modifications done to change or to re-structure the regulatory body.

Source: ITU 1998a and 1998b and Legislation from the countries.

As Table 2.5 shows the creation of semi-autonomous regulatory bodies in the area is recent and widespread. Argentina, Colombia and Venezuela were the leaders in this process. Some countries decided to keep their regulatory body ascribed to a particular minister, as in Chile, Uruguay, Barbados and Belize, while countries like Suriname have not taken even the first step toward independence; i.e., separating the regulatory authority from the operational activities. Paradoxically, Suriname has very high level of main lines per 100 inhabitants³². Some countries have chosen to have a telecommunications regulatory agency (Brazil, Colombia, Ecuador, PerÙ, Paraguay and Venezuela) while others decided to have a non-specialized regulatory body (Costa Rica, Jamaica, Nicaragua and Panama). The legislation backing up the level of the regulatory authority is varied. Some countries have opted for specific laws, while others have enacted decrees.

³² Unfortunately, very little information is available about this country to explain its very successful network expansion.

2.5.3.2 Accountability

On the basis of New Regulatory Economics, regulation can be viewed as a game between various players with different degrees of knowledge and information for making choices that affect the efficiency and fairness of resource allocation. According to Stern and Holder (1999, p. 38), the regulatory framework "should 1) ensure the efficient provision of services to consumers at the minimum necessary prices; and 2) support private investment by continuing to allow companies the reasonable expectation of a normal real rate of return." But there are other players besides consumers and operators in the sector. In terms of the organizational design approach, the legislative or the executive power is the political principal. In reality, despite the fact that agencies are supposed to care for consumers' welfare, regulators are not accountable directly to them, but instead to either the legislative or the executive power.

Because regulators' decisions may affect operators' incentives and outcomes, their decisions may be subject to challenge via some appeals mechanism. Accountability will be to the executive power in most Latin American countries. In some countries like Colombia, a complementary authority was created to safeguard consumers' interest. But accountability also means that there should be a right of appeal on questions of regulatory process, although not on substantive policy issues. The existence of a mechanism to resolve disputes between the regulatory body and operators or conflicts between operators is called due process. Finally, regulatory behavior (not decisions) needs to be accountable. Regulators can have incentives for wrongdoing, and there should be clear mechanisms that limit or curb potential misbehavior.

2.5.3.3 Clarity of roles and objectives

In Latin America, a politically appointed minister of post and telecommunications usually sets telecommunications policy. Recognizing that presidentialism³³ dominates the politics of most countries in the sample is important for analysis because the president can bargain with rival

³³ See Mainwaring and Shugart (1997).

political parties when making appointments³⁴. to align the opposition with the presidential agenda. Because any minister is likely to have a political agenda as well, along with some power delegated by the president or agreed to in the bargaining process for appointment, the minister is likely to come into conflict with any semi-autonomous regulatory body with legal mandates and responsibilities.

In most Latin American countries, some of the regulatory roles are shared between the regulatory body and other government agencies, particularly with the Ministry of telecommunications. This may be viewed as a bad design of regulatory governance because of the potential overlapping of tasks and the increased costs of having separate agencies. However, this may have been the best decision given the relative market power and influence of the telecom players. The principal-agency problem present in the regulatory game shows that "regulators face informational asymmetries in their relationship with the firm they regulate. The regulators do not know, for instance, the exact technologies of the operators and the elasticity of their demands", (Estache and Martimort [1999], p. 2). This asymmetric information between the ignorant regulators and the operators gives rise to the fact that regulators cannot extract informational rents from the firm. In sum, asymmetric information implicitly increases the cost of capture. The separation of responsibilities (roles) between different regulatory bodies acts as a mechanism to prevent (or reduce) regulatory capture by the interest groups and to improve commitment (see Tirole [1994] and Olsen and Torsvick [1995]). Furthermore, theoretical research suggests that

³⁴ "Presidentialism" refers to a political system dominated by the presidency regardless of the majority party in the congress; see Mainwaring and Shugart (1997). Oxborn and Ducatzenzeiler (1998a, p.237) refer to "hyper-presidentialism" and argue it "reflects the extreme concentration of political authority in the office of the president. The person who occupies that office becomes a key political actor in mediating diverse conflicts within society but as a result is not by any means an autonomous actor. Rather, the president's political power and how he (or she) exercises it reflect the nature of the social forces and other actors who provide the president's basis of political support." Five countries in the sample (Barbados, Belize, Guyana, Jamaica and Trinidad and Tobago) do not have a presidential system, but their parliamentary systems may be plagued with similar political compromises.

when commitment capacity by the government to the regulatory contract is limited or when renegotiations is a likely outcome of the reform process, separation of powers between different regulatory agencies is a better design.

From the point of view of practitioners, (Stern and Holder 1999), some questions about clarity of roles are: 1) does the legislation establish unambiguously which entity is responsible for what regulatory functions? 2) are there any functions carried out jointly, or any that are ambiguous, between the regulator and those of the relevant minister(s)? and 3) is it clear where the regulator has an advisory role rather than a decision-making role?

Regarding tasks the regulator performs, the following broad fundamental missions can be considered. First, regulation may promote social goals concerning universal service. In Latin America the coverage of households with telecom services is very low. Some schemes have been created to expand services to low-income people, and regulators can affect this process. Second, regulators and an ombudsman often protect users' interest and implement mechanisms to consider user complaints. Third, industry market structure is an issue. Regulators generally have some responsibility toward increasing competition in the sector and reducing an incumbent's market power. Today, more and more sector analysts state that technological advances have made obsolete the natural monopoly argument. So the telecommunications sector may no longer be a monopoly but an oligopolistic market.

Clarity of roles is also important in the supervision of the dominant telecom operator. This has been an important reason for creation of a regulatory body. All Latin American countries have had state telecom operators that were monopolies. After privatization and with the exclusivity period granted to them, these became private monopolies. A regulatory body is needed to curb the monopolist incentive to exercise market power, impose high prices and reduce

the consumers' welfare³⁵. But as noted above, the concession contracts signed with new owners usually include many targets in terms of coverage, quality, price schemes and so on. Without any doubt, this is one of the most important missions the regulatory body can have. In this respect, the regulatory body should have the power to set tariffs for those markets where competition does not exist.

A fifth mission is assuring technical preconditions for effective operations. If competition will be allowed, this becomes a crucial mission. There must be clarity regarding numbering plans, number portability, technical standards or rules concerning interconnection. A sixth area of concern involves managing common resources effectively. This includes the allocation of the electro-magnetic spectrum, public rights of way and the design of clear mechanisms of allocating those rights. At issue is who is responsible for policing the telecommunications sector, which turns out to be a very important matter. Regulation will be credible if it bites. Thus, regulatory body may have to issue legally binding orders when it makes a decision (resolution) or when it concludes that an operator is violating a regulatory norm. The recourses available to the regulatory authority if legally binding decisions are persistently violated are also encompassed.

2.5.3.4 Transparency

Practitioners (see Stern and Holder [1999], Tyler and Bednarczyk [1993], ITU [1993] and Tenenbaum [1996]) argue that "regulators in developing countries are always under suspicion because often their first big task is to lift prices up to costs" (Tenenbaum, 1996, p. 34). That suspicion is raised because of the potential collusion of regulators with the regulated firms. Transparency is firmly related to processes of the regulatory design. Three main aspects then should be considered. First, a clear specification of the rules of the game; second, a sound

³⁵ As Pisciotta (1997, pp. 339-40) states "most countries engaged in liberalisation commonly experience a need for increased regulation. Licencing, enforcement of license obligations, rate rebalancing and review, interconnection rules, accounting standards an frequency allocation all normally require a significant degree of regulatory oversight -at least until fair competitive market rules are firmly established."

opening up of the process to take or implement decisions; and lastly, a mechanism to explain or publicize the decisions. Notice that the better the transparency of the regulatory process, the more accountability is imposed on the regulatory authority and the less may be the likelihood of regulatory capture.

2.5.4 Legal Scope of the Regulatory Framework

An important feature of regulatory governance made explicit by Levy and Spiller (1994 and 1996a) is the scope of the legislation that created the regulatory body in each Latin American country and the strength of the judiciary. Many analysts emphasize this aspect because credibility is lacking in many developing countries.

Bolivia is cited by Borner et al. (1995, p.19) "On 11 January 1990 President Jaime Paz Zamora issued Supreme Decree No 2247, which contained a series of measures aimed at encouraging private investment by domestic and foreign entrepreneurs. Chapter IV was dedicated to a 'regime de garantPa a las inversiones', guaranteeing that foreign and domestic investors would enjoy equal rights (Article 31) and be subject to the same fiscal duties (Article 32), that foreign and domestic property would be respected (Article 33), that there would be no restriction on capital transfers (Article 34) and that the convertibility of the boliviano would be maintained (Article 35)...

From the point of view of efficiency the decree introduced the right policies. The question is whether these policies are credible. In this respect, a presidential decree promising to respect property rights seems almost a paradox. Obviously, under the political system in Bolivia the president has enough discretionary power to write a decree that guarantees the safety of investments, but in such a system this guarantee depends upon the benevolence of the president and there is no way of knowing whether he or a future president will change his mind and write a new decree that rescinds all former promises. *The fact that there is an executive who can implement rights simply by issuing decrees shows that there are no mechanisms for guaranteeing*

property rights other than the will of the executive. There is hardly anything worse for investor confidence than discretionary power with no institutional safeguards to prevent arbitrary changes in policy. *Credibility cannot be established by decree.*” (italics added). This point is applicable to all Latin American countries and the political system governing the region. Following Levy and Spiller, I agree that a regulatory framework introduced through presidential decrees may be prone to great instability and hence will not be credible.

Despite the presidentialism present in Latin American, regulatory frameworks created through laws enacted by the elected legislative body are stronger safeguards of the stability of the regulatory framework than executive decrees. Presidential decrees or simple decrees will fail to convey credible signals to private investors.

2.5.5 Contracts and the Regulatory Framework

The literature on contracting theory tells us that contracts are by nature incomplete because of economic agents' limited (bounded in terms of Williamson) rationality. Because agents' capabilities to foresee all the possible contingencies that may arise in the future are limited, contracts are prone to renegotiations and to opportunistic behavior by parties. In the case of public utilities like telecommunications, the existence of multiple principals and the lack of (full) commitment aggravate the problem faced by stakeholders.

However, long-term contracts have been common in the water, sewerage, energy and telecommunications industry. Levy and Spiller (1996a) argue that in some cases long-term contracts are the only way some government can credibly commit not to behave opportunistically. They argue that regulation by contract may be the only way to mitigate lack of government commitment. In their study of Jamaican telecommunications history, they show that the highly discretionary power exerted by the executive power (the prime minister and the relevant minister) spurred government opportunism that, in turn, brought a steady underinvestment in the telecommunications sector by the foreign provider operator. They also studied the Jamaican

judiciary system, which has always been very independent and strong, with last appeals are taken to the Privy Council in the United Kingdom. Given a history of opportunism and the strength of the judiciary system in Jamaica, the best design of the regulatory framework was regulation by contract.

Concession and license contracts have been common in Latin American ownership reforms. Countries like Argentina, Venezuela, Jamaica, Trinidad and Tobago and Mexico signed such contracts, which stipulate the obligations and rights of the operators and the pricing mechanism. But any contract is incomplete and subject to renegotiations, as the recent Asian experience shows.³⁶ A main feature of the Levy and Spiller analysis is the idea that the design of the regulatory framework should be compatible with the institutional structure of the country's government and the legal and administrative traditions of the country. The signing of a long-term contract for telecommunications in Jamaica was the optimal choice.

This suggests that regulatory governance can include two different uses of contracts. "The first one is that long-term contracts are intended to be a substitute for a separate regulatory institution. The second one is long-term contracts are a complement to a separate regulatory institutions, providing an agreed basis for regulation" (Stern and Holder [1999], p. 39). The first use given by Levy and Spiller was valid in the context of a single monopoly provider, as was the case for Telecommunications in Jamaica in 1987. That contract is currently subject to hard renegotiations between the government of Jamaica and C&W of Jamaica. The contract has limited the ability of government to expand competition in the sector and to reduce the too high profit level of the company. Furthermore, at least in telecommunications, the technological advances seem to be unlimited. Concession contracts are extremely inflexible ways of creating a regulatory framework and of binding future governments. In the end, long-term contract may create wrong beliefs about private investment among consumers and the public and may lead to

³⁶ For some examples of where and why renegotiations occurred, see Stern and Holder (1999).

undesirable political opportunism. I advocate the second use, having³⁷ concession contracts be a *complement* to the separate regulatory framework. Contracts may set some of the major rights and obligation guidelines, but they should leave enough flexibility for the regulatory authority to make necessary changes in a rapidly changing environment. As some Latin American countries (Ecuador [1978], Chile [1989], Argentina [1994], Brazil [1989], Colombia [1991], Paraguay [1992], Perù [1993], Bolivia [1993], Guatemala [1994] and Nicaragua [1994]) enacted a new constitution or amended the old one, a key element of the reform has been an effort to strengthen and ensure greater independence of the judiciary system.³⁸ We should expect that a stronger judiciary system be a mechanism for constraining executive or legislative discretion; however, one should not underestimate the difficulties of implementing laws and norms in Latin American countries.³⁹

2.6 The Regulatory Framework Index

In Latin American there has been a movement toward the strengthening or creation of the institutions since the region has become more integrated into international markets. From the last five years in the 1980s to the first five years of the 1990s, the sum of exports and imports as a proportion of GDP increased 11 percentage points. Structural reforms implemented in the last decade have also affected institutions. Lower state participation has increased the needs of private sectors for sound and fair institutions if firms are to expand investments. Lastly, changes in urbanization process have urged governments to create an adequate institutional environment to allow more citizen participation in economic policy development. As noted constitutions have

³⁷ See also Barbour (1997).

³⁸ For more details, see Gargarella (1997).

³⁹ Oxhorn and Ducatenzeiler (1998b, p. 19) state that "the new democracies in the region are characterized by low political-party institutionalization, intermittent stalemates between the executive and legislative branches, and the persistence of the tendency to rule by decree (decretismo) as a way to overcome a permanent crisis of governability." This is a more cautious picture of Latin American democratization process and perils. See also Weffort (1998).

been enacted or amended. Regulatory bodies have been created for banking activities, capital markets have matured, changes in the judiciary have been implemented, improvements in the educational sector and reforms in the public administration were carried out. Although the success of these new institutions has been mixed, it shows the care and concern that most of the governments have shown toward institutional building⁴⁰.

Institutional changes in the telecommunications sector have been shown in the previous sections. The question is how to create an index of the regulatory framework for the telecommunications sector for the Latin American countries? To my knowledge, Guti rrez and Berg (1999) made the first attempt to construct such an index. The index was based on a paper by Galal and Nauriyal (1995). Following the theoretical insights of the incentive literature, Galal and Nauriyal looked at telecom regulation in seven developing economies. Their analysis stressed the importance of factors like (1) the level of autonomy/neutrality of the regulatory agency, (2) agency enforcement power and (3) the existence of mechanisms of conflict resolution. Guti rrez and Berg (1999) constructed a dichotomous index, giving a score of one to a regulatory agency with at least two of the three attributes and zero otherwise. They did so by reviewing the existing literature on the subject. Although the index proved useful in a preliminary econometric exercise, it has some shortcomings. The first is that it is based on secondary sources and involves a high degree of subjectivity, not only by the authors of the papers but also by the interpretation of the index's builders. The second is that once the dichotomous index reached the upper bound (one), the reader might think that a country had achieved a complete regulatory development in the telecommunications sector.

The later availability of work by ITU (1993) and Tenenbaum (1996) allowed us to re-think the construction of the index. And more recent work by Stern and Holder (1999) set some

⁴⁰ For more about this topic, see Burki and Perri (1998), Birdsall et al. (1998) and Graham and Naim (1998).

broad criteria analyzed in full in the previous section. The four criteria exposed above were: autonomy, accountability, transparency and clarity of roles.⁴¹ Again we faced the problem of how to measure aspects like autonomy or accountability and how to reduce the level of subjectivity. The next problem was how to make those concepts operational in an index.

To solve this, we adopted the view of practitioners like the ITU (1993) and Tenenbaum (1996). Tenenbaum (1996, p. 36) proposes the following features among others, to address the autonomy question: "a) substantially independent funding of the regulatory body; b) fixed and staggered terms for commissioners; c) limits on the government's ability to remove (freely) commissioners before the end of their terms; d) restrictions on the government's ability to delay or overrule commission decisions." To this list, we could add another one (Estache and Martimort, [1999]): the regulatory body should have complete freedom in recruiting its own specialized staff. This will require an exemption from the civil service salary and recruitment rules to be able to get highly trained personnel⁴².

With regard to the accountability dimensions, ITU (1993) stresses the importance of having a right of appeal on questions of regulatory process, although not on substantive policy issues. We think of a due process or existence of a mechanism to resolve disputes between the regulatory body and operators. The clarity of roles dimension might include several factors, including the right of the regulator to set a tariff for basic services and whether the regulatory body may impose fines or punishments.

⁴¹ Stern and Holder (1999) additionally include predictability and participation. We drop the last because it is closely related to transparency and accountability and the first because it is, in our opinion, more prone to subjectivity.

⁴² For instance, Petrazzini (1997, p. 365) says that "the process of building regulatory capabilities in developing countries is proving to be one of the most difficult and elusive tasks of the reform. Acquiring the necessary funds, hiring a diversified and highly professional staff, buffering...can be a slow and painstaking process."

In addition, since we posit the building of the regulatory framework in telecommunications from the beginning of the 1980s, we introduce as a first element a separation of operational and regulatory activities in two different entities. This separation matters whether the regulatory tasks were delegated to a government unit or agency within the related ministry.

Lastly, we incorporate the legal framework that created the regulatory body. As stated by Levy and Spiller, there is a rank of alternatives that may be related to legal norms. For instance, laws voted by the whole congress give a greater stability to the regulatory framework than presidential decrees. Presidential decrees are, in turn, more accountable than decrees issued by the related minister. We reduced the problem to just laws and decrees.

Once the main criteria were identified and linked to concept on the topic from the literature, we proceeded to operationalize them into the index. The first step consisted of reviewing the literature about telecommunications reform in Latin American, including journal articles, books, press releases, Internet websites and, more importantly, the national legislation⁴³. An informal survey of regulators and industry managers was also considered. After the study of all this material, I extracted the relevant information to match all of the above criteria. Unfortunately, it was not possible to collect reliable information for all the criteria for most of the 24 Latin American countries⁴⁴. I gave the most weight to the information extracted from the legislation (laws, decrees, resolutions, etc.). In cases of some doubt about the existence of the attribute, I assigned the lower value.

In Table 2.6 below, I illustrate the telecommunications regulatory framework for 1997. First, the three dimensions suggested by Stern and Holder are shown. They are operationalized

⁴³ A partial list of the legislation used is shown in Appendix A.2.

⁴⁴ The countries with reliable information were: Argentina, Barbados, Belize, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Guyana, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Perù, República Dominicana, Suriname, Trinidad and Tobago, Uruguay and Venezuela.

using the ITU/Tenenbaum criteria. Right after them, we get the average of these three factors. The next column is the ITU separation of regulatory and operating activities. The next to last column relays the Levy and Spiller's legal rank. The last column offers some estimate for the 1997 telecommunications regulatory framework index.

Table 2.6 Regulatory Framework Index -RFI- 1997

Country	Autonomy (1)		Clarity of Roles (2)		Accountability (3)	Average (1+2+3)/ n	ITU ©/ τ/	Legal Frame τ/	RFI
	Funding*/	Removal*/	Prices*/	Fines*/	Appeal*/				
ARG	1	0	1	1	1	0.8	1	0.5	.81
BAR	0	0	1	1	0	0.4	1	0.5	.48
BEL	0	0	1	1	1	0.6	1	1	.72
BOL	1	1	1	1	1	1.0	1	1	1.0
BRA	1	1	1	1	1	1.0	1	1	1.0
CHI	0	0	1	1	1	0.6	1	1	.60
COL	1	1	1	1	1	1.0	1	1	1.0
COS	1	1	1	1	1	1.0	1	1	1.0
ECU	1	1	1	1	0	0.8	1	1	.86
ESAL	1	0	0	0	1	0.4	1	1	.58
GUA	1	0	1	1	1	0.8	1	1	.86
GUY	0	1	1	1	1	0.8	1	1	.86
HON	1	1	1	1	1	1.0	1	1	1.0
JAM	0	0	1	1	1	0.6	1	1	.72
MEX	0	1	1	1	1	0.8	1	0.5	.81
NIC	0	1	1	1	1	0.8	1	1	.86
PAN	1	0	1	1	1	0.8	1	1	.86
PAR	0	0	1	1	1	0.6	1	1	.72
PER	1	1	1	1	1	1.0	1	1	1.0
RDOM	0	0	1	1	1	0.6	1	1	.72
SUR	0	0	1	0	0	0.2	0	0.5	.14
TRIT	1	0	1	1	1	0.8	1	1	.86
URU	1	0	1	1	1	0.8	1	0.5	.76
VEN	0	0	1	1	1	0.6	1	0.5	.67
The countries in alphabetical order are: Argentina, Barbados, Belize, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Guyana, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Perú, República Dominicana, Suriname, Trinidad and Tobago, Uruguay and Venezuela.									
The weights assigned to each dimension are: (i) 70% to the average of autonomy, clarity and accountability, (ii) 20% to the separation of regulatory activities and (iii) 10% to the legal framework.									
*/ It refers to ITU/Tenenbaum criteria; ©/ It refers to ITU 1993 criterion; τ/ It refers to Levy and Spiller criterion									

The further operationalization was to have a dichotomous procedure for every dimension.

To illustrate, if the country had a regulatory body with an independent source of financing, I gave

it a value of one (and zero otherwise). I then averaged the ITU/Tenenbaum criteria. In this way, the five attributes of the ITU/Tenenbaum can reach a maximum of one and a minimum of zero. For the ITU criterion of separation between the regulatory and operating activities, I assigned a one if there was such a separation and zero otherwise. And for Levy and Spiller's legal ranking, I gave a value of one for a law and 0.5 for any other kind of legislation backing up the regulatory body.

The last operationalization was to give some weights to each of the three main overall dimensions. Here, there was room for subjectivity. I assigned the following values. The three dimensions of autonomy, accountability and roles were given a 70% weight. This means that each factor included for these dimensions has a 14% of weight that seems reasonable. In the future when more factors (and dimensions) are added their weights should increase accordingly. The ITU separation criteria a 20% and the remaining 10% went to Levy and Spiller's legal rank.

The regulatory framework index has its limitations. First, the index tries to measure regulatory governance and *not* regulatory incentives structure. In the United States, researchers have studied the relationship between incentive regulation and telco performance⁴⁵ for several years, shedding light on the ranking of price regulation, price-cap, earning-share and rate of return regulation. They assume the regulatory framework as a given, and it is not subject to study. After all, the FCC and the state regulatory commissions have more than 60 years of experience. My index, then, is an attempt to set the regulatory framework and *its development* in telecommunications for selected Latin American countries.

Second, my index tries to capture objective aspects that a sound regulatory framework should have. Thus it reflects the letter of law and is silent about how the law as applied. When I assign a one to those countries with legislation that says that the regulators cannot be freely

⁴⁵ See the survey by Kridel et al. (1996) and Berg and Foreman (1996).

removed, I am assuming that this is accurate. However, day-to-day politics can deviate from legal theory. A recent case in Bolivia is illustrative.

Bolivia's regulatory body has its own budget, and its members are selected by two-thirds of the congress. It has authority to enforce relevant legislation and set tariffs. Its legal status was conferred under congressional law. It appears an ideal model, but the following report from Pyramid Research (1998, p. 145) reveals shortcomings. "Following controversy over the activities of the first administration at the helm of the Superintendent regarding the awarding of concessions that violated ENTEL's monopoly, the Bolivian Congress voted in a new telecom regulatory administration in October 1997 for a six-year term that will end in 2003. The fact that the Bolivian Congress was able to remove the Superintendent because of a decision that threatened ENTEL's market share does not reflect positively on the autonomy and transparency of the regulatory body. This signifies that the Congress's decision had more weight than the law." I did not attempt to correct for such weakness by including the beliefs of practitioners or experts about the performance of a regulatory body and then weight it accordingly over time (as in, say, the various rating systems for U.S. state regulatory agencies). The actual index would reflect only the letter of the legislation and the day-to-day (year-to-year) evolution of the regulatory tasks by the regulatory authority.

Third, I was not able to include more factors regarding autonomy, transparency, accountability and clarity of roles. With more factors, the value of the index for most of the countries would go down, but it would be a more comprehensive measure of changes in a country's regulatory framework standing. This work realistically can be done, and I am currently working on improvement and fine-tuning of the index.

The existing index involves mistakes of interpretation. This is a second-generation effort to construct a useful index and the availability of better information will allow me to develop a

better index in the future. The index has low correlation with the economic, demographic and institutional variables presented in Table 2.1.

Table 2.7 presents some averages of the regulatory framework for the 24 Latin American and Caribbean countries for different periods of time. Countries like Chile, the Dominican Republic and Trinidad and Tobago started well ahead of the rest, and their progress in strengthening the regulatory framework was small. The case of Chile catches our attention because it was one of the first countries that enacted a modern telecommunications law and one of the firsts to privatize. It has enjoyed a very stable regulatory environment, its telecommunications sector is very competitive and there exists a long tradition of sound judiciary and so on. However, Chile does not have an independent regulatory body, measured by factors a) and b) of the ITU/Tenenbaum criteria. Except for the 1981-82 years, the index has been kept constant for this country. The Dominican Republic is also interesting given the long existence of a private monopoly. Dominican Republic telecommunications reform has been more oriented toward opening the market to competition and recently toward developing a more independent regulatory authority. This is an example of a country where, despite not having an autonomous regulatory body, the government agency responsible for regulating the sector was empowered to set tariffs and fine operators. It had some of the ITU/Tenenbaum factors.

Some countries have had a similar evolution in the regulatory framework. The Central American countries (El Salvador, Guatemala, Honduras, Nicaragua and Panama) present a similar pattern in the process of developing the regulatory framework.

Bolivia, Brazil, Colombia and Perú have reached the upper bound of the regulatory framework (Table 2.6), this does not mean that the regulatory framework is done. As I mentioned before, it just means that those countries have apparently progressed in the right direction in terms of institutional factors comprising in this second-generation index.

In general, an effort by almost all countries in the region to develop the regulatory framework is clear, whether or not they have privatized their telecom operator. However, more has to be done. The index is subject to a lot of improvement but it is another step forward in understanding the regulatory framework in the Latin American telecommunications sector.

Table 2.7 The Regulatory Framework Index for Telecommunications 1980-97		
Country	80-89	91-97
Argentina	0.34	0.72
Barbados	0.48	0.48
Belize	0.36	0.69
Bolivia	0.34	0.50
Brazil	0.34	0.53
Chile	0.70	0.72
Colombia	0.34	0.67
Costa Rica	0.14	0.40
Ecuador	0.14	0.63
El Salvador	0.14	0.25
Guatemala	0.34	0.44
Guyana	0.28	0.80
Honduras	0.14	0.36
Jamaica	0.48	0.66
Mexico	0.34	0.49
Nicaragua	0.14	0.34
Panama	0.14	0.24
Paraguay	0.14	0.36
Peru	0.34	0.67
Republica Dominicana	0.62	0.63
Suriname	0.14	0.14
Trinidad and Tobago	0.64	0.85
Uruguay	0.24	0.37
Venezuela	0.34	0.61

2.6 Conclusions

In this chapter I described how the telecommunications reforms have developed across Latin American and Caribbean countries and how privatization reform has been pushed like no other regions in the world. After the privatization of British Telecom in the United Kingdom (the first privatized telecom operator in the western capitalist economies), Latin American countries followed suit. Chile's initiatives served as an important model, but the way privatization took place was different across countries. This point deserves to be further studied and analyzed.

The liberalization of the main telecom markets has, however, been slow. Unfortunately, at the time of privatization, governments across the region gave monopoly power to the new owners, reducing the beneficial impact of the ownership reform. For some countries, the exclusivity periods are about to end, and open or partial competition will be possible. A by-product of the concession of exclusivity period has been the entrenchment of the incumbents and the appearance of anti-competitive behaviors.

Lastly, I presented a second attempt at constructing an index of the regulatory framework for the telecommunications sector (basic services). The index is based on some of the main factors recommended by policy analysts and practitioners. The broad categories are: autonomy, accountability, transparency and clarity of roles. To operationalize an index, some factors related to these categories were analyzed, such as independence of funding of the regulatory body, constraints on the executive to freely remove the regulators, the capability of the regulatory body to set tariffs and enforce the norms. Also, consideration was given to the legal status of the norms that created the regulatory body (and telecom rules). The outcome has been a conscious effort in most countries to build (legally) the regulatory framework. A major shortcoming of the index is that it reflects the letter of the legislation. Events and politics may mean that the law can be circumvented. The regulatory framework index needs to be extended to incorporate such factors.

CHAPTER 3
TELECOMMUNICATIONS REFORM-- THE IMPORTANCE OF THE REGULATORY
FRAMEWORK INDEX: A PANEL DATA ANALYSIS

3.1 Introduction

In the last two decades the telecommunications sector has experienced tremendous transformations. Technological developments that have emerged reduce or eliminate barriers to entry and economies of scale. Fiber-optic cable¹, wireless telephony and advances in digital electronics have made obsolete the concept of natural monopoly in telecommunications. The divestiture of AT&T and the privatization of British Telecom in the U.K. spurred new investments in the telecommunications sector that in turn accelerated the development and introduction of new technologies. Additionally, some countries started using new approaches to regulation that have become very popular (like price-cap in the U.K. and the United States, where operators are allowed to increase their prices by the retail price-index minus a correction for productivity). The deployment of such new technological and policy developments in developing countries, especially in Latin America and the Caribbean, was slow during the 1980s and early 1990s.

Although telecommunications development in Latin America between the 1950s and 1970s might be characterized as good, it began slowing down in the early 1980s in most countries in the region. The model of telecommunications development in the region followed the general economic pattern. The state was meant to be the driving force behind the evolution of the sector. Not surprisingly, from the 24 countries under study, only in the Dominican Republic was the

¹ As Melody (1997b, p. 111) points out, "Improved cable technology, and in particular the introduction of optical fibres has reduced costs of cable substantially.... Optical fibre cable provides significantly greater capacity, and price reductions now make it competitive with copper cables for installation...".

incumbent telecom operator a private one. As a corollary of these circumstances, it is not surprising to find that in all the countries in the region, monopoly was the dominant market structure before 1990. Again, due to this way of development, in which private participation in telecommunications was non-existent, there was not much effort during the 1960s, 1970s and 1980s to develop specialized regulatory telecommunications agencies in the region.

However, beginning in the mid-1980s "Latin America has taken the lead in reforming telecommunications in the developing world" (Wellenius and Stern [1994, p. 25]). The main elements of telecommunications reform, which almost all countries in the region have undertaken, are the privatization of the former state-owned telecom operators, the development of more competitive markets and especially the *creation* of stable, credible and empowered regulatory telecommunication agencies.

This study concerns the telecommunications reform in 24 Latin American and Caribbean countries during 1980-1997. By telecommunications reform I mean the combined effect of privatization, competition and regulatory reform. The main hypothesis is that a strong regulatory framework increases investors' confidence and hence leads both to higher levels of main lines per 100 inhabitants and to better efficiency levels as measured by main lines per employee.

The importance of focusing on Latin America is clear in that the region has been leading in not only the privatization process but also regulatory reform like no one else in the world. The telecommunications sector, although it does not represent more than 2% of GDP, has profound implications for the competitiveness of regional countries in the international arena in a world increasingly globalized.

Using panel data techniques, I find that the regulatory framework index is *always* positively associated with the level of network deployment and the efficiency level. Those countries where regulatory reform has been furthered had growing levels of main lines per 100 inhabitants no matter their income level. Also, those countries that have allowed competition in

basic telecommunications services had more main lines per one hundred inhabitants and better efficiency level. Privatization is positively associated with those two variables except for the whole sample. However, privatization is not associated positively with network deployment and efficiency for countries whose average GDP per capita is lower than US\$1,500.

Section 3.2 sets the theoretical background on which the study is based. Section 3.3 reviews related empirical studies of telecommunications reform and performances. I then present a statistical and econometric analysis and explain in detail the main variables regarding the telecommunications reform in Latin America and the Caribbean. The last section contains general conclusions.

3.2 Theoretical Framework for Telecommunications Reform

Telecommunications reform may be thought of as a multidimensional process. It involves changes in at least three areas: allowing private sector participation (or privatization), promoting competitive markets (liberalization) and, most importantly, developing a sound and stable regulatory environment (Wellenius and Stern [1994], Willig [1993], and Schultz [1994]). The multidimensional process of privatization, competition and regulation can be analyzed with the NIE approach which affirms that institutions in a society provide the rules of the game that determine the incentive for individuals to engage in growth-enhancing activities.

Institutions are both formal and informal. Formal institutions consist of the laws and regulations of a society. Informal institutions are the norms and customs of a society (North 1990). These are the macro levels of the NIE. The micro level deals with the institutions of governance, "the market, quasi-market and hierarchical modes of contracting (more generally of managing transactions and seeing economic activity through completion)" (Williamson [1998, p. 93]).

3.2.1 The Transaction Cost Economics Approach

A major task of Latin American governments has been to signal the credibility of their telecommunications reform. Without credibility, the expectation of a future policy reversal might become a self-fulfilling prophecy, defeating the purpose of the reform. In telecommunications, credibility is perhaps important because the following features characterize the sector. First, the technologies used in the sector are very specific (i.e., they are not easily re-deployable in other activities and so become sunk). Second, the technologies exhibit important economies of scale and scope which means that only a few operators can profitably provide services. And, third, telecommunications services are massively consumed and may be considered necessity goods for most of the population. This confers a strong political component to telecommunications. The combination of these three features separates the telecommunications sector (among other utility sectors) from other economic sectors (Spiller [1996]).

All these factors, in one way or another, may have contributed to the past pattern of telecommunications development by the state in all Latin American countries. But more importantly, they all together give rise to opportunistic behavior on the part of governments and (private) investors. From the point of view of private investors, the undertaking of long-term investments in telecommunications carries two potential problems: the hostage problem and the expropriation problem. The former (Williamson [1983]) refers to government's ability to force utilities to charge unprofitable rates for their services. Given the nature of the investments (very specific and sunk), investors would rather keep providing the service than leaving the business. The latter refers to the possibility that at some point in the future the government may decide to expropriate private investors². McCubbins (1995, p. 9) calls this political risk, or the "probability that the entire regulatory framework in which a company operates will be changed."

² Spiller (1996, p.480), calls it sunk assets' expropriation and notes that "sunk assets' expropriation has been more prevalent in Latin America than direct utility takeovers or expropriation without compensation."

But all that being so, how can governments attract private (foreign) investments in the presence of their own opportunistic behavior? Or, which solutions are available to get over those problems? Very roughly, one may think of at least two *complementary* solutions. The first involves the design of contracts between governments and potential investors and the second includes the creation of a specialized regulatory body that can credibly guarantee fairness.

Transaction cost economics originated with the work of Williamson (1979)³. He states that the basic unit of analysis is the contract or single transaction between two parties in an economic relationship. Every transaction is said to have three characteristics: frequency, uncertainty and asset specificity. Williamson explains that the greater the asset specificity and the higher the level of uncertainty, the more complex become the contracts. So the transaction costs of drawing up a contract are likely to increase with the uncertainty and the transaction-specific nature of the investment. These costs comprise the direct costs of a) obtaining information, b) negotiating among the parties to reach an agreement and c) communicating all the provisions to the involved agents. There are also indirect costs, like the cost of monitoring and enforcing terms and conditions of contracts and the output lost due to potential contractual default.

Contracts may be subject to hold-up, given that the expenditure in plants and equipment is likely to be transaction-specific. The transaction-specific nature of expenditure generates positive quasi-rents; i.e., the telecom operator will get more from its best alternative in telecommunications use than from its second-best alternative. Since the quasi-rents are large, the telecom operator stands to lose a lot if it has to turn to its second best alternative. This opens a door for governments to exploit the large quasi-rents through hold-up. Besides, it is said that it is impossible to draw up complete contracts that cover all the possible contingencies that may arise in providing telecom services and that could affect the returns from the investment. Opportunistic

³ For a detailed analysis of the main elements of transaction cost economics, see Williamson (1989).

behavior by the government is expected. Additionally, some ex post transaction costs may arise precisely because of the incompleteness of contracts. Those costs are: a) dispute resolution and the establishments and operation of governance procedures and b) monitoring and enforcing the contracts. In the case of telecommunications reforms, some governments of the region (Argentina, Jamaica, Mexico and Peru, among others) signed very specific contracts with the (new) owners of the privatized incumbent telecom operator.

The degree of opportunistic behavior varies from country to country and one should expect opportunistic behavior to be greater when there is not a sound institutional and regulatory environment. Thus, if governments want to encourage private investment, they have to create an institutional arrangement that limits their own ability to behave opportunistically once the (private) telecom operators undertake their investments.

The institutional arrangement or governance is nothing more than the creation of a regulatory framework. In Williamson's words (1998, p. 95, italics in original) transaction cost economics "holds that governance is the means by which *order* is accomplished in a relation where potential conflict threatens to undo or upset opportunities to realize *mutual* gains." In this sense, I posit that the creation of a regulatory body will tend to minimize transaction costs. But the creation of a regulatory body brings a new set of questions and problems⁴ to solve. What degree of independence, autonomy and accountability should the regulatory body have? A response to all these factors would be very long but it suffices to take into account the following points.

First, commitment (to uphold contracts or the regulatory environment) is a very important variable. If the country has a history of commitment problems, transaction costs will increase.

⁴ Additionally, the reader should bear in mind that regulators are not accountable for their acts directly to consumers, but instead to political principals, from either the legislative or executive branch. This adds new hierarchies, each of which brings its own principal-agent structure. For a very concise summary about the main points of what it is called the new regulatory economics, see Estache and Martimort (1999).

Estache and Martimort (1999, p. 4) point out that "these higher transaction costs may be justified by the need to retain some flexibility in order to ensure that past regulators or political principals are not allowed to bind the future of society to a given regulation. This is important because consumers tastes may change in the future, or the political principals themselves may change after an election and these new decision makers may favor other groups." Given that the constitutional mandate in most Latin American countries prohibits re-election of the president, the terms of regulators should be short say 4-6 years. Regarding autonomy, will the regulatory body have its own source of funds or will it be dependent on the congressional appropriation of funds? Third, how will the regulatory body be staffed? Will it have to follow civil servant service laws? Fourth, what will the process of appeals be? Fifth, to whom should the regulator(s) report? And can the regulator be freely removed? Sixth, will the regulatory body be a collegiate body or not?

A contract between government (in most cases the ministry of communications is responsible for concessions, licenses or permits) and new telecom operators together with the setting of a regulatory framework will eliminate or at least attenuate the uncertainty felt by private investors. Once private investors feel confident that the government will not behave opportunistically, they will undertake their investment according to their expected future earnings.

3.2.2 The Agency Problem in Telecommunications Reform

Telecommunications reform involves the privatization of the former public telecom operator(s) (PTO), the introduction of competition in the sector and the creation of a regulatory framework. Popular ideas of privatization may suggest a clear and well-defined theory to explain the superiority of private over public ownership, but this is not the case. The economic arguments for privatization rest on a number of hypotheses about the relationship between ownership, information and incentives, and their impact on performance. However, most analysts argue that

privatization enhances productive efficiency (i.e., greater production at lower costs) and allocative efficiency (i.e., prices closer to marginal costs of production).

It is said that under public ownership property rights are dispersed and no individual owner (i.e., the voter/elector as a shareholder) has the incentive to bear the costs of collecting necessary information to exercise control over the management of the telecom operator. The main problem under public ownership seems to be the dissipation of property rights that severs the link between asset ownership and its control and management. Other derived problems with public operators are the many links in the agency chain that make agents responsible to more than one principal. The CEO of the company must report to the vice-minister, minister of communications and the president. In other cases, the congress also oversees the telecom operator. Also, the links between effort and efficiency (inputs) and performance (output) are extremely weak in these organizations. All these combined effects allow governments to pursue non-commercial objectives (or objectives that are not the social function of the telecom operator) which are inconsistent with efficient and financially viable performance. In addition, given the dispersion of the principal-agent relationship, the control and monitoring of the management and workers is usually too loose. Poor and bad direction by management blunts incentives and deepens the inefficiencies that characterized many state-owned operators in developing countries. Hence, one could expect that under public ownership, performance or deployment of telephone lines would be lower.

It is argued that the transfer of property rights from public to private hands (privatization in our case) enhances the performance of the telecom operator (see B \bar{s} and Peters [1991a, 1991b]). However, research has shown that this is true only if the owners are also the managers of the firm or if owners have complete information about managers' and workers actions, among other requirements. In response, it is said there are instruments that shareholders may use to discipline management, including the threat of takeovers, yardstick competition and the design of

managerial incentives.⁵ These mechanisms may align management's interests with those of the owner(s), leading to a higher level of managerial supervision and higher outcomes than in public firms.

Moreover, as the studies by Ramamurti (1996), Molano (1997), Petrazzini (1995), Levy and Spiller (1996) and Adam et al. (1992) show, most of the privatization processes in Latin America included very tight performance goals for increases in network expansion. More than that, the five-and-ten-year exclusivity periods given to some of the new operators motivated some to invest heavily to limit entry by new competitors⁶.

Without formalizing any of these ideas, the discussion on the links between ownership and performance shows how complex the relationship is between the type of ownership and the performance of a telecom operator. In general, then, under private ownership, one should expect telecom operators to have better performances.

3.2.3 Competition and Performance

For a long time, a body of theory argued that the provision of telecommunications services exhibited the property of natural monopoly. This argument was the centerpiece for not allowing competition in telecommunications, especially for local telecommunications. In the case of the U.S., the natural monopoly argument for regulation supported restricting entry into the local telecommunications sector and awarding a franchise. This in turn was the justification for regulating the telecom operator and also for preventing the local telecom operator from engaging in other telecommunications services (long distance, for example). However, as Spulber (1995) points out, technological and market changes have invalidated the premise of natural monopoly in

⁵ For more detailed explanation about these options see Tirole (chapter 0, 1989) and Milgrom and Roberts (chapters 6 and 12, 1992).

⁶ The study by Pyramid Research (1998) although descriptive in nature, shows how the former telecom operators, now privatized, have increased their level of investment in face of the ending of the exclusivity period. The increase in investment after privatization seems to be more acute due to the globalization approach of new foreign investors.

telecommunications. Assuming competition is allowed in the telecommunications sector, I will explore very briefly the theoretical relations that may exist between competition and performance (in terms of network expansion for instance) in the telecommunications sector.

Competition among telecom operators means that prices and profits reveal information about the efficiency of using inputs. In a market without competition, the principals (the owners of the telecom operator) are unable to determine if a raise in profits is due to better demand or efficiency and effort by part of the management. But when markets are competitive, then prices, profits or any other performance measure help the principal to determine the amount of management slack. Thus, the information provided by competition improves the efficiency of management supervision, reward and overall operator performance.

In this brief theoretical analysis of transaction cost economics, I have argued that the creation of a regulatory environment for telecommunications and the existence of contracts give sufficient assurance to private (and especially foreign) investors regarding non-opportunistic behavior by government. Consequently, private investors will undertake investments according to their plans and provisions. Secondly, the transfer of telecom operators' property rights from public to private hands does not eliminate all agency problems but tends to enhance the performance of telecom operators. Lastly, if the argument of natural monopoly is no longer valid for telecommunications (either local or long distance telecommunications), the more and better information that prices and profits provide may lead to an increase in the level of network expansion once competition is allowed.

3.3 Empirical Studies on Telecommunications Reform

Telecommunications reform in Latin America has seldom been studied. All the empirical studies thus far about telecommunications reform in *Latin America* have been limited to a few

countries that privatized (totally or partially) their former public telecom operators⁷. To date, no econometric study has linked the telecommunications reform in Latin America (privatization, competition and regulation) with any performance measure, say, the deployment of main lines per 100 inhabitants.

Some recent econometric studies have been tried to explain partial telecommunications reforms or the effects of political and institutional variables on network deployment.⁸ Henisz and Zelner (1998) explored how the political environment determines the long-run level of penetration of basic telecommunications infrastructure in 59 countries during 1975-1992. Their political constraint variable showed a strong and positive relationship with the level of main lines per 100 inhabitants. The economic and demographic variables were significant and with their expected signs.

Gutiérrez and Berg (1999) studied the effects of telecommunications reforms and political variables on the network expansion for 20 Latin American countries. Using a limited time sample (1986, 1990, 1995) and a random effect model, they found that political and institutional variables help explain the level of network expansion and constructed the *first* index of regulatory framework in telecommunications for the region. The index was found to be

⁷ It is not our purpose to review in detail any of those works. The more outstanding ones have been: a) Ramamurti (1996), who analyses the privatization process in Argentina, Jamaica, Mexico and Venezuela; b) Molano (1997), who studies the effects of micro and macro variables on telecommunications in the Southern Cone of Latin America (Argentina, Brazil, Chile and Uruguay); c) Adam et al. (1992), who briefly review the cases of Jamaica and Trinidad and Tobago; d) Levy and Spiller (1996), who thoroughly study the regulatory process in Argentina, Chile, and Jamaica; e) the five studies on Latin America contained in the book edited by Wellenius and Stern (1994); f) Petrazzini (1995), who analyzes the cases of Argentina and Mexico; and g) Galal et al. (1994), who examine the welfare effects of privatization of the telecom operators in Chile and Mexico. These studies and a few dozen more helped out in the construction of the index of regulatory framework for 24 Latin American countries. For more details, see Gutiérrez (1999).

⁸ Henceforth, "variable network deployment" will mean the variable main lines per 100 inhabitants.

positively associated with network deployment, which means that a better, specific regulatory environment leads to greater investments in telecommunications.⁹

Lee (1999) examined how and to what extent social and institutional endowments¹⁰ affect network expansion and efficiency (measured as number of employees per 100 lines) in the Asia-Pacific region¹¹. He found, using panel data analysis, that the performance of telecommunications is positively related with better and sound macro-regulatory procedures. Furthermore, privatization of former state-owned operators results in higher efficiency as well as in higher network expansion.

Canning (1998a and 1998b) ran regressions relating stocks of infrastructure to demographic (population, land area, level of urbanization) and economic (per capita domestic product) variables. For a total of 79 countries around the world and during the period 1965-95, he found that the growth rate of telephone main lines, although negatively associated with the area, was positively associated with the growth of GDP per capita, population and change in the urbanization ratio. Canning did not include any institutional or political variables, let alone regulatory variables.

In a working paper, Wallsten (1999) analyzed telecommunications reform for a sample of countries in Africa and Latin America. As we do, he tested how and to what extent variables like privatization, competition and regulation may have affected network expansion from 1984 to 1997. Using a fixed effect model, his main results are that competition impacts positively main

⁹ That index suffers from some shortcomings. The most important is that it was a dichotomous one, i.e., it took one if the country satisfied some elements (degree of independence, enforcement and neutrality of the regulatory body) and zero otherwise. I think to have overcome some of those problems. For more information, see Gutierrez (1999).

¹⁰ To control for the institutional environment, Lee (1999) uses the ICRG variable popularized by the study of Knack and Keefer (1995).

¹¹ The countries included in his sample are: Australia, Bangladesh, China, Hong Kong, India, Indonesia, Japan, Korea, Malaysia, New Zealand, Pakistan, the Phillipines, Singapore, Sri Lanka and Thailand.

line penetration, but that privatization is negatively associated with such penetration, although not statistically significant. Regulation alone is negatively and significantly associated with network expansion. Wallsten made competition and privatization interact with the regulatory variable and finds that both of them affect the level of main line penetration positively.

Although, Wallsten's research is a good contribution to the study of telecommunications reform, in my opinion it suffers from two main shortcomings. The first one is mixing countries in two very dissimilar areas, Africa and Latin America. Even across Latin America, there is a lot of different institutional and cultural development that one needs to control for. The second problem is the use of limited proxies for main variables like competition and regulation.

To measure competition, Wallsten uses the number of cellular companies in a country. This is a misleading approach, because all the Latin American countries at least are divided into separate regions and that use what is called Band A and Band B. The main difference between these two bands is the frequency on which cellular operators are allowed to provide service. For instance, in Chile, Band A transmission frequencies go from 825.030 to 834.990 MHz, while Band B starts at 835.029 and goes to 844.980 MHz. The frequencies vary from country to country depending on the availability of frequencies. In essence, at least in Latin America, the cellular markets are duopolistic in the sense that cellular operators in a region cannot *legally* provide telecommunications services other than in their own markets. A cellular user wanting to call to a different region has to use a long distance operator. The regulatory measure also suffers from the fact that it is a dichotomous variable, taking one or zero if the country-year observation has the attribute or not. Although this approach is also used in Guti rrez and Berg (1999), I have tried to overcome this problem in this study.

In a study similar to this one, Ros (1999) presents an econometric analysis of the effects of ownership and competition on main lines per 100 inhabitants and the growth rate in that variable for a sample of 110 countries around the world. His main results are that ownership (or

privatization) is positively related to the main lines variable and with its growth rate. Competition, however, seems to have no effect on network expansion¹².

The work of Ros clarifies some effects of telecommunications reform but does not explain at all the effect that regulation may have had on telecommunications performance. As he mentions, (Ros [1999, p. 72, italics added]) "Regulation plays an important role that affects a firm's efficiency... As such, it is important to attempt to control for the type of regulation that the newly privatized firms are exposed to... While all these factors are important theoretical determinants of network expansion and efficiency, data constraints prevented them from being *formally modeled below. As a result, any conclusions obtained below must take this into account.*"

Again, as in the case of Wallsten's study, Ros mixes developed and developing countries, and countries that have and have not privatized their operators. There is a lot of heterogeneity in his sample. Even running regressions for countries with GDP per capita less than \$10,000 US may not reduce the level of heterogeneity and the scope of his conclusions.

3.4. Statistical and Data Analysis

In this section, I will analyze the effects of telecommunications reform on network deployment (main phone lines per 100 inhabitants) and on an efficiency or productivity measure (total main phone lines per employee). Before proceeding with the econometric analysis, I will explain the main statistical features of the economic, demographic, regulatory and telecommunications data for Latin American countries.

Latin America and the Caribbean are composed of more than 30 large and small countries with a wide variety of cultural, economic, institutional and political factors. For this analysis, I

¹² Ros includes some price variables like interconnection prices for residential and business users, network access prices, and price of a 3-minute local call. Some of these tend to capture the supply-side constraints that telecom operators may have had. As explained later, the information, I got from the ITU data base is, at least for 24 Latin American countries, totally poor if not unreliable.

consider the telecommunications markets in 24 Latin American and Caribbean countries¹³. Therefore, the data is limited to those 24 countries for the period 1980-97.

Table 3.1 shows the main variables that will be used throughout this analysis. As stated previously, my hypothesis is that those countries that have implemented telecommunications reform, and specifically a better regulatory framework, will have higher network deployment and higher levels of efficiency. In this study, the *two* dependent variables are network deployment (main phone lines per 100 inhabitants) and efficiency (main phone lines per employee).

Telecommunications reform is composed of three main aspects: privatization, competition and regulatory development. TOWNER will be the variable that measures the level of privatization.¹⁴ Contrary to other studies that use a dummy to explain privatization, I use the percentage of ownership that is in private hands. I feel confident using that percentage because it reflects the degree of private participation in the (main basic) telecommunications sector in the region. I think we get a better idea of the effect of the privatization on the dependent variables with this measurement. COMPET shows if there exists competition in basic telecommunications services in the country. As in Ros's study (1999), I use a dummy variable, assigning one when the country's regulatory authority allowed competition in a given year and zero if competition was not permitted.

Lastly, REGUL is a measure of the regulatory framework in telecommunications for every country. This index has three dimensions. The first is the separation of the operating telecommunications activities from the regulatory ones (ITU, 1993). This might not mean that there is a specialized and separate regulatory body. It just means that the telecom operator handles

¹³ The countries in alphabetical order are: Argentina, Barbados, Belize, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Guyana, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Dominican Republic, Suriname, Trinidad and Tobago, Uruguay and Venezuela.

¹⁴ For more detailed information about the sources of this variable see Guti rrez (1999).

telecommunications operations while the regulatory activities (no matter the number of activities) are handled by an office in the government or by an independent agency. The second dimension is features a regulatory body should encompass: (1) autonomy, that I measured by budgetary independence and presence of limits on freely removing the regulators, (2) accountability, measured by existence of mechanisms to resolve disputes, (3) clarity of roles, approximated by using empowerment of the regulatory to set tariffs and fine or penalize operators, and (4) transparency (that I will be operationalized later). The third dimension, following Levy and Spiller (1996a), is whether the creation of the regulatory body (or the separation of the operating and regulatory activities) is backed by law or some minor norm (presidential decree, decree, etc)¹⁵.

The three dimensions are weighted and summed up. The criterion used to weight them may seem subjective. I assigned 70% for the second dimension; 20% for the ITU separation between operating and regulatory activities and the remaining 10% to Levy and Spiller's legal rank. The index will reflect a continuous growth to the extent countries' legislation includes any new criteria not adopted previously. Unfortunately, the index will always show increases, unless new legislation in a country or countries rules out some of the criteria already in place. The index is still subject to some shortcomings but is an improvement on Guti rrez and Berg (1999). Again, this is the second study to create an index of this type and address econometrically its impact on network deployment and efficiency in Latin America and the Caribbean.

The main telecommunications variables are taken from the ITU data disc. The disc contains information for more than 120 telecom-related variables, the most important perhaps being network deployment and efficiency. It also contains information about prices for a 3-minute call, price of connection to the network by a residential or business user, access price and investment in telecommunications. However, with the exception of information on faults per 100

¹⁵ A full explanation of the index is given in Guti rrez (1999).

inhabitants shown in Table 3.1. I will *not* use those price or quality variables. These variables are extremely important in explaining network expansion and efficiency, but the quality and availability of them for Latin American and Caribbean countries are very unreliable. To illustrate, on average, on the 100% country-year observations, the ITU data-base just gives between 19.9% and 28% of the observations. Also, some countries provided the same information for two different variables, a situation that degrades the quality of the data.

As in most of the econometric studies cited, I control for economic and demographic variables. Economic theory says that income may be the most important driven-demand factor¹⁶. I proxy income by using GDPPC, GDP per capita, TRADE, or the sum of exports plus imports as a percentage of GDP, and VSER; that is, the ratio of the value added by services sector, net of transportation and telecommunications to the GDP. Economic theory also says that cost factors affects supply of goods and services. I proxy costs by using either URBAN, the total percentage of urbanized population, or DENSITY, the ratio of population to area. I expect that the more urbanized a country, the lower should be the cost to deploy a network. Hence, the more urbanized a country, the more network will be deployed. Similar reasoning applies to density.¹⁷ As stated above, I do not count on good information about price or quality variables related to main telecommunications services.

Descriptive statistics are presented in Table 3.1, which shows, for the whole sample, three main comparisons. The first comparison is presented in columns one and two, which show means and standard deviations and test the *statistical* significance of the mean differences for all

¹⁶ As Saunders et al. (1994, p. 203) assert, "on a national basis, the input-output analysis suggested that the most frequent users of business telephones in developing countries as well as industrial countries are persons employed in trade, services, government administration, and to some extent transport. In other words, the tertiary sector of an economy generally purchases the largest quantity of telecommunications services."

¹⁷ For more about demand and cost factors, see Falch (1997).

the variables for those countries that privatized¹⁸ their former state-owned telecom operators against those that did not. The second comparison, contained by columns three and four, shows whether there exist *statistical* differences in the means for the same variables in those countries that introduced competition in basic telecommunications services and those that did not. The last comparison, in columns five and six, compares statistically the means of the same variables for countries that have and have not implemented a (better) regulatory framework.

In Table 3.1, one sees that the countries, that privatized their former telecom operator(s) during the 1980-1997 period, have, on average, more than one and a half times the network expansion than those countries that did not privatize. Countries with privatized operators almost doubled the efficiency level achieved by non-privatizing countries. Importantly, Table 3.1 shows that the level of regulatory framework index is almost double in those countries with operators owned by private investors than in those countries with public ownership. Lastly, the level of competition permitted is also higher in countries where the telecom operators are in private hands than in the countries with state-owned operators. Not surprisingly, the number of faults¹⁹ per 100 employees is higher in the countries that did not privatize than in the countries that did. Additionally, the variable that captures *other* aspects of the institutional environment, aside from telecommunications, happens to be not significantly different between these two groups.

The second comparison shows similar interesting results. The countries where competition exists experiences a 45% more network deployment than those without competition in basic telecommunications services. The regulatory framework development in telecommunications is much better in the countries that allow competition than in those having monopolistic conditions. On average, when competition in basic services takes place, efficiency

¹⁸ In this study, a privatized operator is one at least 50% owned by private investors.

¹⁹ Faults refer mainly to faulty terminal equipment on the customer's premises.

is 2.5 times greater than when it is not allowed. Surprisingly, neither the ownership measure nor the GDP per capita is (statistically) different in the two market structures.

Table 3.1 Descriptive Statistics for 24 Latin American Countries 1980-1997							
Variable.	0	1	2⊕/	3	4⊗/	5	6∅/
	All Countries	Majority State Owned	Majority Privately Owned	No Competition In Basic	Competition In Basic Services	Low ^/ Regulatory Environment	High ^/ Regulatory Environment
Urban	66.08 (16.67)	57.39 (15.79)	62.76*** (16.53)	57.44 (15.82)	75.29*** (8.52)	55.90 (15.5)	65.14*** (15.7)
Teleden	9.58 (7.25)	6.20 (4.95)	10.01*** (8.01)	6.83 (6.04)	9.89*** (3.12)	6.29 (6.17)	8.82*** (4.91)
GDPPC	2,575 (1,587)	2,051 (1,458)	2,564*** (1,774)	2,148 (1,571)	2,356 (1,071)	2,063 (1,547)	2,408** (1,516)
VSER	45.10 (6.49)	45.07 (7.57)	41.29*** (8.62)	44.51 (8.09)	40.44*** (3.94)	45.37 (7.90)	41.52*** (7.45)
TRADE	45.91 (33.34)	60.41 (62.99)	56.51 (40.77)	67.0 (42.91)	57.14 (26.01)	63.65 (41.75)	73.11** (42.35)
REGUL	.528 (.2734)	.3407 (.2227)	.6569*** (.1639)	.3879 (.2394)	.7226*** (.1318)	.2714	.7502***
InstInv	28.53 (11.76)	27.58 (14.24)	29.97 (12.11)	27.33 (13.65)	37.49*** (13.25)	26.52 (14.43)	31.8*** (11.58)
TOWNER	.428 (.415)	-	-	.6924 (.699)	.7526 (.3759)	.1108 (.2427)	2.15** (12.39)
COMPET	.1733 (.381)	.02 (.152)	.2043*** (.405)	0.01 -	1.0 -	.006 (.084)	.2016*** (.4028)
Faults	53.50 (37.61)	57.32 (38.62)	43.98* (33.70)	46.25 (36.28)	64.63 (39.65)	47.12 (32.04)	56.03 (41.24)
Efficiency	93.74 (52.78)	56.21 (38.51)	105.6*** (64.25)	61.06 (43.2)	154.38*** (57.27)	53.13 (33.47)	100.62*** (64.56)
N-Obs. (mean)	432	339	93	405	27	308	124
^/ It refers to REGUL > 0.5.							
⊕/ Stars in this column means that the means of column 2 are statistically different from those in column 1.							
⊗/ Stars in this column means that the means of column 4 are statistically different from those in column 3.							
∅/ Stars in this column means that the means of column 6 are statistically different from those in column 5.							
***,**,*/ Statistically significant at the 1%, 5% and 10% confidence level respectively.							

The third comparison is between countries whose level of regulatory framework is greater than .5 against those with lower levels. The most striking point is that all the relevant measures are significantly different between the two samples, and always in favor of those

countries with a better telecommunications regulatory framework. In those countries, network deployment is 40% higher, competition is greater and efficiency is almost 90% better.

Economic development across Latin America has not been even. Some countries have, on average, a higher income than others do. To illustrate, during the period 1980-97, Barbados reached an average GDP per capita of \$6,180 US, while Nicaragua attained roughly an average of \$536 US of GDP per capita, a difference of more than ten times. For this reason, I think it is convenient to analyze the performance of the variables in Table 3.1 for countries with an average income lower than \$1,500 US (in 1990 dollars).²⁰

In general, the results, shown in Table 3.2, in this sample parallel the ones in the whole sample. For the period 1980-97, the deployment of telecommunications network in countries that privatized their former state-owned operator is 25% higher than in countries that did not privatize and have an average GDP per capital lower than \$1,500 US. Privatization also leads to an 84% higher efficiency level in the telecommunications sector. More importantly, for those countries with telecom operators owned by private investors, the level of regulatory framework has been almost three times greater, and the degree of competition has also been higher. However, there are some puzzling results. Within this sample, the countries that privatized their telecom operators had lower GDP per capita. The Institutional Investors index, which tries to capture the macro-institutional factors affecting the deployment of telecom networks, turns out to be higher in the countries with state-owned operators.

The second dimension, comparing those countries that implemented competition (column 4) and those that did not (column 3), reveals similar conclusions. On average, when competition is allowed, the main lines per 100% inhabitants is 2.5 times larger than in the countries with monopolistic market structures in telecommunications. Also, it seems that competition brings a

²⁰ In alphabetic order these countries are: Bolivia, Colombia, Ecuador, El Salvador, Guatemala, Guyana, Honduras, Nicaragua, Paraguay, the Dominican Republic, and Suriname.

higher level of efficiency. Comparing both groups, we see that the efficiency is almost three times larger in the pro-competitive countries than it is in the non-competitive countries. Again, it is evident that competition in basic telecommunications services is positively associated with a better regulatory environment in that sector; and the degree of private ownership on telecom assets is also larger in the countries that have implemented competition.

Variable	1	2⊕/	3	4⊗/	5	6
	Majority State Owned	Majority Privately Owned	No Competition in Basic Services	Competition in Basic Services	Low ^/ Regulatory Environment	High^/ Regulatory Environment
URBAN	48.74 (10.42)	52.03 (10.58)	48.26 (9.9)	65.4*** (6.0)	47.84 (9.99)	53.62*** (10.9)
TELEDEN	3.72 (2.97)	4.66* (2.17)	3.55 (2.58)	9.07*** (2.87)	3.38 (2.73)	5.38*** (2.87)
GDPPC	989 (333)	831*** (135)	946.6 (312)	1,166** (336)	942 (313)	1,013 (325)
VSER	41.89 (7.08)	37.0*** (10.0)	41.11 (7.94)	42.73 (.8276)	41.74 (7.38)	39.47* (8.61)
TRADE	68.58 (80.35)	77.47 (61.63)	70.96 (79.81)	50.78 (25.04)	70.67 (84.68)	67.18 (50.93)
REGUL	.2876 (.2190)	.6993*** (.1322)	.3218 (.2365)	.7545*** (.1737)	.2191 -	.7532*** -
InstInv	21.4 (13.31)	19.9 (5.0)	20.58 (12.32)	29.79** (13.11)	20.28 (13.4)	24.02* (9.09)
TOWNER	- -	- -	.0994 (.2852)	.6364*** (.5045)	.0033 (.0406)	.534** (.4738)
COMPET	.023 (.152)	.250*** (.441)	0.01 -	1.0 -	.0000 (.0000)	.2340*** (.428)
Faults	67.1 (34.5)	133.2* -	65.25 (35.85)	96.58* (24.85)	58.6 (23.5)	92.29** (47.85)
Efficiency	49.02 (38.51)	90.37** (64.25) *	49.34 (42.58)	145.44*** (68.63)	41.91 (34.26)	95.26*** (66.24)
N-Obs. (Mean)	170	28	187	11	151	47
^/ It refers to Regul > 0.5.						
⊕/ Stars in this column means that the means of column 2 are statistically different from those in column 1.						
⊗/ Stars in this column means that the means of column 4 are statistically different from those in column 3.						
***, **, */ Statistically significant at the 1%, 5% and 10% confidence level respectively.						

The last dimension which relates countries with a higher regulatory framework to those with a lower one (columns 5 and 6 respectively), shows encouraging results. The network deployment is 60% larger in countries with a higher regulatory framework, and the level of efficiency reached is double. Surprisingly, however, the number of faults per 100% main lines is consistently lower for those countries that did not privatize but kept monopoly structures and developed a low regulatory framework.

3.5 Econometric Analysis

The analysis undertaken in the previous section sheds some lights on the relationship between telecommunications reforms and the extending of the telecommunications network and its level of efficiency. In most cases, the two main dependent variables were positively and significantly associated with privatization, competition and regulation. In this section, I extend the analysis using econometric methods to determine how and to what extent the two main dependent variables (network deployment and efficiency level) are explained by the three main components of the telecommunications reforms while controlling for income and costs variables.

3.5.1 The Model

In the theoretical literature on telecommunications, there is not any indisputable guideline about how the functional form for explaining the network expansion should be done. As the survey by Kridel et al. (1996) shows, research trying to link the (incentive) regulation with some performance or investment measure in telecommunications is varied so far. Some authors prefer to use linear models while others use non-linear ones. The studies quoted in the empirical section use different kinds of approximations, but use simple linear models, with the variables in levels (Lee [1999], Guti rrez and Berg [1999], Wallsten [1999]). In this study, I follow Ros (1999) and use a semi-logarithmic functional form. Although I control for the main characteristics of telecommunications reform in Latin America, there are still many unobserved country-specific factors. For this reason, I use the panel data techniques.

Our model is then²¹.

$$\ln Y_{it} = \alpha_i + \beta_K I_{it} + \gamma_H Z_{it} + \delta_J M_{it} + \varepsilon_{it}$$

Where Y_{it} are the dependent variables, network deployment or efficiency, Ξ_k is a 1 x K vector of coefficients and I_{it} is the number of control (explanatory) variables that have been shown meaningful in explaining telecommunications performance in most past studies.

(is a 1 x 2 vector of coefficients, and Z_{it} are ownership (privatization) and competition, where competition is a *dummy* variable and ownership is given by the percentage of the telecom operators in private hands. These variables have been important in the studies reviewed above. Our *main* variable of interest is the index of regulatory framework in telecommunications, REGUL (from the M-set)²². And ε_{it} denotes the remainder disturbance.

Among the I -vector variables, I include GDPPC lagged one period (GDP per capita), the ratio of total export plus imports to GDP (TRADE lagged one period), the percentage of value added of service sector to GDP (VSER lagged one period), the percentage of value added of manufacturing sector to GDP (VMAN lagged one period), the percentage of urbanized population (URBAN), and the population per square kilometer (DENSITY). The last variable measures the macro-institutional effects (INSTINV). These variables are used alone or jointly to test the

²¹ I follow the extreme bound analysis (EBA) proposed by Leamer (1983 and 1985) for the study of growth theory. The idea is that if we vary the subset I of variables included in the regression, the variable(s) of interest \mathbf{M} should pass the standard hypothesis. As Leamer states, "*We need to be shown that minor changes in the list of variables do not alter fundamentally the conclusions, nor does a slight reweighting of observations, nor correction for dependence among observations, etcetera, etcetera*". Although the EBA has been criticized for being too strong (Sala-I-Martin, [1997, p. 178]), I think it worthwhile to do something similar in the work on the determinants of investment in public utility sectors like telecommunications.

²² In the model I lag economic variables one period: GDP per capita, TRADE, VSER and VMAN. The main justification for this is the assumption that extending or deploying telephone lines takes time. Again, there is no theoretical support to offer about the choice of the time lag of these variables. Nor is for the remaining variables.

stability of the *key* variable M, the regulatory framework index. As noted before, neither prices nor investment (value) are included because of the poor quality of information.

3.5.2 Methodology

With the availability of telecommunications data for longer periods, and given the advantage of panel data techniques²³, researchers of the telecommunications sector have been prone to use them. Most studies mentioned in the empirical section above use panel data techniques. However, the use of panel data for long periods of time brings new problems. For longer data series, one should see whether the time series are stationary or non-stationary. If the series are non-stationary, Pedroni (1995) shows that, unless the relationship estimated between a series like TELEDEN (network deployment) and our main independent variables is a cointegrating one, the estimated parameters in a panel regression with fixed effects converge asymptotically to zero. Moreover, with non-stationarity, the usual t statistics are inconsistent in panels, so inference can be wrong. Hence, if the series were non-stationary, the use of panel data would give misleading results.

The first step when using panel data is to check the non-stationarity of some series. To address this problem, Im et al. (1997) suggest a panel unit root test, which they call the LM-bar test, for the joint null hypothesis that every time series in the panel is non-stationary²⁴. In my research, two variables are potentially non-stationary, GDP per capita and TELEDEN (main lines per 100 inhabitants). Following the technique proposed by Im et al., I found that, fortunately, both

²³ Panel data are obtained by observations on a cross-section of countries over several time periods. The benefits of using panel data (Baltagi [1995]) are: a) ability to control for individual heterogeneity, b) more informative data, less collinearity among the variables, more degrees of freedom and more efficiency, c) better ways to study the dynamics of adjustment and d) ability to construct and test more complicated behavioral models than pure cross-section or time-series data.

²⁴ Canning (1998a) explains in detail the main procedure.

series are stationary. The results of those statistical tests are in Appendix B and validate the use of panel data techniques.

3.5.3 Endogeneity of Competition

Ros (1999), quoting Kridel et al. (1996) raises the point that competition and privatization (and perhaps regulation) may be endogenously determined. This is an important issue. First, Levy and Spiller (1996) have made clear the distinction between regulatory governance and regulatory incentive. The governance framework includes all the mechanisms a society have to restraint government behavior and solve disputes, while the regulatory incentive focuses on pricing, subsidies and operating policies. As Levy and Spiller stress, in the past researchers have paid too much attention to regulatory incentives and have disregarded regulatory governance. The studies surveyed by Kridel et al. are just a sample. The regulatory framework measure presented here focuses completely on regulatory governance in telecommunications, leaving less room for any problem of endogeneity.

Second, in contrast to Ros, I assume that privatization is *exogenous* too, for the following reason. Although macroeconomic factors like high fiscal deficits, heavy external debts and ideology may have triggered privatization, other factors like low quality in the provision of service, high unmet demands and a large number of faults per main lines may have contributed as well. However, I do not have good data on any of the above variables.

Lastly, similarly to Ros, I assume that competition is more likely to be *endogenous* than privatization or regulation, at least in this first stage of telecommunications reform. The privatization processes in Latin American and the Caribbean, although fast in many countries, were accomplished through the negotiation of key issues, the most important of which was the exclusivity period. In all the cases in this study, the new (foreign) owners demanded and attained exclusivity periods either for local or long distance services. So competition was likely determined to some extent as part of the ownership reform.

Following Donald and Sappington (1997), I first run a logit model to analyze the discrete choice of allowing competition or not. COMPET stands for competition and will take the value of one if competition is permitted in basic telecommunications services, zero otherwise.

$$\text{COMPET}_{it} = \beta * I_{it} + \gamma * T_{it} + \delta * M_{it} + \mu_{it}$$

And to get the estimate probability of allowing competition, we get \hat{p} as

$$\Pr(\text{COMPET}_{it} = 1) = \Pr(\mu_{it} > \beta * I_{it} - \gamma * T_{it} - \delta * M_{it}) = 1 - F(\beta * I_{it} - \gamma * T_{it} - \delta * M_{it})$$

Second, using the fitted value coming from logit model of equation (2) as an additional instrument variable, I run a two-stage least square dummy variable model to assure consistent estimators.

In all the regressions reported below, I present both the *country-specific* fixed-effects²⁵ results with and without correcting for the potential endogeneity problem.

3.6 Main Findings

The results of the *one-way* fixed-effect models explaining the impact of telecommunications reforms on network expansion are shown in Table 3.3. Table 3.4 shows the effects of the same variables on the level of efficiency in telecommunications, measured by main lines per employee. In both cases, I run regressions for the whole sample and for those countries with average GDP per capital lower than \$1,500 (in 1990 US dollars).

After correcting for endogeneity of competition, I show the outcomes for the whole sample of countries in column 3 of Table 3.3 while column 4 shows the results for countries with an average GDP per capital lower than US\$1,500. The variable of interest, the regulatory framework index, is always positively associated with the deployment of main lines per 100

²⁵ Most of the panel data applications use a one-way fixed effect model for the disturbances, with

$$u_{it} = \alpha_i + \epsilon_{it}$$

where α_i denotes the unobservable country specific effect and ϵ_{it} denotes the remainder disturbance.

inhabitants, and both privatization and competition reform affect the performance variable positively. The regulatory index has a larger impact on network deployment for the whole sample of countries than for low-income countries. For this sample of countries, privatization is negatively associated with teledensity but not at a statistically significant level. A possible explanation may be that only two countries within this sample privatized their former public operators. These were the Dominican Republic and Bolivia, and recall that Bolivia's privatization occurred in 1995.

	(1)	(2)	(3)	(4)
	Country-specific Fixed-Effects		Country-specific 2-SLQ Fixed-Effects With Endogenous Competition	
Sample	All Countries	GDPPC < US\$1,500	All Countries	GDPPC < US\$1,500
Urban	.084*** (15.23)	.083*** (11.41)	.079*** (13.21)	.0822*** (10.83)
GDPpc (-1)	.13E-05 (.030)	.675E-03*** (3.12)	.3057 (.6369)	.63E-03*** (2.85)
Trade (-1)	.67E-03 (.757)	.243E-03 (.183)	.45E-03 (.494)	.263E-02 (.1965)
Instinv	.058*** (3.40)	.1028*** (3.39)	.59E-02*** (3.27)	.01*** (3.28)
Comp	.196*** (3.78)	.211*** (2.61)	.394*** (3.80)	.252** (2.64)
Owner	.275*** (5.28)	-.3094** (-1.67)	.241*** (3.97)	-.290 (-1.55)
Regul	.2843*** (4.10)	.216*** (2.28)	.284*** (3.97)	.2198** (2.29)
N	356	153	354	153
Adj-R-sq	(.9448)	(.9112)	(.9417)	(.9097)
t-statistic between brackets				
***, **, * Statistically significant at the 1%, 5% and 10% level respectively				
Country-dummy variables are not shown.				

A secondary important result is that the economic variables are non-significant statistically for the *whole* sample. The proxy for cost, URBAN, turns out to be statistically significant and with the expected sign. The contribution of this variable is important. A ten-point increase in the level of urbanization will bring an increase of 8.0% in the level of the telecommunications network.

Table 3.4 Impact of Changes in Parameters on Log of Teledensity

Variable	Change	Whole Sample	GDPPC < US1,500
Regul	1-point increase	28.4%	21.9%
Owner	1-point increase	24.1%	-
Compet	Δ compet	48.3%	28.7%
GDPpc _{t-1}	US1,000 Increase	-	6.3%
Urban	1-point increase	7.4%	8.2%
Instinv	10-points increase	5.9%	1.0%
Source: Table 3.3			

Evaluating the individual effects of telecommunications reforms for the *whole* sample, I can say the following. First, as shown in Table 3.4, a one-point increase in the regulatory index by countries in the whole sample leads to a 28.4 % increase in the level of main lines per 100 inhabitants. Second, countries with private telecom operators have a level of network deployment that is 24.1% greater than countries with public telecom operators. Lastly, main lines per 100 inhabitants are approximately 48.3% higher in countries that allow competition in basic telecom markets²⁶. The message for policymakers is that the overall effect of all the factors of the telecommunications reforms is then important.

The results give us a better idea of the importance of telecommunications reform. Overall, the reform factors seem to outrun the income and costs effects²⁷. Also cost effects seem to be more important than the combined income effects in helping to deploy more main lines per 100 inhabitants for the whole sample of countries. Hence, although privatization for the region as a whole cannot be pushed too much and is a very political issue, there is still a lot of room to increase the level of competition and strengthen the regulatory framework to increase network coverage. I should expect an improvement in the deployment of main lines per 100 inhabitants as governments in the region increase competition and improve their regulatory frameworks.

²⁶ Recall that for semi-logarithmic forms, the mathematical expression for the percentage impact of the dummy variable on the dependent variable is $[e^* - 1]$. In this case, we have $\Delta c = [e^{.394} - 1]$. See, Halvorsen and Palmquist (1980).

²⁷ The reader should be aware that the economic growth in Latin America during the period of analysis was extremely poor, compared to other periods.

For the whole sample, the regulatory framework index and the competition effects are significant and with the expected sign. Ownership turns out to have a negative sign, but it is not statistically significant. It is important to point out that the effect of these two variables is lower for this sample of countries. In effect, main lines per 100 inhabitants will be 29% higher in those allowing competition than in those with closed markets. By the same token, when the regulatory framework is increased one point, the level of network deployment increases 21.9%.

On the other hand, the cost and income effects turn out to be important for these low-income countries as well. Those lower income countries can improve telecommunications network by ameliorating their economic growth and by keeping implementing the telecommunications reform.

Table 3.5 below presents the regression estimates for the main lines per employee, or efficiency. As in the previous analysis, we run regressions for the whole sample and for those countries with average GDP per capita lower than US\$1,500. In first place, column 3 shows the results for the whole sample of countries after correcting for the endogenous competition. The main outcome is that both competition and regulatory reform variables are positively associated with higher level of efficiency. According with Table 3.5, the improvement in the telecommunications regulatory framework leads to higher level of main lines per employee. A point increase in the index of regulation by all the countries in the sample brings an increase of 81% in the level of efficiency.

The Table also shows that those countries that introduced competition achieved higher level of efficiency than the countries keeping monopoly markets. Given the estimate reported in Table 3.5, the efficiency in telecommunications is approximately 32.3 % higher in the countries that permitted competition. This result may corroborate the theoretical arguments about the positive effects of having a more competitive and regulated telecommunications sector.

	(1)	(2)	(3)	(4)
	Country-specific Fixed-Effects		Country-specific 2-SLQ Fixed-Effects With Endogenous Competition	
Sample	All Countries	GDPPC < US\$1,500	All Countries	GDPPC < US\$1,500
Urban	.071*** (9.54)	.068*** (8.32)	.057*** (7.09)	.069*** (8.19)
GDPpc(-1)	.255-05 (.043)	.139E-02*** (4.78)	.61E-04 (.93)	.0075*** (2.74)
Instinv	.59E-02*** (2.67)	.010*** (3.10)	.59E-02** (2.4)	.013*** (3.57)
Comp	.28*** (3.91)	.0054 (.500)	.657*** (4.47)	.0181 (.1544)
Owner	.297*** (4.28)	-.327 (-1.59)	.246*** (3.19)	-.417** (-.115)
Regul	.771*** (8.42)	.592*** (5.26)	.81*** (8.33)	.718*** (6.203.69)
N	348	147	346	147
Adj-R-sq	(.8859)	(.9423)	(.8661)	(.9317)
t-statistic between brackets				
***, **, * Statistically significant at the 1%, 5% and 10% level respectively				
Country-dummy variables are not shown.				

Privatization reform turns out to affect positively the number of main lines per employee. In effect, those countries where privatization was undertaken had 24.6% more main lines per 100 inhabitants than in countries where telecom operators are still in public hands.

The impact of the income and cost control variables is also positively associated with the level of efficiency. Finally, countries having a better ten-points macro institutional environment captured by the Institutional Investor variable get a 5.9% level of efficiency higher.

For those countries with GDP per capita lower than US\$1,500, the analysis is similar. After corrections for endogeneity of competition, the regulatory framework index variable is positively associated with the efficiency level, although the parameter is lower than that obtained for the whole sample. Neither competition nor ownership was statistically significant, even though the sign for competition was the expected one.

Besides the results presented in Tables 3.3 and 3.5, I ran more regressions using three more variables from the I-set-variable in equation (1) above. These variables were the ratio of

manufacturing to GDP (called VMAN), the ratio of service sector net of communications and transport to GDP (call VSER), population density per square kilometer, (DENSITY). Although the signs of these indicators in some cases were the expected ones and statistically significant, in other cases they were insignificant or with the wrong sign. However, in all cases, the sign of our main variable of interest -the regulatory framework index, REGUL- was positively associated with the dependent variables. These results, presented in Appendix B, show that the regulatory index is robust to changes in specification.

I also ran regressions for two different samples of countries, one for the sample of countries that privatized their former public telecom operator and the second for those that did not. These results are also in Appendix B. For the first sample, after correction for endogenous competition, the regulatory framework index and competition reform were found to be related positively with main line per 100 inhabitants and with the level of efficiency. For countries that did not privatize, neither ownership nor competition was robust to changes in the I-set variables. In some cases, the coefficients had the wrong sign or were not statistically significant. In both samples, the variable related to cost, URBAN, was positively associated and significant statistically. GDP per capita and the other economic variables obtained mixed results. In most cases they had the wrong sign or were not significant.

3.7 Conclusion

This research sheds new lights on the effects of telecommunications reform on performance variables like main lines per 100 inhabitants and the level of efficiency. The econometric results show that Latin American and Caribbean countries with a better regulatory framework will have greater network deployment. Competition and privatization (ownership) are associated positively with the level of network and with main lines per employee for the whole

sample. However, ownership is related negatively with these variables for the low-income countries.

The level of urbanization (and density) is also an important factor in the level of network expansion and efficiency in Latin American telecommunications. Although the sample of countries chosen in this study is restricted to the Latin America region, the inferences may be valid for countries with some similarities. The main lesson is that the building of a sound and stronger regulatory environment, the opening of the market to more competition and the free entry of private investors in basic telecommunications services will propel the network expansion and the efficiency across the sector.

Research on telecommunications reform is still in process. I assume in this study that the regulatory framework and the privatization process are exogenously determined. Also, although the ITU database provides information about some price variables, its quality is still very poor. In this research I presented a static model in which no lagged dependent variable was used. Hence, future research should, look for new data about prices in the sector to include in the model, provide better and strong arguments to endogenize the regulatory framework and privatization, make the model dynamic by exploiting fully the advantage of dynamic panel data. The regulatory framework index may be improved with the addition of new factors not yet recognized. In the future, more statistical information about the recent privatization of telecom operators in Central America and Brazil will provide more observations. It is hoped that this study has raised questions for future research in the region and on the sector.

CHAPTER 4
IS THE OPENING OF THE COLOMBIAN LONG-DISTANCE TELEPHONE MARKET TO
FOREIGN INVESTORS WELFARE ENHANCING?

4.1 Introduction

This study provides a framework for analyzing the introduction of competition in Colombian long-distance phone service. Currently, the public telecommunications operator PTO-Telecom provides long distance services in Colombia (national and international). I analyze the effects that opening national long distance market to competition would have on the welfare of the country.

For many years Telecom helped the central government finance its budget and undertake social investment in telephony. However, the price paid for this has been high for consumers in terms of the higher tariffs they have had to pay and continuing union threats of shutdowns, which create uncertainty for consumers.

To tackle the inefficiencies in the telecommunication sector, including all the existing state-owned facilities, in the early 1990s the Colombian government attempted without success to privatize Telecom.¹ This failed undertaking showed that the approach to be followed to improve efficiency in the sector had to be different. Later, in 1994, the government proposed a bill that was subsequently approved by the congress regulating all public utilities in the country.²

¹ See Hooley (1998) and Townsend & Associates (1998).

² Ley 142 de 1994 o Ley de Servicios Públicos (Public Utility Law of 1994). The law states “freedom of competition and non-use of dominant position” by part of public utilities companies as the core of the competitive framework. This law was part of a broader package of new legislation tending to deregulate the economy and, in particular, public utilities services, and is one of the current legal backbones of the Colombian telecommunications sector.

The law stresses competition as a mechanism to achieve efficiency. In the telecommunications sector, the law also allows free entry into the local phone markets and specifies the different regulatory pricing regimes currently in effect.

In 1992, President Gaviria, who was elected in 1990, failed to privatize the incumbent long distance operator Telecom. Thus, recently, la Comisión de Regulación de Telecomunicaciones (Telecommunications Regulatory Commission, or CRT), the Colombian counterpart of the FCC in the United States, was compelled to create once and for all a process of new license concessions to provide service in the long distance market. Very briefly, the CRT resolutions³ allow free entry into the market of long distance service, but impose some requirements, including payments. With the resolutions, the CRT has tried to satisfy all the interested parties: the large Colombian local exchange companies (LECs), the incumbent Telecom, the private sector, consumers, and the unions. However, there remains much concern on the part of unions and the public about the desirability of this liberalization process.

Some groups argue that Colombian regulators take for granted that the introduction of competition will bring clear welfare gains, but that is not necessarily true. Their main example is other Latin American countries that have allowed competition in that market. Even though tariffs have decreased in those countries while investment has increased and technology has improved, the welfare of a society depends not only on the surplus consumers can obtain, but also on firms' total profits. If there is some profit sharing with the foreign firms making domestic investment, regulators should consider profit that may flow abroad because this may directly reduce total welfare if the outflow is not offset by the initial capital inflow. Besides, the new competitive

³ CRT Resolutions 086, 087 and 088 of 1997.

scenario causes Telecom, which assumes universal service obligations, to lose much of its market share and profits. Such an outcome could decrease its investment in social telephony.⁴

I analyze the welfare effects of the new scheme of competition. My starting point or benchmark is the current setting, where a single long distance operator (LDO) engages in private and separate negotiation with two local exchange carriers (LEC), named α and β , in two different cities. For example, city A could be the capital Bogota, and city B another industrialized city.

In this bargaining, α and β set their access charges to Telecom for incoming and outgoing long distance calls made by customers in cities A and B. Then, the LDO sets its price to its customers. With this, I propose a simple welfare function that is the sum of the total consumer surplus in cities A and B and the LECs' and LDO's profits. In the competitive scenario, I model the interactions among the two LECs and *two* LDOs, the current incumbent company and a *new* one, with the feature that the new LDO is a subsidiary of one of the LECs. In this new setting, the LEC behaves as an *integrated* firm. Then I proceed to analyze the welfare effects of this new situation compared to the current one.

It is well known that LDOs have to interconnect if a caller from city A is to reach anyone in city B. To do this, the LDO has to secure interconnection with the LECs of both cities A and B and pay interconnection fees.⁵ How much the LDO has to pay for access to the local loops will depend on the interconnection negotiations.

The two local networks and the long distance operator provide in this case perfectly complementary services in the sense that, for a call to be completed, it has to combine them in fixed proportions. If neither LEC is vertically integrated, there are no incentives for these firms to

⁴ Social telephony “will have as objectives to provide the service of telephone to the urban and rural users who given their (low) level of income, cannot afford the whole tariff of service,” Plan de Desarrollo para el Sector de Telecomunicaciones, Documento Conpes 2760, pp. 13.

⁵ The terms “interconnection” and “access” will be used interchangeably.

try to foreclose or engage in non-competitive behaviors (Baumol and Ordover [1994]). In contrast, a vertically integrated LEC (one that also provides long distance services) is a potential source of anti-competitive behavior (Laffont and Tirole [1996a, 1996b], Economides [1995, 1998], Weisman and Zhang [1997] and Sibley and Weisman [1998a, and 1998b]).

In the benchmark scenario, the LDO prices are like those of a single-product monopolist. Markets in cities A and B are treated like one single market. My main result when modeling the competitive scenario is that the introduction of competition in the long distance market increases the total welfare (TW) in the nation, although the current incumbent Telecom *does* suffer a reduction in its profits. Another result is that local phone companies benefit from the liberalization of the (national) long distance market.

I present background on the telecommunications sector in Colombia and the regulatory framework in next section. In section 4.3, the model for the benchmark setting (or current situation) is developed. Section 4.4 models the competitive (future) setting. In section 4.5, welfare analysis comparisons are made between the benchmark and competitive models. Finally, I present some conclusions in section 4.6.

4.2 Background of the Telecommunications Sector and its Regulatory Framework

4.2.1 The Operators

Currently, there are about 30 LECs in Colombia, most of them owned by municipal and state governments, and only one incumbent in the long distance market, Telecom, owned by the central government. The fact that municipal governments are the owners of the local phone companies has been an important institutional feature of the utility sectors in Colombia.⁶ However, some years ago this began to change. Governments wanted to spread phone services to the poor areas of the main cities, small towns, and the rural countryside. The only way to do this

⁶ This feature is (or was) present in all main Colombian utilities (See Gray [1997] and Townsend & Associates [1998]).

was to compel Telecom to implement the policy. To comply, Telecom had to build networks in some (unsatisfied demand) areas of Colombian cities, as well as in the rural countryside, to provide local phone service.⁷

As a result of this situation, of the 4.9 millions lines installed as of December 1995, Telecom owned about 16.3%. The three main LECs -Empresa de Telefonos de Bogota (EPB), Empresas Pùblicas de Medelln (EPM) and Empresas Municipales de Cali (EMPCALI)- controlled about two thirds of the total lines installed across the nation. And at least six LECs had more than 150,000 lines installed in their owns cities.⁸

Legislation in Colombia forced LECs to transform into what are called "industrial and commercial enterprises of the municipal order".⁹ This, and the fact that the superintendent of public utility may take over any LEC if it does not provide good service, has limited political interference by local politicians and obliged the LECs to behave (more closely) as profit-maximizing firms.¹⁰

⁷ As Hooley (1998, p. 111) states, "Telecom Colombia serves areas of low population density and income not served by municipal companies. Such service is expensive relative to the revenue it generates."

⁸ See "TelefonPa a Nivel Nacional, Planta Interna-Capacidad Installada, 1995", DNP, September 1996.

⁹ It is worthwhile clarifying some points. All public utilities were to be transformed into industrial and commercial enterprises, but most did not, and art. 17 of the Public Utility Law was rescinded. So the congress passed a new law (Law 286 of 1996), which mandates that all current public utilities (including Telecom) have to be transformed into what is called "enterprises of public utility"(state-owned companies). Now, a public utility offered shares, the owners of which may be public or private investors.

¹⁰ I am *not* claiming that there exists complete political autonomy. For example, the mayor appoints the CEO, and the city council controls two-thirds of the board of directors. This board has to authorize new loans that the LEC wants to make, as well as authorize any transfer of money to other public utilities of the city. My point about the LECs behaving (closely) as profit-maximizing firms is also stressed by Hooley (1998, p. 107), "Telecom and local companies have had almost unlimited power in their setting of administrative, financing, technological, and general policies."

As mentioned before, the LDO incumbent Telecom owns local phone companies in poor and rural municipalities, as well as in some of the large cities. Yet, Telecom's main *business* is the long distance market. In 1992, Telecom was transformed into an industrial and commercial company of national order.¹¹ This allows the company to behave as a profit-maximizing firm and gives it greater independence.¹² Some studies¹³ recognize that Telecom utilizes modern technology for long distance services and provides a good service to the whole nation. Yet, the same studies show that it has very high labor expenses that translate into high operating costs.

As noted above, Telecom has been responsible for social telephony, which has meant investment in infrastructure, networks and equipment to provide local and long distance service across the nation. This has also meant that Telecom has been subsidizing local phone service in the municipalities and cities where it supplies this service with high long distance tariffs.

Recently, the burden of social investment has been steadily released from Telecom. The Public Utility Law of 1994 created the Communication Fund to make investment in programs of social telephony. The fund currently receives its resources from the concessions of mobile cellular telephony, central government budget and others sources. However, Telecom continues to be the main instrument for implementing universal service.¹⁴

¹¹ Decree 2123 of 1992. I use the term industrial and commercial enterprise following a translation from Spanish expression. Actually, the English form should be state-owned company. Being a state-owned company permits "greater management flexibility and accountability.... state-owned companies are regulated by the laws that govern private entities rather than those that govern public institutions" (Hooley, [1998, p. 109-110).

¹² In the words of its CEO, "Telecom is a profitable enterprise. Its operating profits are about \$30,000 Colombian millions [US\$ 22 millions] per year, but they may be about \$500,000 Colombian millions [US\$ 370 millions] if it were not carrying the social function it serves" (Capitalizacion, Unica Salida para Telecom, El Espectador, November 26, 1997, Internet press release).

¹³ See, Ministerio de Comunicaciones, "Plan Nacional de Telecomunicaciones 1997-2007", capitulo 12. See also Hooley (1998).

¹⁴ See, Ministerio de Comunicaciones-DNP "Plan de Telefonía Social 1997-2000," Documento Conpes 2925, May 28, 1997.

While carrying out this task, Telecom became a local exchange carrier in some cities, and the single long distance operator. This made it a fully vertically integrated firm, which some LECs considered detrimental. These demanded to be allowed an equal footing with Telecom. After lawsuits by those LECs, CRT opened the long distance market to competition.

4.2.2 The Regulatory Bodies

To provide a fair and sound environment for the telecommunications sector, the Colombian Congress approved and passed a law¹⁵ in 1994 that created the CRT, a quasi-independent body with the minister of telecommunications as president of the board. CRT is the main regulatory institution and the only one that directly addresses the telecommunication policies that the government wants to implement. In addition to CRT, the Superintendence of Public Utilities acts as an agency of control but does not influence decisions. The other agencies in the regulatory process are the Ministry of Communications and the Consejo Nacional de Política Económica y Social, CONPES (National Council for Social and Economic Policy).¹⁶

The CRT has tried to follow a regulatory regime that could be labeled "light-handed." Typically, it relies on private negotiations among operators to secure interconnection agreements. It has attempted to reduce or eliminate statutory barriers to entry and has specified clearly all the market practices that are contrary to free competition. Pricing is left to the telecommunication operators once there is enough competition in the market. Regarding the opening of the long distance market, the CRT has set all the rules and requirements potential entrants must follow,

¹⁵ Law 142 of 1994. In strictu sensu, the CRT was created by decree 2122 of 1992, but Law 142 gave to it all the current enforcement powers.

¹⁶ CONPES is an advisory board whose members are the president of the Republic, the ministers, representatives of the central bank, and some other institutions. CONPES decisions apply to different government agencies. The ministry of communication has all the authority in the telecommunication sector, but it has to follow CONPES recommendations. The Ministry cannot change or review CRT decisions.

with its objective being price signals that are efficient and the avoidance of a socially inefficient pattern of entry and investment.¹⁷

However, the CRT has shown an erratic path in some policy areas in its first four years, as one can infer from the decisions regarding the opening of the long distance market. This and the weakness of the judicial system¹⁸ in Colombia may explain why foreign investment has not been, thus far, eager to invest in this sector, compared to other Latin American countries.

4.2.3 The Regulatory Incentive and Market Structures

Levy and Spiller (1996, p. 17) state that the regulatory incentive structure, i.e. "*the rules governing utility pricing, subsidies, competition and entry, interconnection, and the like,*" is a key component of analytical regulatory design. In the Colombian case, the institutional facts described above have shaped the kind of regulatory incentives and the current market structure.

As noted earlier, an important feature of the market structure is that LECs behave as profit-maximizing firms in their own market. Some time ago, LECs' income came from the income generated by the local phone service, plus a small share of the long distance income given by Telecom. There were no rules or norms regulating interconnection, access charges, entry, and competition in the telecommunication markets.

Law 142 of 1994 established new initiatives in all these matters. It paved the way for competition in all the telecommunication markets. The local phone markets were opened to competition. Currently, the market structure in local telephony is that almost all LECs are monopolies in the cities where they provide service. However, in one city, Barranquilla, two

¹⁷ See Schankerman (1996) for more details about this and related subjects.

¹⁸ For example, the State Council ruled that all decisions taken for all the Regulatory Commissions are null. The government appealed to the Constitutional Court but no final decision has been reached so far. See, "Nocaut JurPdicico a las Comisiones que Regularan Servicios," El Espectador, septiembre 30 de 1997, and "Incertidumbre en los Servicios Pblicos," El Mundo, December 17, 1997, Internet press releases.

LECs exist. And one of large LEC¹⁹ recently began installing lines and building networks in other local phone markets or took control over some small LECs. The law also states that investors need only local permits to provide local phone service.

Via the CRT, the long distance market was finally opened. Although at first the government wanted to introduce limited competition to the current incumbent, as in the United Kingdom, the final result was that the market is completely open. Any investors that satisfy some requirements and pay for the license can provide long distance services. Therefore, it is expected that the industry structure will become extremely competitive in coming years.

On the issue of interconnection, the law mandates that interconnection be allowed on a fair basis.²⁰ The CRT is to rule on all the technical and economic aspects regarding interconnection. Although the conditions of interconnection seem to have been taken for granted in legislation about telecommunications, this turns out not to be true.²¹ CRT has established that interconnection agreements have to be freely negotiated by the interested parties, and CRT intervenes only if parties cannot reach an agreement.²² The principles that guide interconnection are the following: a) interconnection must be done at any point in the network that may be technically viable; b) terms and conditions will be ruled by the principle of equal-access equal-

¹⁹ For instance, EPM, the LEC of Medellin, created EPM-Bogota, a new LEC in Bogota that installed 95,000 lines and began operations in January 1998. See "En enero, EPM-Bogota empieza a instalar lineas", *El Tiempo*, 18 de diciembre de 1997, Internet press release.

²⁰ Law 142 of 1994, articles 8 and 28.

²¹ For a very general picture of how this matter was managed in developed countries, see Spiller and Cardilli (1997). The most interesting and referred case is New Zealand, see Arnold (1995), Pickford (1996), Ross (1995) and King (1995). For the United Kingdom case, see Armstrong (1997), Cave (1994) and Vickers (1997).

²² The obligations to interconnect were summarized in CRT Resolution 087 of 1997. The operators have 30 days to reach a direct agreement; afterwards, the CRT will intervene and set an agreement in a term ranging from 15 to 60 days.

charges; c) no better deals on interconnection are allowed to any operator if it is vertically integrated; and d) the elements of interconnection must be offered unbundled.

Law 142 of 1994 required that the *CRT set the access charges*. While this may be thought of as contrary to profit-maximizing behavior, it is not. The CRT defined the access charges as “the charges per minute, or fraction of minute, that reflect the costs of providing service, taking

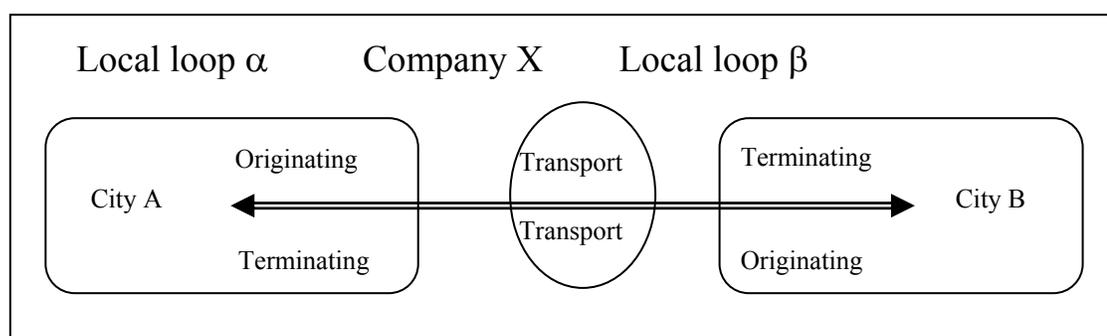


Figure 4.1 Current Scenario

into account all operating costs (including those needed to buy, install, and maintain the equipment and all other elements of the infrastructure) plus a reasonable profit” (CRT Resolution 034 of 1995). The point I want to stress is that the above definition, which resembles the Baumol-Willig rule, is close to one that allows profit-maximizing behavior.²³

Lastly, Law 142 of 1994 (art. 14) and CRT Resolution 087 have defined the regimes of tariffs to apply to public utilities. Currently, there exist three regimes of pricing (competition): regulated freedom status (*libertad regulada*) requires that the CRT set the tariffs; observed freedom status (*libertad vigilada*) allows the telecommunications operators to freely price, but prior to their public announcements, they must send their new price list to the CRT; non-regulated status (*libertad de tarifas*) places no restriction on telecommunications operators in setting their

²³ Although Resolution 034 was later rescinded, CRT initially set interconnection charges at \$30 (Colombian) per minute. Later on, the CRT set the current access charge of \$30 (Colombian pesos) [US\$0.023] for long distance operators (CRT Resolution 087 of 1997). In this resolution, the CRT is silent about the way it defines or sets the access charges.

tariff and no obligation with the CRT. The first regime is supposed to disappear once there is enough competition in the markets. Currently, the LECs cannot increase their local tariffs as much as they want. In general, CRT has determined a methodology for annual increases in the local tariffs. As a rule, all LECs and LDO increase their tariffs and access charges by the maximum allowed.

The CRT has also ruled that tariffs for either local or long distance calls will be set by the operators once there exists enough competition in both local telephony and long distance services. Currently, the annual increase in the long distance service must not be above the central bank's ceiling on inflation.

4.3 The Model

4.3.1 The Current Setting

Suppose two local exchange carriers, \forall and \exists , located in cities A and B²⁴ provide local phone service and interconnection for long distance service (assume only national services). Assume that *neither* of the LECs is vertically integrated and each is a monopoly in its own city. Also assume that there exists an incumbent in the long distance market –call it company X- that is not vertically integrated and that provides national long distance services for consumers located in cities A and B.

A national long distance call can be thought of as consisting of three main components. Figure 1 shows how a long distance call is composed of an access charge for the use of the network of the LEC located in city A and another for the LEC in city B, and a third component labeled “transport” for connecting callers in cities A and B. Assume that two units of access are needed to complete a long distance call, one for terminating calls and one for originating calls. In

²⁴ One can think of A and B as follows: a) city A is the capital or any other large city and b) city B is a city of similar size or the summation of some cities such that their aggregate size is similar to that of city A. This will be a simplifying assumption that eases the math involved and make the results intuitively more clear.

this sense, the originating and terminating components are perfect complements. The long distance service is, then, a composite good composed of the two access charges and transport.

4.3.1.1 The local phone market

The municipalities of the cities are the only owners of the LEC, but the central government has imposed the conditions that LECs cannot transfer money to the municipalities and that LECs have to be self-financing. Therefore, I assume that both LECs are profit-maximizing firms that set their local tariffs and negotiate independently and separately their interconnection agreements and access charges with the LDO, company X.²⁵ For simplicity, I assume that the revenue earned for local tariff is zero (implicitly, there are no costs for local phone service). This is not a realistic assumption but assuming otherwise adds nothing to the focus of this study.

I assume that the constant marginal costs²⁶ of both LECs α and β for providing interconnection (access) are C_A and C_B , respectively. Following Sibley and Weisman (1997), I also assume that there is a fixed proportion relationship between the access charges, t , that each LEC provides and Q , a unit of long distance call. This unit includes the fraction for originating, the fraction for terminating and a fraction for call set-up, busy signal etc. Then the relationship between a unit of access, t , and a unit of long distance call, Q , is $t_i = \lambda Q^i$, where $\lambda \geq 1$.²⁷ LECs

²⁵ Although the CRT has established that operators must freely reach agreements, it has also mandated that all the agreements are subject to modification by the CRT *if* there is any practice contrary to free competition. See CRT Resolution 087 of 1997, Art. 4.13-4.19.

²⁶ I assume that the total marginal cost for providing access or interconnection is the sum of access plus usage costs. The first is the cost of being able to connect the subscriber to the whole network, and is independent of calls; the second is affected by the distance, which a call travels (in the network of the LEC) and the amount of switching required to handle a call.

²⁷ In the case of the United States, Sibley and Weisman (1998b) found that $\lambda = 1.6$.

α and β sell all units of access charges, t , at prices α and β .²⁸ Given the demands of access charges t_A and t_B , firm α solves

$$\underset{\alpha}{Max} \quad \pi_{\alpha} = (\alpha - C_A)t_A + (\alpha - C_A)t_B \quad (1)$$

And firm β solves

$$\underset{\beta}{Max} \quad \pi_{\beta} = (\beta - C_B)t_B + (\beta - C_B)t_A \quad (2)$$

$$t_A = \lambda Q^A, \text{ and } t_B = \lambda Q^B \quad (3)$$

where t_A and t_B are the demand for access needed to make possible long distance basic voice telephony from cities A and B. One can interpret equation 1 as follows: the first term represents the profits from access charge for outgoing long distance calls, the second one represents the profits from incoming long distance calls. The same applies to equation 2.

For simplicity, normalize λ so that $\lambda = 1$. Then, $t_A = Q^A$ and $t_B = Q^B$. Profit functions for LECs are

$$\underset{\alpha}{Max} \quad \pi_{\alpha} = (\alpha - C_A)Q^A + (\alpha - C_A)Q^B \quad (1')$$

$$\underset{\beta}{Max} \quad \pi_{\beta} = (\beta - C_B)Q^B + (\beta - C_B)Q^A \quad (2')$$

4.3.1.2 The long distance market

The long distance operator, company X, is the incumbent monopolist and needs to interconnect to the networks of companies α and β . For the provision of the long distance service, the LDO charges a final price P_A and P_B to consumers for calls from city A to city B, and vice versa. As mentioned earlier, the level of incomes of cities A and B may be different, but I assume, for simplicity, that they are identical.

²⁸ Although it may lead to some confusion, I will use the same notation for the names of the LECs and the prices they charge for interconnection. I hope this warning will reduce any possible misunderstanding.

As explained above, company X is a profit-maximizing firm. To simplify the analysis further in the second setting, I assume that company X maximizes profit by manipulating quantities rather than prices.²⁹ Therefore, X solves:

$$\underset{Q^A, Q^B}{Max} \pi_X = P_X^A Q^A - [C_X + \alpha + \beta] Q^A + P_X^B Q^B - [C_X + \alpha + \beta] Q^B \quad (4)$$

where $P_X^A = a - bQ^A$ and $P_X^B = a - bQ^B$ are the inverse demand functions (for long-distance services) from cities A and B, respectively.

I assume that company X incurs a marginal cost C_x per long distance call. For this first attempt, I put aside fixed costs.³⁰ The demands for long distance calls from city A and B are Q^A and Q^B respectively.

The last assumptions I make are that consumers in both cities derive their utility from incoming and outgoing calls. These are equal, and there is *always* an interior solution.

4.3.2 Timing and Game Structure

The strategic interactions among the operators can be thought of as a two-stage game with complete information. In the first stage, the LECs engage in simultaneous and separate negotiations with company X for the interconnection fees α and β , knowing each other's

²⁹ Having company X choose quantities rather than prices is based on the sequence of decisions. However, as Hinton et al. (1997, p. 187) state, referring to the choice of level of output, "This behavioral assumption has recently been characterized as reasonable for the long-distance industry by economists at the FCC." In effect, X makes its capacity decision, which determines quantities. Alternatively, I could appeal to Kreps and Scheinkman (1983), who establish conditions under which capacity decisions (i.e., commitments to intermediate goods purchases) followed by price are analogous to Cournot competition. See also Tirole (1989, p. 215-18) for more detailed explanations.

³⁰ Currently, Telecom bears a large portion of the social telephony. However, the creation of the Communication Fund and the implication rule imposed on potential new entrants will reduce those fixed costs. Although as mentioned above, there are very high (fixed) labor costs, they may be incorporated easily into the model without changing dramatically the main results. Hence, it is not unrealistic to put them aside.

demand function and technology. In the second stage, once the access charge has been arranged, company X sets the end-to-end service tariff P_A and P_B to consumers in cities A and B.

4.3.3 Analysis and Equilibrium Prices P_X^A, P_X^B, α^* and β^*

As explained in Fudenberg and Tirole (1991), backward induction can be applied to any finite game of perfect information. Solving by backward induction in this two-stage game, I can find the sub-game perfect equilibrium. In the second stage, company X chooses the output level for long distance calls, taking as given the access charges α and β , i.e., $Q^A(\alpha, \beta)$ and $Q^B(\alpha, \beta)$. In the first stage, once the LDO has chosen its level of output, each LEC maximizes independently and separately its profit functions to get its access charges. In equilibrium, each LEC chooses its access charges by predicting correctly the tariffs the LEC in the other city will charge, and the final output level chosen by company X.

Hence, solving backwards, I have that from maximization of (4) and get:

$$Q^A(\alpha, \beta) = [a - C_X - \alpha - \beta] / 2b \quad (5)$$

$$Q^B(\alpha, \beta) = [a - C_X - \alpha - \beta] / 2b \quad (6)$$

Once the incumbent X has determined its level of output in the first stage, LECs α and β choose their optimal access prices. From the maximization of (1') and (2') and having the call volumes from cities A and B, $Q^A(\alpha, \beta)$ and $Q^B(\alpha, \beta)$, one gets the reaction functions,

$$\alpha(\beta): a - [C_X + C_A + \beta] - 2\alpha = 0$$

$$\beta(\alpha): a - [C_X + C_A + \alpha] - 2\beta = 0,$$

By solving this pair of equations, the equilibrium access prices α^* and β^* are found.

Now, plug these values into $Q^A(\alpha, \beta)$ and $Q^B(\alpha, \beta)$ and one has the following result:

Result 1: Given the above assumptions, the incumbent's equilibrium quantities (prices) and LECs' access charges for the current scenario are

$$Q^{A*} = Q^{B*} = \frac{a - C_A - C_B - C_X}{6b} > 0$$

$$P_X^{A*} = P_X^{B*} = \frac{5a + C_A + C_B + C_X}{6}$$

$$\alpha^* = \frac{a + 2C_A - C_B - C_X}{3}$$

$$\beta^* = \frac{a + 2C_B - C_A - C_X}{3}$$

Some comments are in order. First, notice that although company X can set different prices for cities A and B, in equilibrium they are equal in both cities. This result may reflect the fact that company X being a monopoly, treats the two cities, like if they were a single market. Or, given that the elasticities are the same, the incumbent has no gain from discriminating. This, in fact, is the result one can see in Colombia, where Telecom prices the same for calls between cities no matter where the call originates. Second, access charges are symmetric. More than that, they show that each LEC's income for its access charges would decrease whenever inefficiencies, either by the incumbent or by the other LEC, increase, $\frac{\partial \alpha}{\partial C_X} = \frac{\partial \beta}{\partial C_X} = \frac{\partial \alpha}{\partial C_B} = \frac{\partial \beta}{\partial C_A} < 0$.

It is easy to show that replacing the equilibrium values found in Result 1 into equations (1'-2') and (4) gives the level of profits for the two LECs and the LDO. Thus I have Result 2.

Result 2: Given the prices and quantities found in result 1, profits for the LECs and the LDO are:

$$\pi_\alpha^* = \pi_\beta^* = \frac{[a - C_A - C_B - C_X]^2}{9b}$$

$$\pi_X^* = \frac{[a - C_A - C_B - C_X]^2}{18b}$$

Since demands from cities A and B, in equilibrium, are the same, LECs' profits are the same. And since the local phone companies get income from incoming and outgoing calls, their profits are twice the incumbent's.

Now, given the linearity of the inverse demand function, define consumer surplus for city A and B as:

$$CS_{P_i} = \frac{[a - P_i](Q^{A^*} + Q^{B^*})}{2}, \quad i = A, B. \quad (7)$$

Total Consumer Surplus, TCS, is just the sum of the consumer surplus in cities A and B.

Next, define total welfare as follows:

$$TW = \pi_X + \pi_\alpha + \pi_\beta + TCS \quad (8)$$

Now, it is easy to show that by substituting the equilibrium values found in Result 1 and the outcomes in Result 2 in equations 7 and 8, one obtains Result 3.

Result 3: Given the equilibrium prices and quantities found in Result 1, consumer surplus, CS, in cities A and B, total consumer surplus, TCS, and total welfare, TW, are

$$CS_A^* = CS_B^* = \frac{[a - C_A - C_B - C_X]^2}{36b}$$

$$TCS_{A+B}^* = \frac{[a - C_A - C_B - C_X]^2}{18b}$$

$$TW^* = \frac{[a - C_A - C_B - C_X]^2}{3b}$$

It is easy to show that given Results 2 and 3, the following also holds

$$\pi_\alpha = \pi_\beta > \pi_X$$

This result demonstrates that both LECs earn money from originating and terminating calls, while the incumbent X gets money only from the composite good (the long distance call).

4.4 The Competitive Setting

I now turn to the analysis of the competitive scenario. Recently, CRT issued a resolution opening the long distance market. To become a new operator in this market, some requirements must be satisfied. The most important ones are that one of the partners must be a LEC that has at

least 150,000 installed lines, and that it has to team up with an international partner with extensive experience in the telecommunications market.³¹

I model a situation where the new LDO is a utility company with shares in the stock market.³² I suppose that one of the LECs teams up with a foreign company to form the *new company*, Y . Consequently, in this setting, like in the former one, there are *two* LECs, α and β , located in cities A and B, that provide local phone services and interconnection for long distance services. However, one of the LECs is *vertically integrated*, i.e., it provides local and long-distance services. Figure 2 shows the new scenario. Here, company Y is a *subsidiary* of company β and this is represented by bold contour lines.

As in the former setting, company Y has to interconnect with the local operator α in city A, as well as with β in city B, paying access charges for originating and terminating calls. Company X is not integrated but also has to interconnect with α and β . The LEC in city A is an independent provider of local service and interconnection.

This scenario contains an important feature. I assume that LEC \exists sets its access charges by maximizing the profits of the integrated firm, for example, the sum of the upstream profits plus downstream profits, given an exogenous profit share r . Here, r is the share of Y 's profits that LEC \exists KEEPS, AND $(1 - r)$ is the portion of Y 's profits that the foreign company takes out the

³¹ More specifically, the resolution demands that new entrants have an international operator as a partner have an operating contract with one. This operator must have had more than 400 million minutes in international calls during the year previous to the beginning of operations. The LEC (or LECs if they team up) must not have more than 35% of the total installed lines in the nation. I model the competitive situation like the one where there is a foreign company as a partner of the LEC. Even in the extreme case, where the foreign company enters only through an operating contract, we can think of it as if the fees for this contract were part of the total profits earned by the new LDO.

³² The long distance service can be provided directly by a LEC (or group of LECs) or by a subsidiary of a LEC. I will work the second case because, so far, it is the most interesting.

country. This jointly maximization approach is shared by many researchers (see, Vickers [1995a], and Economides [1998]).

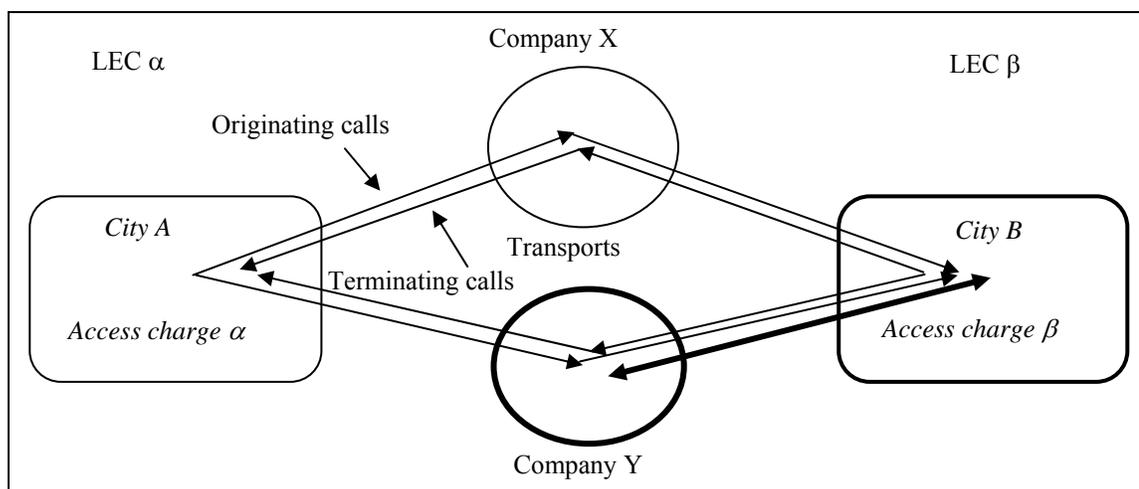


Figure 4.2 The Competitive Scenario

Another approach would be to consider the LEC maximizing its own profit function, i.e. choosing the optimal access charge over its upstream profits, without taking into account the profits of its downstream subsidiary. This behavior may be the result of regulatory constraints or due to some other reasons (see Sibley and Weisman [1998b]).

Furthermore, company Y is modeled as a *fully separate subsidiary* competing in the long distance market, the shares of which are owned partially by the LEC β , foreign investors, and other investors, whether private or public. All these investors care primarily about the profits of the subsidiary. Besides, the CRT has established that interconnection is mandatory and that the owners of essential facilities cannot discriminate against their downstream competitor(s) (if integrated vertically). Therefore, I assume that company Y maximizes the level of output only over its profit function, taken as given the access charges that α and β determine in equilibrium.

4.4.1 The Long Distance Market

The long distance market is now a duopoly with two companies, X and Y. Both companies need to interconnect to the networks of companies α and β to provide long distance

service. Companies X and Y behave as profit-maximizing firms. Company X and Y, given the access prices α and β , solve:

$$\underset{q_X^A, q_X^B}{Max} \pi_X = P_X^A Q^A + P_X^B Q^B - [C_X + \alpha + \beta][Q^A + Q^B] \quad (9)$$

$$\underset{q_Y^A, q_Y^B}{Max} \pi_Y = P_Y^A Q^A + P_Y^B Q^B - [C_Y + \alpha + \beta][Q^A + Q^B] \quad (10)$$

Notice that since I assume that LEC β is a fully separate subsidiary, Y's profit function is similar to X's.

Here, $P_X^A = P_Y^A = a - bQ^A$ and $P_X^B = P_Y^B = a - bQ^B$ are the prices that companies X and Y set for the long distance calls from city A and B respectively. And $Q^A = q_X^A + q_Y^A$ and $Q^B = q_X^B + q_Y^B$ represent the total demand for long distance calls that callers from cities A and B make.³³ The entrant Y also incurs a marginal cost C_Y per long distance call. One assumption will be crucial here that $C_X > C_Y$. Company X utilizes modern technology, including a modern fiber optic network, but has high labor costs involving excess workers, early pensions, and so forth. Thus, the operating costs (marginal) end up being (very) large. The new entrant, Y, is assumed to have up-to-date technology in long distance telecommunications. One way or another, it will be associated with foreign firms, which may cause its operating costs to be somewhat lower. This scenario captures the current and actual features of the Colombian telecommunications sector.

It is worth recalling the role of fixed costs. The new LDO has to build its own backbone of networks (or lease it from the incumbent, X) and provide long distance service to some cities according to a timetable. Besides the initial cost of the license, the entrant has to incur, then, some (high) fixed costs,³⁴ while the incumbent does not have to pay for a license and has amortized its

³³ I implicitly assume that the goods (long distance calls) are perfect substitutes.

³⁴ Thus far, two of the large Colombian LECs have decided to enter the long distance market, Empresa de Teléfonos de Bogotá (ETB), and Empresas Públicas de Medellín (EPM). EPM, the second largest LEC, has estimated that the cost to build the backbone network, using fiber optic

current equipment and infrastructure over time. To simplify the problem, I will assume away the fixed costs in this study.

4.4.2 The Local Exchange Carriers

In this competitive setting the game is as follows. In the second period, the local exchange carriers maximize their objective functions, choosing their optimal level of access charge, \forall and \exists . Then, in the first period, the long-distance provider will determine the optimal level of capacity it can provide. As in the original setting, the LECs earn income just from the tariffs they charge LDOs for interconnection. To provide interconnection service, they incur a marginal cost per call, whether at the originating or terminating end of the call, C_A and C_B . But now the objective functions for the local exchange carriers differ because of the vertical integration of LEC \exists with the long distance company Y. Hence, local exchange carrier α solves:

$$\underset{\alpha}{Max} \quad \pi_{\alpha} = (\alpha - C_A)Q^A(\alpha, \beta) + (\alpha - C_B)Q^B(\alpha, \beta) \quad (11)$$

But now local company β has teamed up with a foreign company to form company Y. Recall that CRT resolution established that every new entrant in the long distance market must have a local phone company as a partner. This may give the LECs greater bargaining power. However, the foreign company is needed for the full operation of the new long distance operator, and many potential partnerships are possible.³⁵ In the present study, I do not model the bargaining

technology, is about \$200 million US. See "EPM se convierte en un gran inversionista," el Tiempo, Noviembre 7 de 1997, Internet Press Release. ETB has estimated that the infrastructure of the telecommunications network will cost about US\$100 million, see "En seis meses, la ETB dara servicio de larga distancia," El Tiempo, Noviembre 25, 1997, Internet press release.

³⁵ So far, according to press releases, five well-known foreign operators have shown some interest in entering the market independently. These are MCI, Bell Canada, France Telecom, Deutsche Telekom and Sprint; see, "Larga distancia en espera," Poder y Dinero, Nov. 1997, "Telefónicas locales arman tordo aparte," El Tiempo, October 3, 1997, and "Dos divorcios en larga distancia," El Espectador, October 3, 1997, Internet Press Releases.

outcome between company β and the foreign investors. Instead, I assume that there exists a given share of company Y's profits $(1-r)$ that company β shares with its foreign associates, and that the LEC makes the maximization decision.³⁶ Therefore, company β solves:

$$\text{Max}_{\beta} \Pi = r \pi_Y + \pi_{\beta}, \text{ or} \quad (12)$$

$$\begin{aligned} \text{Max}_{\beta} r[P_Y^A Q^A + P_{Y_B} Q^B - (C_Y + \alpha + \beta)(Q^A(\alpha, \beta) + Q_B(\alpha, \beta))] + \\ (\beta - C_{\beta})(Q^{\beta}(\alpha, \beta) + Q^A(\alpha, \beta)) \end{aligned}$$

Institutional assumptions:

As explained above, one institutional assumption is that the marginal costs of the incumbent, company X, are greater than the marginal costs of the entrant, company Y.

$$(A1) C_X > C_Y.$$

Technical assumption:

One technical assumption regarding parameters will be needed to make comparisons between the current scenario and the competitive one once the new entrant, company Y, enters.

This is:

$$a > 4C_X - 3C_Y + C_A + C_B \quad (A2)$$

This assumption guarantees that all quantities are positive. More than that, it also ensures positive end-to-end and access prices.

4.4.3 Timing and Game Structure

I model the interactions between the LECs and the LDOs as a two-stage game with **complete information**, as in the first setting. In the first stage, the LECs maximize their profits for the interconnection fees, α and β , knowing each other's demand function and technology. In

³⁶ This may be thought of as if the reservation profits (opportunity costs) for the foreign company were zero.

the second stage, once the access charges have been established, the LDOs behave as Cournot competitors with regard to their output decisions.³⁷ These output choices determine demands for the intermediate good (originating and terminating access). The cost structure is also known from the beginning.

For the subsequent analysis, I will first deal with the general case. Then I will work two extreme cases. I call the first case, where $r = 0$, the full sharing of profits, or 100%-sharing; i.e., the foreign company takes all the profit. I call the case where $r = 1$, when the local loop β is the only owner, null sharing profits or 0%-sharing. These two extreme cases allow insight into whether the sharing of profits can (or cannot) be harmful for total welfare.

4.4.4. General Case r.

Recall that LDO Y is a profit-maximizing firm that takes as given the access charges that LECs α and β choose. One can think of this as a naive assumption, in the sense that the integrated (or parent) company may have incentives to try to foreclose rivals, company X here. But since my main purpose is to answer concerns about the deregulation process in the long distance market, I do not address this point.

In a backward way, in the second stage, profit maximization by LDO X on the choice of level of output $q_i^j = X, Y; j = A, B$ requires:

$$\frac{\partial \pi_X}{\partial q_X^A} = a - 2bq_X^A - bq_Y^A - [C_X + \alpha + \beta] = 0 \quad (13)$$

$$\frac{\partial \pi_X}{\partial q_X^B} = a - 2bq_X^B - bq_Y^B - [C_X + \alpha + \beta] = 0. \quad (14)$$

³⁷ See footnote 29 for a full explanation.

Profit maximization by company Y on the level of output requires,³⁸

$$\frac{\partial \pi_Y}{\partial q_Y^A} = a - 2b q_Y^A - b q_X^A - [C_Y + \alpha + \beta] = 0 \quad (15)$$

$$\frac{\partial \pi_Y}{\partial q_Y^B} = a - 2b q_Y^B - b q_X^B - [C_Y + \alpha + \beta] = 0. \quad (16)$$

From these four equations we can find the total long distance calls made by consumers from city A and B, taking as given the access charges α and β , i.e., $Q^A(\alpha, \beta)$, and $Q^B(\alpha, \beta)$.³⁹

$$q_X^A(\alpha, \beta) = \frac{(a - b q_Y^A - [C_Y + \alpha + \beta])}{2b} \quad q_X^B(\alpha, \beta) = \frac{(a - b q_Y^B - [C_Y + \alpha + \beta])}{2b} \quad (17)$$

$$q_Y^A(\alpha, \beta) = \frac{(a - b q_X^A - [C_Y + \alpha + \beta])}{2b} \quad q_Y^B(\alpha, \beta) = \frac{(a - b q_X^B - [C_Y + \alpha + \beta])}{2b} \quad (18)$$

Next, in the first stage, after substituting the corresponding above expressions into equations (11) and (12), LECs manipulate the (access) prices. Then, LEC profit-maximizing over α requires:

$$\frac{\partial \pi_\alpha}{\partial \alpha} = 4a - 2C_X - 2C_Y + 4C_A - 8\alpha - 4\beta = 0. \quad (19)$$

The parent company, LEC β , maximization over profits requires:

$$\frac{\partial \Pi}{\partial \beta} = -2r[a + C_X - 2C_Y - \alpha] + 2r\beta + 3[2a - 2\alpha - C_X - 2C_Y] - 12\beta = 0 \quad (20)$$

Result 4: The equilibrium access prices charged by local exchange carriers α and β are:

$$\alpha^* = [6a + 2(6 - r)C_A + (3r - 3)C_X - (3 + 3r)C_Y - 6C_B] / (2(9 - r))$$

$$\beta^* = [2(3 - r)a + 2(r - 3)C_A - (5r + 3)C_X + (7r - 3)C_Y + 12C_B] / (2(9 - r))$$

³⁸ The second order condition for both firms' maximization is $b < 0$.

³⁹ Recall that $Q^A = q_X^A + q_Y^A$ and $Q^B = q_X^B + q_Y^B$.

Proof. To obtain this result, just solve equations (19) and (20).

From Result 4, I obtain some interesting, although well-known, facts. The first is that, to the extent that assumptions 1 and 2 hold, LEC β 's access price is decreasing in r . More formally, I found that $\frac{\partial \beta}{\partial r} < 0$. This result is not surprising. Intuitively, it says that whenever r increases (i.e., β becomes more vertically integrated), LEC β reduces the impact of double marginalization.

From that it is easy to arrive at the following result.

Result 5: Access price β is decreasing in r .

Proof. See Appendix C.

Intuitively one can reason as follows. As r increases, LEC β 's stake in company Y increases. The limit will be reached when the firm is completely integrated, i.e., $r = 1$. A well-known fact in industrial organization is that when two monopolies interact there exists double marginalization. Here, the increase in r reduces the double marginalization.

Some comparative static exercises can be made. The gains (losses) of efficiency by the incumbent, company X, and LEC α tend to increase (decrease) the access price LEC β demands no matter how integrated β is. In contrast, with regard to its subsidiary, LDO Y, the effect is ambiguous, depending on the value of r .

If $r = 3/7$, then the access price for LEC β does not depend on the marginal cost of its subsidiary company Y. For values greater than that, access charge β will increase, and for values less than $r = 3/7$, it will decrease. This may suggest that the parent company, LEC β might be interested in getting some degree of control, i.e., $r > 3/7$, if it values its upstream profits more than its downstream ones.

The second outcome, derived from result 5, is that α 's income should increase because the double marginalization in access price β tends to zero,⁴⁰ which decreases the end-to-end service price. Indirectly, the local phone company in city A is better off because of the increase in the quantity of long distance calls, and thus it can increase its access price. Then I have

Result 6: Access price α is increasing in r .

Proof. See Appendix C.

It is worthwhile looking at some comparative statics of the parameters on access price α . First, for whatever value of r , a decrease in the marginal cost of LDO Y or LEC β tends to increase the access charge α , i.e., $\partial\alpha/\partial C_Y = \partial\alpha/\partial C_B < 0$. Also, the effect of an increase in the incumbent's costs, company X, is also mostly negative, although in the case of $r = 1$, access price α will not depend on it at all.

Result 7: Given Results 5 and 6 the equilibrium level of output by companies X and Y is

$$q_X^A = q_X^B = [a - C_A - 5C_X + 4C_Y - C_B + rC_X - rC_Y]/(9-r)b$$

$$q_Y^A = q_Y^B = [a - C_A + 4C_X - 5C_Y - C_B]/(9-r)b$$

Furthermore, $q_Y^A = q_Y^B > q_X^A = q_X^B$.

Proof. This proof is straightforward. Take the values of α and β found in Result 4 and plug them into equations (16) to (17) and you will have the above quantities ♦

This again is not surprising. Since we assume that company Y has a cost advantage over company X, it is natural that company Y obtains a larger market share. But as long as the cost inefficiency tends to disappear, i.e., if $C_X \cdot C_Y$, the companies will share the market in equal parts.

Result 8: Given Result 7, the total quantity of long distance calls from cities A and B and the

⁴⁰ Recall that the market structure in the telecommunications sector is that LECs are monopolies. As Tirole (1989, p. 175) states, "What is worse than a monopoly? A chain of monopolies." In our

equilibrium prices are

$$Q^A = Q^B = [2a - 2C_A - C_X - C_Y - 2C_B + rC_X - rC_Y] / (9 - r)b$$

$$P^A = P^B = [7a - ar + 2C_A + (1 - r)C_X + (1 + r)C_Y + 2C_B] / (9 - r)$$

Proof. Again, take the values of \forall and \exists found in Result 4 and put them into the equilibrium values for total quantities and prices \blacklozenge .

It is easy to show that $\frac{\partial Q^A}{\partial r} = \frac{\partial Q^B}{\partial r} = \frac{\partial P^A}{\partial r} = \frac{\partial P^B}{\partial r} > 0$. This is very intuitive because,

as shown in Result 6, the effect of r on access charge β is negative. This tends to decrease the final price of long distance calls and increase the total calls made by consumers.

With the equilibrium values of α^* , β^* , Q^A , Q^B , P^A and P^B , it is straightforward to find the profit values for all the companies and total consumer surplus in city A and B. One needs only to plug them into the equations (5) to (8) to obtain the following result.

Result 9. The equilibrium profits for LDOs and LECs and total consumer surplus TCS are

$$\pi_X^* = [a - C_A - 5C_X + 4C_Y - C_B + rC_X - rC_Y]^2 / ((9 - r)^2 b)$$

$$\pi_Y^* = [a - C_A + 4C_X - 5C_Y - C_B]^2 / ((9 - r)^2 b)$$

$$\pi_\alpha^* = 3 [2a - 2C_A - C_X - C_Y - 2C_B + rC_X - rC_Y]^2 / ((9 - r)^2 b)$$

$$\pi_\beta^* = [6a - 2ar - 6C_A - 3C_X - 3C_Y - 6C_B - 5rC_X + 7rC_Y + 2rC_A + 2rC_B]^*$$

$$* [2a - 2C_A - C_X - C_Y - 2C_B + rC_X - rC_Y]^2 / ((9 - r)^2 b)$$

$$TCS^* = 2 [2a - 2C_A - C_X - C_Y - 2C_B + rC_X - rC_Y]^2 / ((9 - r)^2 b)$$

case, becoming more integrated and maximizing over total profits, LEC β reduces the double marginalization.

Besides the fact that all these objective functions are positive, the only intuitive results come from the comparative statics. How sensitive are these to an exogenous change in the level of r ? I found that, bearing in mind the assumptions A1 and A2, all the above expressions tend to increase positively as r increases, with the exception of π_B , i.e., $\frac{\partial \pi_X}{\partial r}, \frac{\partial \pi_\alpha}{\partial r}, \frac{\partial \pi_Y}{\partial r}, \frac{\partial TCS}{\partial r} > 0$.

The explanation is straightforward. The reduction in the double marginalization tends to decrease the access price for LEC in city B. This in turn affects positively the final price of long distance calls, i.e., it decreases. This increases the quantity of long distance calls consumers make. Hence, LDO Y, LEC α 's profits and TCS increase.

To answer the question, is TW increasing in r ? And is it always greater in the competitive scenario than in the current setting? I analyze the extreme cases where $r = 1$ and $r = 0$.

4.4.5 Extreme Cases $r = 0$ and $r = 1$

4.4.5.1 The full sharing of profits, $r = 0$

To be able to say in what setting total welfare is the most, given all the assumptions stated earlier, I analyze two extremes cases. Results 10 and 12 are easily found if one just replaces the value of r in the equilibrium expressions found in Results 4, and 7-8. So no formal proof is needed.

Result 10: Taking $r = 0$, the equilibrium access charges and end-to-end service prices for the competitive scenario are

$$\alpha^* = [2a + 4C_A - C_X - C_Y - 2C_B] / 6$$

$$\beta^* = [2a - 2C_A - C_X - C_Y + 4C_B] / 6$$

$$P_{r=0}^A = P_{r=0}^B = [7a + 2C_A + C_X + C_Y + 2C_B] / 9$$

Some comments can be made. First, access prices are symmetric because this case represents two LECs that are not at all integrated. In this case, access charges are more sensitive to the other LEC's marginal cost than to the LDOs. Second, long distance prices are more

sensitive to the marginal costs of the local phone companies. One can say that, given that each LEC is a monopoly in its own city, the structure of this model suggest that consumers are worse off in the case of fully independent operators. The double marginalization effect reduces welfare. Currently, regulators set the access charges by following closely the Baumol-Willig rule. But this rule, in the case of monopolies like the LECs, may mean that the opportunity costs are the monopoly profits.

Result 11: Given prices and quantities found in Results 9 and 10, profits for the local loops, the long distance operators, total consumer surplus (TCS) in cities A and B, TCS, and total welfare (TW) are

$$\pi_{\alpha_{r=0}}^* = \pi_{\beta_{r=0}}^* = [2a - 2C_A - C_X - C_Y - 2C_B]^2 / 27b$$

$$\pi_X^* = 2[a - C_A - 5C_X + 4C_Y - C_B]^2 / 81b$$

$$\pi_Y^* = 2[a - C_A + 4C_X - 5C_Y - C_B]^2 / 81b$$

$$CS_{A_{r=0}}^* = CS_{B_{r=0}}^* = [2a - 2C_A - C_X - C_Y - 2C_B]^2 / 81b$$

$$TCS_{r=0}^* = 2[2a - 2C_A - C_X - C_Y - 2C_B]^2 / 81b$$

$$TW_{r=0}^* = 2[4(2a - 2C_A - C_X - C_Y - 2C_B)^2 + (a - C_A - 5C_X + 4C_Y - C_B)^2] / 81b$$

Given the higher efficiency of the new entrant and assumption A2, in general it holds that,

$$\pi_{\alpha}^* = \pi_{\beta}^* > \pi_Y^* > \pi_X^*.$$

Also, it is easy to show that the outcomes in Result 11 lead one to conclude that

$$[\pi_{\alpha}^* + \pi_{\beta}^* + \pi_Y^* + \pi_X^*] > TCS$$

4.4.5.2 The null sharing of profits - $r = 1$

Result 12: Taking $r = 1$, the equilibrium access charges and end-to-end service prices for the competitive scenario are

$$\alpha_{r=1}^* = [6a + 10C_A - 6C_Y - 6C_B] / 16$$

$$\beta_{r=1}^* = [a - C_A - 2C_X + C_Y + 3C_B] / 4$$

$$P_{r=1}^A = P_{r=1}^B = [3a + C_A + C_Y + C_B] / 4$$

Some comments are in order here. First, notice that the end-to-end service price and the access charge do not depend on the marginal cost of the incumbent. In this case, because company β is fully vertically integrated, the double marginalization effect disappears. This result is not intuitively reasonable and deserves a careful thought. But I can say that the marginal costs of company X seem to be reduced once company β becomes more fully integrated.

Result 13: Given the prices and quantities found in Result 12, profits for the local loops, the long distance operators, and total consumer surplus are

$$\pi_{\alpha_{r=1}^*} = 3[a - C_A - C_Y - C_B]^2 / 16b$$

$$\pi_{\beta_{r=1}^*} = [a - C_A - C_Y - C_B][a - C_A - C_B + C_Y - 2C_X]^2 / 8b$$

$$\pi_{X_{r=1}^*} = [a - C_A - 4C_X + 3C_Y - C_B]^2 / 32b$$

$$\pi_{Y_{r=1}^*} = [a - C_A + 4C_X - 5C_Y - C_B]^2 / 32b$$

Result 14: Total welfare in the competitive scenario when $r=1$ is

$$TCS_{r=1}^* = [a - C_A - C_Y - C_B]^2 / 8b$$

$$TW_{r=1}^* = 5[a - C_A - C_Y - C_B]^2 / 16b$$

$$+ [a - C_A - C_Y - C_B][a - C_A - C_B + C_Y - 2C_X]^2 / 8b +$$

$$[(a - C_A - 4C_X + 3C_Y - C_B)^2 + (a - C_A + 4C_X - 5C_Y - C_B)^2] / 32b$$

4.5 Welfare Analysis and Other Results

As mentioned in the introduction, there has been substantial concern about the opening of the long distance market. It is feared that this will be harmful to the incumbent, company X, and affect total welfare. In this section, I compared the total welfare in the first scenario with the total welfare in the competitive setting. I ask, does full profit sharing ($r = 0$) hurt total welfare? In this the extreme case, where all the profits of the new entrant go abroad in this one-shot game. I proceed to analyze the situation, taking as benchmark the current scenario, where the only distance provider is the incumbent company X.

Given all the previous results, Table 4.1 shows how the different equilibrium outcomes found in both settings compare. The table will just show the direction of the inequalities. One can observe that, given the lower price and greater level of output demanded, total consumer surplus is greater in the potential competitive scenario than in the current setting. More than that, even in the case of full sharing of profits, i.e., where the foreign company gets all the profits from company Y, consumers as a whole are better off. Hence, the invitation of a foreign company *does not* hurt consumer surplus.

Variable	Monopoly		Competition		
			Full-Sharing		Null-Sharing
\forall	$\forall_{\text{MONOPOLY}}$	<	$\forall_{r=0}$	<	$\forall_{r=1}$
\exists	$\exists_{\text{MONOPOLY}}$	<	$\exists_{r=0}$	<	$\exists_{r=1}$
$Q_A = Q_B$	Q_{MONOPOLY}	<	$\{Q_A = Q_B\}_{r=0}$	<	$\{Q_A = Q_B\}_{r=1}$
$P_A = P_B$	P_{MONOPOLY}	>	$\{P_A = P_B\}_{r=0}$	>	$\{P_A = P_B\}_{r=1}$
TCS	TCS_{MONOPOLY}	<	$TCS_{r=0}$	<	$TCS_{r=1}$
B_X	$B_{X\text{monopoly}}$	>>	$\{B_X\}_{r=0}$	<	$\{B_X\}_{r=1}$
B_{\forall}	$B_{\forall\text{monopoly}}$	<	$\{B_{\forall}\}_{r=0}$	<	$\{B_{\forall}\}_{r=1}$
B_{\exists}	$B_{\exists\text{monopoly}}$	<	$\{B_{\exists}\}_{r=0}$	>	$\{B_{\exists}\}_{r=1}$
TW	TW_{MONOPOLY}	<	$TW_{r=0}$	<	$TW_{r=1}$

Nevertheless, company X's profits decrease. Still, this is due more to the introduction of competition than entry by a foreign company. Actually, as the table shows, the double sign (>>) means that company X profits are (much) greater in the benchmark setting than in the extreme cases of competition, $r = 1$ and $r = 0$; although company X's profits are higher when $r = 1$. I will refer more to this subject again later on.

Now the fact that company X's profits decrease when it faces competition is more than compensated by the *increase* in the profits of LECs A and B and company Y. This effect is of great importance because it shows that local phone companies that keep providing only local phone service will increase their revenue and profits, which may help them to finance the modernization of their networks and perform better in implementing social telephony. Indeed, all this leads to the main result in this study.

Proposition 1: The introduction of competition in long distance service will increase total welfare, TW, even when profits are appropriated by the foreign investor, i.e., $TW_{r=1} > TW_{r=0} > TW_{Monopoly}$.

Proof. See Appendix C.

This result is important because it suggests that the efforts of the Colombian government to introduce competition into the long distance service are justified. Besides, given that I assume (implicitly) that the reservation profits for the foreign company is zero, the optimal r is given by null sharing of profits, i.e., $r = 1$. Notice that a somewhat different result may be derived if one models a regulator maximizing over total welfare subject to a participation constraint greater than zero for a foreign company.

It is worthwhile showing some of the results in a different way. Bearing in mind the assumptions A1 and A2, I found,

$$\begin{array}{ll}
 \pi_{\alpha} > TCS & \forall r \in [0,1] \\
 \pi_{\alpha} = \pi_{\beta} & r = 1 \\
 \pi_{\alpha} > \pi_{\beta} & r < 1 \\
 \pi_Y > \pi_X & \forall r \in [0,1] \\
 \pi_{\alpha} > TCS = \pi_{\beta} > \pi_Y > \pi_X & r = 0 \\
 \pi_{\alpha} > TCS > \pi_{\beta} = \pi_Y > \pi_X & r = 1 \\
 \pi_X \cong 0 &
 \end{array}$$

when $r = 1$, \wedge if $a \cong 4C_X - 3C_Y + C_A + C_B$

The last result, which I want to highlight, is that the profits of company X, are almost zero when $r = 1$. That is, the level of calls provided by company X may be extremely low⁴¹ (close to zero). Otherwise, profits of company X will be positive. The policy implication is that company X must make reduce operating costs to keep having positive profits. With competition, an incumbent will always lose market share, but the losses are higher the greater its marginal costs (or its fixed labor costs).⁴² Concerns, by unions and other parties, that company X will lose market share and profits and not able to implement social investment may be true, but attributable to current inefficiencies (excessive labor force and too high wages) rather than to the opening of the long distance market to competition.

4.6 Conclusions

In this study, I have modeled the introduction of competition in the national long distance market in Colombia. The main results in the competitive scenario are as follows.

As competition reduces prices, the call volumes from cities A and B increase, as expected. Consequently, total consumer surplus in both cities also increases. The incumbent monopolist, company X, given its (assumed) cost disadvantages, sees its profits reduced. Total consumer surplus ranks higher under null profit sharing, i.e., $r = 1$ (100% foreign ownership of X).

The most important result is that the participation of a modern foreign phone company does not reduce the total welfare for the country. Although I do not include it, I can say that benefits would be even greater if service quality were explicitly taken into account.

⁴¹ Remember that A2 means that $a > 4C_X - 3C_Y + C_A + C_B$. However, one can write the expression as $a = 4C_X - 3C_Y + C_A + C_B + \varepsilon$, where $\varepsilon > 0$. Now if ε is very small, it may mean that total share for company X tends to be small, or that demand is very small.

⁴² $\frac{\partial q_X^A}{\partial C_X} < 0$, then as C_X increases, the equilibrium output level supplied by Company X goes down.

I found that the r -value that gives the *maximum* total welfare is $r = 1$. This is the case when a fully vertically integrated firm provides local (access) and long distance phone services. The result may be sensitive to the fact that the r is chosen exogenously. Further extensions could introduce into the model some factors put aside in this study. One of these issues is the cross subsidy problem. Another would be to try to obtain the equilibrium bargaining of profit sharing if regulators ensure the participation of foreign firms. Also, I would give a more active role to the LECs. Given the expected higher demand for services, how will LECs play their future strategies with regard to the expansion of their networks? Similarly, strategic investment by a global telecommunications company may involve different (lower) costs than assumed above. Dynamic cost-containment activities by the incumbent would be stimulated by LDOs entry. These considerations may reinforce the conclusions from this static model.

Lastly, I have not analyzed factors regarding the incentive by LEC β to raise rivals' costs or foreclose rivals. This subject has become central in discussions regarding whether to allow the Baby Bells to enter long distance markets in the United States. It may also be a concern for Colombian regulators, given the incentives that current LECs have to become more integrated.⁴³

⁴³ The interested reader can refer to Economides (1998), Sibley and Weisman (1998a), Beard et al. (1998) and Weisman and Zhang (1997), which deal nicely with this subject. See also Krayttenmaker and Salop (1986), Klass and Salinger (1995) and especially Noll (1995).

CHAPTER 5 CONCLUDING REMARKS

I have reviewed telecommunications reform in Latin America, with a specific focus on Colombia. In Chapter 2, I presented an analytical study of the development of regulatory governance in the region, analyzing ownership (privatization) reform and liberalization reform. Privatization was accomplished differently in Latin America than in the Asian Pacific region. The presence of foreign capital and well-known, international telecommunications carriers has been an important feature. Privatization reform failed in six countries (Colombia, Ecuador, Honduras, Nicaragua, Paraguay and Uruguay), and Costa Rica and Suriname have not taken any steps toward privatization.

Liberalization reform has been quite slow. Latin American governments sold and gave up control of the former state-owned telecom operators. Across the region, governments that privatized their PTOs were willing to grant exclusivity periods in order to sell their state-owned operators. This translated in monopolistic market structures, and there was no gain in social welfare in this case. Only recently, in the later privatization schemes, have governments been able to keep their markets open to competition.

The main contribution of my study is the creation of an index of the regulatory framework in telecommunications for 24 Latin American countries. The index shows that regulatory reform in the region was slow until the mid-1990s, when efforts increased to create more modern and independent regulators. Most countries created specialized regulatory agencies to deal exclusively with telecommunications. Some countries chose to have regulatory bodies within the minister of telecommunications.

My main conjecture throughout is that a better regulatory framework is essential for increasing the confidence level of private investors so that they will undertake investments in telecommunications. Because telecommunications investment is largely specific, is huge in economies of scale and is done to provide necessary services, governments may be tempted to behave opportunistically. If uncertain about government intentions, private investors will invest sub-optimally or may refrain altogether from investing. To overcome this potential problem, governments institute regulatory governance in the form of a specialized, autonomous regulatory body with the authority to constrain government opportunism. Hence, I test the hypothesis that the existence of a good regulatory framework is positively associated with two performance variables, main lines per 100 inhabitants and efficiency. In a parallel test, I examine how and to what extent privatization and liberalization affect main lines per 100 inhabitants and level of efficiency in telecommunications service.

The econometric results show that Latin American and Caribbean countries with a better regulatory framework will have greater network deployment no matter their level of income. Competition and privatization (ownership) for the whole sample are associated positively with the level of network development and main lines per employee. Ownership is related negatively to these variables, however, for the low-income countries.

The policy implications are straightforward. Those countries that target a greater level of main lines per 100 inhabitants and increased efficiency should strengthen their regulatory framework. It is shown that the gains for doing this are large.

Chapter 4 contains a stylized model showing that the opening of the Colombian long distance market is welfare enhancing. The main results are that the incumbent, Telecom, will lose market share, but consumers will gain because of a decline in prices and an increase in the provision of long distance services. Indirect winners will be the local exchange carriers, who benefit by the larger amount of access charges that competition brings. An interesting result is

the fact that the incumbent is unlikely to be driven from the market. However, as the assumption states, if the incumbent's costs are too high, it will likely lose a sizable amount of the market and may potentially quit. Further research should introduce into the analysis the fixed cost of the incumbent, Telecom, and the fixed amount required from the foreign investor to be able to participate. These factors and others not included might lead to different conclusions.

The main features associated with types of reform are listed below in a summary form.

Privatization/Ownership

- Presence of foreign capital (investors usually forming consortia)
- Presence of a strategic partner as a major stakeholder
- Transfer of control from former PTO
- Granting of long exclusivity periods by countries among the first to privatize (Argentina, Jamaica, Trinidad and Tobago, among others)
- Governments' demand for network expansion and improved quality of service
- Shares may be sold privately, to employees, and via public offerings
- Presence of worldwide carriers (Telefonica in Argentina, Chile, Brazil, Venezuela, Guatemala, Peru and El Salvador; MCI in Belize and Mexico; STET in Bolivia, Argentina and Chile; GTE in Mexico and Venezuela; Cable & Wireless in Barbados, Panama, Jamaica, Trinidad and Tobago); France Telecom in El Salvador and Mexico)

Liberalization Reform

- The first countries to privatize gave up long exclusivity periods (Argentina, Jamaica, Trinidad and Tobago, among others).
- Recent privatization has not required countries to give up exclusivity (Brazil and Guatemala, among others).
- Some countries have tried and are still trying to renegotiate the exclusivity formerly granted (Jamaica).
- One country liberalized its markets without privatizing (Colombia).
- Most countries in the region will liberalize in the early 2000s.

Regulatory Reform

- Most countries created regulatory bodies dealing exclusively with telecommunications.
- Some countries still have their regulatory agencies within the ministry of telecommunications.
- There is a pattern of development in the regulatory framework across sub-regions in the area.
- Almost all countries showed considerable progress in the strengthening of regulatory governance for telecommunications.

APPENDIX A
VARIABLES AND MAIN LEGISLATION PER COUNTRY FOR CHAPTER 2

Source of the Variables.

MLINES is main telephone lines: each line represents “a telephone connecting the subscriber's terminal equipment to the public switched network and which has a dedicated port in the telephone exchange equipment.” Main lines per one hundred inhabitants or *teledensity* is derived by taking (Main Lines/Population) *100. It is taken from ITU Database World Telecommunications Indicators 1997a.

GDPPC is the GDP per capita in 1990 US dollars; *TRADEGDP* is the ratio (export plus imports)/GDP and; *VSERGDP* is value added in the service sector as a percentage of GDP. These variables are taken from the (public) Inter-American Development Bank, IADB, Social and Economic Database.

The demographic variables *URBAN*, urban population represents the degree of urbanization. It is derived by taking (urban population/total population). *DENSITY*, population density is found as total population/ area. These variables are taken from the World Bank, "Economic and Social Indicators 1997 CD-ROM".

ICRG index is compiled by the IRIS (Center for Institutional Reform and the Informal Sector at the University of Maryland) using the Political Risk Services Group Information. This is a private international investment risk service company that employs experts to provide political and economic risk ratings of countries. We used the composite index that is made up of five components.

GOVTYPE index was constructed using the data provided by Jagers and Gurr (1996). We follow Londregan and Poole (1996) and combine the two measures of DEMOC and AUTOC (democracy and autocracy) to construct GOVTYPE. $S = \text{DEMOC} - \text{AUTOC}$. This raw measure creates a 21-point scale with a floor of -10, and a ceiling of 10. Applying the logistic transformation to it, we get $\text{GOVTYPE}(S) = \ln(S + 10.5) - \ln(10.5 - s)$. This converts scores to a truly continuous scale. A value of S at 10.5 would correspond to a T(S) of 4; an S of -10.5 corresponds to a T(S) at -4. The Polity III data-base also contains information on eight indicators of political framework: (1) Regulation of Executive Recruitment; (2) Competitiveness of Executive Recruitment; (3) Openness of Executive Recruitment; (4) Institutional independence of chief executive; (5) Constraints on Chief Executive; (5) Regulation of Political participation; (6) Competitiveness of Political Participation; and (7) Centralization of State Authority). For a more detailed description see Jagers and Gurr (1995).

THE ECONOMIC FREEDOM INDEX was constructed using the data provided by the Economic Freedom Network. The index is based on four major areas: (1) money and inflation, (2) structure of the economy, (3) takings and discriminatory taxes, and (4) international trade. The index we use is the simple sum of the four developed by Gwarthy and Robert (1997). The index is available for every five years starting in 1980 (1985, 1990 and 1995).

INSTINV or Institutional Investor Index is the average of the Country Credit Rating index that the *Institutional Investor* magazine publishes twice a year (March and September). The index goes on a scale of 0 to 100, with 100 representing those with the least chance of default. The sample of the study ranges from 75 to 100 banks, each of which provides its own ratings.

EUROMONEY is the average of the Country Risk rating index that the *EUROMONEY* magazine publishes twice a year. The index also goes on a scale of 0 to 100. The index is composed of nine categories each with different weighting. Economic performance and political risk account for 50% of the total index.

CELLSUB variable is the number of cellular subscribers per 100 inhabitants, taken from the ITU Database World Telecommunications Indicators 1997.

EFFICIENCY is the efficiency or productivity index. It represents the total main phone lines per telco employee. This index is constructed by using the total main phone lines and the total full telecommunications staff indicators provided by the ITU database disk.

THE STRUCTURAL POLICY INDEX is taken from the Inter-American Development Bank, IADB, (1997). Latin America After a Decade of Reforms, Economic and Social Progress in Latin America, 1997 Report, Washington, D.C. This index was constructed by Eduardo Lora an IADB researcher. His index covers 20 countries in the region from 1985 to 1995. "The structural policy index is a simple average of the policy indices of the following five areas: (i) trade policy, (ii) tax policy, (iii) finance policy, (iv) privatization, and (v) labor legislation. Each of the basic indices can move on a scale of 0 to 1, where 0 corresponds to the worst observation for any year and any country within the period and countries considered, and 1 is the best" (IADB, 1997, pp. 95). The most important feature of the index is that it reflects policy variables, like tariffs, tax rates and so on, and not results variables like ratio of exports to GDP and so on

THE GENERAL REFORM INDEX is a joint work of researchers in the ECLAC, Morley Samuel, Roberto Machado and Stefano Pettinato, (1999). This index covers 17 countries in the region and extends Lora's index by adding another reform's dimension and more years. The new dimension of reform is the control of foreign capital transactions. This index covers a period of years from 1970 to 1995.

Argentina.

1. Ley 19,789 de 1972. Ley Nacional de Telecomunicaciones
2. Decreto Ejecutivo 1,185 de 1990. It created the National Telecommunication Commission, NTC.
3. Decreto 1,260 de 1996. It merged the NTC with the National Post and Telegraph Commission into the National Communication Commission.
4. Decreto 1,620 and 1,626 de 1996. It set the Organizational structure of the Communications Secretary and the National Communication Commission.
5. Decreto 80 de 1997. It created the National Communications Commission.
6. Decreto 1,304 de 1998. It created the Subsecretary of Communications under the Secretary of Communications and assigned its responsibilities.

Barbados

1. Public Utilities Act of 1978. It set the regulatory norms of Public Utilities.
2. Telecommunications Act of 1991. It established the norms regarding all telecommunications services and matters.

Belize

1. Telecommunications Act of 1987. It set the general norms for telecommunications services.

Bolivia

1. Ley General de Telecomunicaciones. It defined the telecommunications services and created the Directorate for Telecommunications (Dirección General de Telecomunicaciones).
2. Ley SIRESE or Ley 1,600 de 1994. It created SIRESE (Sistema de Regulación Sectorial) tasked with providing oversight for five utility sectors, including Telecommunications. It created the Superintendence of Telecommunications.
3. Ley de Telecomunicaciones de 1995 o Ley 1,632 de 1995. It set general norms, responsibilities and roles of the Superintendence of Telecommunications.

Brazil

1. Decreto-Lei de 1967. It created the Minister of Communications.
2. Lei Mínima de 1996 ou Ley 9.295 de 1996. It established regulations about telecommunications services.
3. Lei 9,472 de 1997. It created ANATEL (Agência Nacional de Telecomunicações) as the regulatory agency for telecommunications in Brazil
4. Decreto 2,338 de 1997. It set ANATEL (Agência Nacional de Telecomunicações).

Chile

1. Decreto 1,762 de 1977. It created the SubSecretary of Telecommunications and set its responsibilities.
2. Ley General de Telecomunicaciones de 1982, or Ley 18,168 de 1982. It set the norms for telecommunications services. It (re)set the responsibilities of the Subsecretary of Telecommunications.

Colombia

1. Decreto 3,069 de 1978. It empowered the National Board of Public Services with the responsibilities of setting tariffs and control telephone rates.
2. Decreto 129 de 1976. It separated regulatory activities from the operating ones. The regulatory activities are granted to the Minister of Communications.

Decree 2122 de 1992. It reorganized the Minister of Communications and created the CRT (Comisi.:n de Regulaci.:n de Telecomunicaciones) Regulatory Commission of Telecommunications.

3.Ley 142 de 1994. It (re) created the CRT and set its final responsibilities.

Costa Rica

1.Decreto-Ley 3226 de 1963. It created the ICE (Instituto Costarricense de Electricidad).

2.Ley 7,593 de 1996. It created ARESE (Autoridad Reguladora de Servicios Publicos), the regulatory agency for public utilities and set its responsibilities and roles.

Ecuador

1.Ley Especial de Telecomunicaciones de 1992. It set a supervisory body to rule the telecommunications sector.

2.Ley Especial de Telecomunicaciones Reformada. de 1995. It created CONATEL (Comisi.:n Nacional de Telecomunicaciones), SENATEL (SecretarPa Nacional de Telecomunicaciones) and SUPTEL (SuperIntendencia de Telecomunicaciones) as regulatory bodies for the telecommunications in Ecuador.

3. Modificaci.:n a la Ley Especial de Telecomunicaciones Reformada o Decreto-ley 17 de 1997.

El Salvador

1.Ley de Creaci.:n de la SIGET, Decreto No 808 de 1995. It created the SIGET (Superintendencia General de Electricidad y Telecomunicaciones and set its responsibilities and roles.

2.Decreto Legislativo No 807 de 1996 o ley de Telecomunicaciones. It created the general norms that rule the telecommunications sector.

3.Decreto 142 de 1997, o (nueva) Ley de Telecomunicaciones. It re-set the norms and regulations for the telecommunications sector and the roles and responsibilities of SIGET.

Guatemala

1.Decreto No 94 de 1996. Ley General de Telecomunicaciones. It set the norms that rule the telecommunications sector in Guatemala. It created SIT (Superintendencia de Telecomunicaciones) as the regulatory body responsible for regulating the sector.

2.Decreto 115 de 1997, o Reforma a la Ley General de Telecomunicaciones. It supplemented the Decreto No 94 de 1996 and amended.

Guyana

1.Public Utility Commision Act No 26 of 1990. It created the Public Utility Commission as the regulatory body for telecommunications and energy.

2.Telecommunications act No 28 of 1990. It established the regulatory norms for telecommunications.

3.Acts No 10 of 1990 and 14 of 1994. They set minor amendments to the Public Utility Commission Act No 26 of 1990.

Honduras

1.Decreto No 185 de 1995 o Ley Marco del Sector de Telecomunicaciones. It set the general norms for the telecommunications sector and created CONATEL (Comisi.:n Nacional de Telecomunicaciones) as the regulatory body in telecommunications.

2.Acuerdo No 89 de 1997. It established new regulation for telecommunications.

Mexico

1. Ley de VPas Generales de Comunicaci.:n de 1940. It set the norms regulating the telecommunications sector and responsibilities given to the SubsecretarPa de Telecomunicaciones SCT.
- 2.Modificac.:n al TPtulo de Concesi.:n de Telmex de 1990. It set the responsibilities of the SCT regarding pricing policies and policing Telmex's concession.
- 3.Reglamento de Telecomunicaciones de 1990. It set some norms that regulated telecommunications sector.
- 4.Ley Federal de Telecomunicaciones de 1995. It set modern rules and regulations for telecommunications in Mexico. It mandated the creation of a regulatory agency responsible for regulating the telecommunications services.
- 5.Decreto Presidencial de 1996 crea COFETEL (Comisi.:n Federal de Telecomunicaciones) as the regulatory authority for telecommunications.

Nicaragua

- 1.Decreto No 1,862 de 1971. It created the DGTN (Direcci.:n General Nacional de Telecomunicaciones)
2. Decreto 1,053 de 1982. It created TELCOR (Instituto Nicaragense de Telecomunicaciones y Correos) as the regulatory and operating telecommunications agency.
- 3.Ley 200 de 1995 o Ley General de Telecomunicaciones y Servicios Postales. It established TELCOR as the regulatory body in telecommunications and created ENITEL (Empresa Nicaragense de Telecomunicaciones) as the operating company.

Panama

- 1.Ley 80 de 1973. It established INTEL (Instituto Nacional de Telecomunicaciones) as the regulatory and operating telecommunications agency in Panama.
- 2.Ley 26 de 1996. It created ENTE (Ente Regulador de los Servicios Pblicos) as the regulatory body responsible for all the public utilities.
3. Ley 31 de 1996. It established the norms and regulations for the telecommunications sector.
- 4.Decreto Ejecutivo No 73 de 1997. It set the regulations for ENTE.

Paraguay

- 1.Ley 642 de 1995. It created CONATEL (Comisi.:n Nacional de Telecomunicaciones) as the regulatory body for telecommunications in Paraguay.
- 2.Decreto 14,135 de 1996. It defined telecommunications services.

Per

- 1.Ley 19,020 de 1971. It empowered ENTEL-Per as the sole provider of telecommunications services in Per. It set that ENTEL is under the Ministerio de Transportes y Comunicaciones.
- 2.Decreto-Ley 702 de 1992. It mandated the creation of a regulatory authority for telecommunications.
- 3.Decreto Supremo 013 de 1993. It created OSIPTEL (Organismo Supervisor de la Inversi.:n Privada en Telecomunicaciones) as the telecommunications regulatory authority.
- 4.Decreto Supremo 06 de 1994. It set the general norms for telecommunications.
- 5.Decreto Supremo 062 de 1994. It set the responsibilities and roles of OSIPTEL.
6. Decreto Supremo 004 de 1996. It set the responsibilities for OSIPTEL and the Ministerio de Telecomunicaciones.

7. Decreto Supremo 002 de 1999. It set amendments to el Reglamento General de la Ley de Telecomunicaciones.

Republica Dominicana

1.Ley de Telecomunicaciones de 1966.

2.Ley 153 de 1998 o Ley General de Telecomunicaciones. It set modern norms and regulations for telecommunications and mandated the creation of a regulatory body for telecommunications.

Suriname

1.Amendment to the Government Ordinance of July 26, 1945 of 1993. It set the general norms for telecommunications.

Uruguay

1.Decreto-Ley 14,235 de 1974. It created ANTEL (Administración Nacional de Telecomunicaciones) as the telecommunications operator under the Ministerio de la Defensa.

2.Ley de 1984. It created the Directorio Nacional de Telecomunicaciones (DGT) under the Ministerio de la Defensa as the regulatory agency.

Venezuela

1.Ley de Telecomunicaciones de 1940. It set the telecommunications norms.

2.Decreto Presidencial 1,826 de 1991. It created CONATEL (Comisión Nacional de Telecomunicaciones) as the regulatory body under the Ministerio de Transportes y Comunicaciones.

APPENDIX B
DATA ANALYSIS FOR CHAPTER 3

Variable	Period	Number of Countries	Lags	Average ADF	Test Statistics
Teleden	1980-1997	24	3	.84	7.00***
GDPPC	1980-1997	24	2	-1.06	1.66*

***, */ Statistically significant at 1% and 10% respectively.

Country-specific 2-SLQ Fixed-Effects With Endogenous Competition					
Sample	All 24 countries				
Urban	.089*** (13.7)	.081*** (13.37)			
DENSITY			.023*** (12.13)	.025*** (14.49)	.024*** (12.57)
GDPpc(-1)	.24E-04 (.51)	.22E-04 (.433)	.258E-04 (.420)	.58E-04 (1.12)	.36E-04 (.578)
TRADE(-1)			.78E-03 (.723)		
VSGDP(-1)	-.62E-02 (-.903)			-.0208*** (-2.9)	
VMGDP(-1)		.0159 (.156)			-.036*** (-3.33)
Instinv	.062*** (3.38)	.060*** (3.36)	-.23E-02 (-1.13)	-.24E-02 (-1.31)	-.16E-02 (-.84)
Comp	.355*** (3.60)	.351*** (3.71)	.96*** (5.78)	.80*** (6.71)	.95*** (6.30)
Owner	.228*** (3.95)	.243*** (4.41)	.144** (2.14)	.109** (1.76)	.166** (2.57)
Regul	.296*** (4.15)	.289*** (4.05)	.494*** (6.58)	.542*** (8.22)	.431*** (5.67)
N	354	354	354	354	354
Adj-R-sq	.9426	.9425	.9242	.9381	.9280
t-statistic between brackets					
***, **, * Statistically significant at the 1%, 5% and 10% level respectively					
Country-dummy results are not shown.					

Table B.3 Parameter Estimates for Log of Main Lines per 100 Inhabitants B					
Country-specific 2-SLQ Fixed-Effects With Endogenous Competition					
Sample	Countries with Average GDPPC < US\$ 1,500				
Urban	.09***	.084***			
	(12.3)	(11.61)			
DENSITY			.026***	.028***	.027***
			(19.9)	(22.98)	(19.41)
GDPpc(-1)	.65E-03***	.61E-03***	.42E-04	.13E-03	.19E-04
	(3.03)	(2.72)	(.277)	(.971)	(.1222)
TRADE(-1)			.36E-03***		
			(4.22)		
VSGDP(-1)	.024**			-.051***	
	(1.91)			(-6.78)	
VMGDP(-1)		.0151			-.721
		(.769)			(-.50)
Instinv	.097***	.097***	-.92E-02***	-.515E-02***	-.847E-02***
	(3.08)	(3.20)	(-4.47)	(-2.63)	(-3.73)
Comp	.185***	.254***	.19***	.232***	.226***
	(2.28)	(2.59)	(2.67)	(3.69)	(3.19)
Owner	-.226	-.327*	.682**	.384**	.671***
	(-1.21)	(-1.73)	(5.56)	(3.22)	(5.13)
Regul	.167*	.256**	.518***	.592***	.572***
	(1.71)	(2.43)	(8.75)	(11.45)	(7.9)
N	153	153	153	153	153
Adj-R-sq	.9123	.9101	.9560	.9632	.9506
t-statistic between brackets					
***, **, * Statistically significant at the 1%, 5% and 10% level respectively					
Country-dummy results are not shown.					

Table B.4 Parameter Estimates for Log of Efficiency		
Country-specific 2-SLQ Fixed-Effects With Endogenous Competition		
Variable	All 24 Countries	Countries with GDPPC < US\$1,500
Density	.01326*** (4.27)	.021*** (9.88)
GDPpc(-1)	-.100-03 (-1.03)	.1057E-03 (.426)
Instinv	.8994E-03 (.279)	-.2358E-02 (-.7109)
Comp	1.44*** (5.38)	.1898* (1.64)
Owner	.127 (1.17)	.3968** (2.03)
Regul	.932*** (7.97)	1.01*** (11.15)
N	346	147
Adj-R-sq	(.7819)	(.9423)
t-statistic between brackets		
***, **, * Statistically significant at the 1%, 5% and 10% level respectively		
Country-dummy results are not shown.		

Table B.5 Parameter Estimates for Log of Main Lines per 100 Inhabitants I						
Country-specific 2-SLQ Fixed-Effects With Endogenous Competition						
Sample	Countries that Privatized their former State-Owned Operator					
Urban	.073***	.066***	.073***			
	(8.07)	(6.97)	(8.05)			
DENSITY				.028***	.022***	.021***
				(10.56)	(7.77)	(5.99)
GDPpc(-1)	.54E-03	.65E-04	.38E-04	-.29E-04	-.44E-04	-.11E-04
	(.843)	(1.05)	(.569)	(.494)	(-.706)	(-1.32)
TRADE(-1)	-.97E-03			-.73E-03		
	(-.518)			(-.427)		
VSGDP(-1)		-.025**			-.028**	
		(-1.96)			(-2.3)	
VMGDP(-1)			.471E-02			-.036*
			(.255)			(1.74)
Instinv	.38E-02	.39E-02*	.36E-02	.26E-02	.32E-02	.27E-02
	(1.46)	(1.6)	(1.40)	(1.15)	(1.29)	(.964)
Comp	.522***	.468***	.482***	.472***	.738***	.986***
	(4.77)	(4.60)	(4.63)	(3.89)	(5.74)	(5.59)
Owner	.238	.214***	.244***	.142**	.066	.090
	(3.19)	(2.90)	(3.33)	(2.15)	(.895)	(1.07)
Regul	.444***	.438***	.437***	.518***	.780***	.798***
	(3.20)	(3.21)	(3.18)	(6.94)	(6.12)	(5.37)
N	168	168	168	168	168	168
Adj-R-sq	.9167	.9198	.9174	.9370	.9250	.8997
t-statistic between brackets						
***, **, * Statistically significant below the 1%, 5% and 10% level respectively						
Country-dummy results are not shown.						

Table B.6 Parameter Estimates for Log of Main Lines per 100 Inhabitants II						
Country-specific 2-SLQ Fixed-Effects With Endogenous Competition						
Sample	Countries that did not Privatized their former State-Owned Operator					
Urban	.10***	.099***	.096***			
	(15.27)	(16.3)	(14.34)			
DENSITY				.025***	.025***	.025***
				(17.89)	(17.12)	(19.1)
GDPpc(-1)	.3E-03***	.28-03***	.32E-03	.57E-03***	57E-03***	.46E-03***
	(3.7)	(3.17)	(3.43)	(6.94)	(6.67)	(6.70)
TRADE(-1)	-.344E-03			.22E-02***		
	(-.405)			(2.96)		
VSGDP(-1)		.029***			.27E-02	
		(3.97)			(.375)	
VMGDP(-1)			-.013			-.049***
			(-1.38)			(-6.42)
Instinv	.084***	.7E-02***	85E-02***	-.011***	-.0122***	-.9E-02***
	(3.87)	(3.62)	(3.93)	(-6.5)	(-6.70)	(-5.811)
Comp	-.10***	-.16***	-.105	.138**	.111*	.084
	(-1.56)	(-2.48)	(-1.58)	(2.29)	(1.76)	(1.53)
Owner	-.75***	-.98***	-.74***	-.035	-.089	-.18
	(-2.94)	(-3.92)	(-2.96)	(-.156)	(-.76)	(-.87)
Regul	.195***	.198***	.183**	.525***	.584***	.476***
	(2.61)	(2.81)	(2.49)	(9.16)	(10.45)	(9.07)
N	187	187	187	187	187	187
Adj-R-sq	.9686	.9712	.9689	.9742	.9728	.9782
t-statistic between brackets						
***, **, * Statistically significant below the 1%, 5% and 10% level respectively						
Country-dummy results are not shown.						

APPENDIX C
ANALYSIS FOR CHAPTER 4

Derivation of Result 5

Given $\Xi^* = [2a(3-r) + (7r-3)C_Y - (5r+3)C_X + 2(r-3)C_A + 12C_B]/2(9-r)$, differentiate it with respect to r and one gets some simplification

$$\frac{\partial \Xi^*}{\partial r} = \frac{1}{2} [-12a + 60C_Y - 48C_X + 12C_A + 12C_B]/(9-r)^2$$

Now, assumptions A1 and A2 give us

$$\frac{\partial \Xi^*}{\partial r} = \frac{1}{2} [-96(C_X - C_Y) - 12a]/(9-r)^2 \quad \square \quad r \in [0,1]. \text{ Therefore } \frac{\partial \Xi^*}{\partial r} < 0 \quad \square$$

Derivation of Result 6

Since $\forall^* = [6a - (3+3r)C_Y + (3r-3)C_X + 2(6-r)C_A - 6C_B]/2(9-r)$, differentiate it with respect to r and one gets after some simplifications

$$\frac{\partial \forall^*}{\partial r} = 3 [a - 5C_Y + 4C_X - (C_A + C_B)]/(9-r)^2$$

Now, assumptions A1 and A2 give us

$$\frac{\partial \forall^*}{\partial r} = 3 [8(C_X - C_Y) + a]/(9-r)^2 \quad \square \quad r \in [0,1], \text{ and } a \text{ small. Hence } \frac{\partial \forall^*}{\partial r} < 0 \quad \square$$

Derivation of Proposition 1

From results 3, 11 and 14, I obtained:

$$TW^*_{\text{monopoly}} = [a - C_A - C_B - C_X]^2/3b$$

$$TW^*_{r=0} = 2 [4(2a - 2C_A - 2C_B - C_X - C_Y)^2 + (a - C_A - C_B - 5C_X + 4C_Y)^2]/81b$$

$$TW^*_{r=1} = 5 [a - C_A - C_B - C_Y]^2/16b + [a - C_A - C_B - C_Y][a - C_A - C_B - 2C_X + C_Y]^2/8b \\ + [(a - C_A - 4C_X + 3C_Y - C_B)^2 + (a - C_A - C_B + 4C_X - 5C_Y)^2]/32b$$

Then, assume $TW^*_{r=0} > TW^*_{\text{monopoly}}$. After some algebra calculations and applying assumption 2, one can get

$$151 [C_X - C_Y + a]^2 > 0 ; \text{ given assumption 1, this is true.}$$

Now, assume $TW^*_{r=1} > TW^*_{r=0}$. Then, after some algebra calculations and applying assumption 2, one can get

$$254 [C_X - C_Y + ,]^2 > 0 ; \text{ given assumption 1, this is true. Hence if}$$

$TW^*_{r=1} > TW^*_{r=0}$ and $TW^*_{r=0} > TW^*_{\text{monopoly}}$, it follows that $TW^*_{r=1} > TW^*_{\text{monopoly}}$ is also true

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BIOGRAPHICAL SKETCH

Luis Hernando Guti9rrez Ramirez was born December 23, 1957, in Barranquilla, Colombia. He is the second child in his family. His father is Luis Hernando Guti9rrez Barrantes and his mother is Lilia Ramirez de Guti9rrez. He received his B.A. in economics from Universidad del Atlantico in Barranquilla, Colombia, and his M.A. in economics from Universidad Nacional de Colombia in Santa Fe de Bogota, Colombia. He worked for the Colombian Central Bank from 1985 to 1988. He also worked for the National Department of Planning in Bogota, Colombia, from 1990 to 1995. While studying and doing his research, he was a research associate for the Public Utility Research Center, PURC, at the University of Florida. He will receive his Ph.D. in economics in May 2000. He is happily married to Olga Cristina Salamanca. They married July 19, 1990.