

Telecommunications

Information has joined capital and labor as a fundamental factor of production, implying a huge increase in recent years in the demand for information processing and transmission. For example, globalization has prompted the expansion of international telephone traffic in Latin America by about 15 percent annually over the past 20 years, about four times the pace of the global economy.¹ This fast-growing demand has put tremendous pressure on telecommunications, which has become a large and rapidly growing industry.

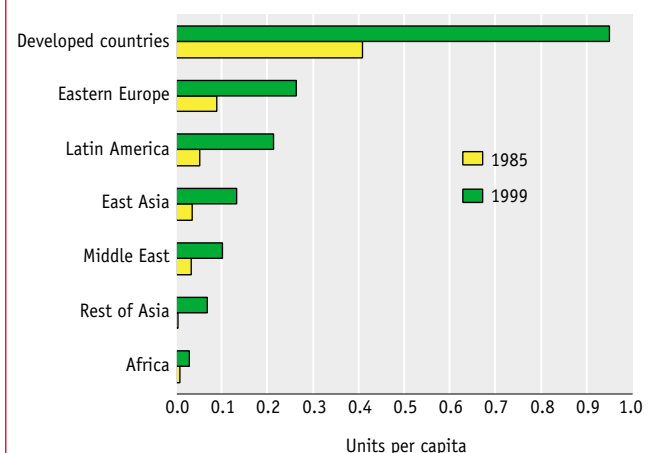
Telecommunications is both the core and infrastructure of the new global information economy. It is crucial for many industries like banking and other services, and it facilitates trade in goods and services. Moreover, companies today not only set up subsidiaries abroad to take advantage of cheap labor for making manufactured goods, but they also process information abroad. Swiss Air's accounting transactions, for example, are processed overnight in India.

Even before the huge explosion in demand for telecommunications services, which began less than 20 years ago, the quality and density of telecommunications networks had been recognized as major indicators of the level of economic and social development. Highly developed countries can afford more developed networks, and the availability of telecommunications seems to contribute to economic growth and competitiveness. Not surprisingly, the state of telecommunications varies considerably between developed and developing countries, as well as within countries. Developed countries have on average around five times the number of main line and cellular phones per capita as developing countries (see Figure 13.1). Latin America is the region with the

third highest telephony penetration (measured as the sum of main lines and mobile phones). The ratio between developed and developing country penetration fell from six to five between 1985 and 1999, with Latin America reducing its gap a little faster than the average developing country.

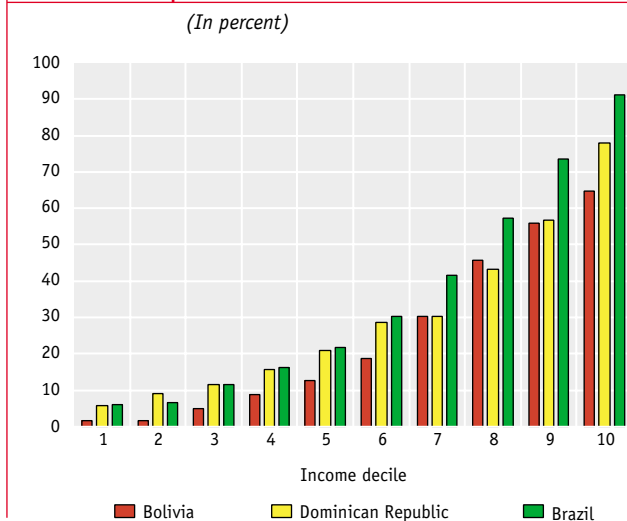
For developing regions, particularly Latin America, the internal "relative gap" in telecommunications is even more dramatic than the international one. The same strong relationship observed between economic development and telecommunications service across countries is observed within countries. Figure 13.2 presents main lines per capita by income decile in three Latin American countries. Less than five percent of people in the lower quintile have access to telephones at home, whereas around 80 percent have access in the highest decile. The difference between the level of penetration in the lowest and high-

Figure 13.1 Telephone Main Lines and Mobile Lines by Region, 1985 and 1999



Source: ITU (1999).

¹ A similar pattern is observed worldwide.

Figure 13.2 Persons Living in Households With a Telephone Line, by Income Decile

Source: IDB calculations based on 1998/99 national households surveys.

est decile is most pronounced in Brazil, the country with the worst income distribution in the region.

To close these gaps, over the past decade many developing countries have reformed their telecommunications sectors, changing their regulations, introducing private capital, and liberalizing the market in order to increase efficiency and investment. Latin America has been a leader in these reforms. By 1999, more than two-thirds of the countries in the region had fully or partially privatized the main operator, and around half had reformed regulation to introduce competition. The conventional wisdom supported by case studies shows that privatization by itself is not enough to both improve sectoral performance and fully distribute its benefit to final customers. Privatization also requires an effective regulatory framework and competition to discipline firms.

There is still a long way to go in Latin America—internal and external gaps remain large. Moreover, developing countries must concentrate not only on the gap in basic telephone services but also on the introduction and diffusion of advanced, customer-oriented services like data transfers and Internet access.

Recent Trends²

For decades, telecommunications was thought of as a mature industry where services were provided by a se-

cure state-owned post, telephone and telegraph monopoly. Changes were slow and incremental. The absence of competition was motivated by network harmonization requirements, the obligation to provide universal service, and, principally, the existence of large fixed costs in several parts of the network, whose duplication was not desirable. The telecommunications industry was generally believed to be a “natural monopoly.”

Several pivotal events beginning in the 1980s altered these precepts and sparked dramatic changes worldwide in the telecommunications sector. The most important were rapid and significant technological changes, the growing awareness of the inefficiency of incumbent monopolies, the huge distortion in relative prices induced by cross subsidies, and fiscal considerations.

Technological development created momentum toward deregulation. Some traditional market segments, as well as new ones such as data transfer, could now be efficiently served by new players. Mobile communications, which have low fixed costs, have become a close substitute for local networks, reducing incumbent market power. Extreme cases are Paraguay and Venezuela, where more than 50 percent of total telephone subscriptions are mobile phones. Moreover, infrastructure costs have declined rapidly due to increased capacity and functionality. This trend toward lower infrastructure costs has undermined one of the rationales for maintaining a monopoly in telecommunications services.

In addition, the growing awareness of the inefficiency of incumbent services has put great pressure on policymakers to reform the sector. Monopolists typically had little incentive to reduce costs due to the “cost plus” nature of most regulations. This poor incentive system increased marginal costs and therefore implied high prices for final consumers. In addition to high costs, price structures were severely distorted due to cross subsidies, which conspired against sound business practices. Cross subsidies among services were substantial, with business, mobile and long distance services subsidizing residential, local and rural ones.³ Under this price

² This section is based on Laffont and Tirole (2000) and ITU (1999, 2000).

³ In theory, the optimal price structure should follow Ramsey pricing, meaning that products or segments with lower demand elasticity should pay a higher portion of fixed costs. See Viscusi, Vernon and Harrington (1997).

Table 13.1 Exclusivity Period of the Incumbent Operator

	Services under exclusivity	Commencement of exclusivity	Period (years)
Argentina	Local, national and international long distance	1990	10 (7 extended by 3)
Bolivia	Local, national and international long distance	1995	6
Brazil	Local, national and international long distance	1998	0.5 (during license awards)
Chile	None		
Colombia	None		
Ecuador	Local, national and international long distance	1995	5
El Salvador	None		
Guatemala	None		
Honduras	Local, national and international long distance	1995	10
Mexico	National and international long distance	1990	6
Nicaragua	Local, national and international long distance	1995	4
Panama	Local, national and international long distance	1997	5
Peru	Local, national and international long distance	1994	5
Venezuela	Local, national and international long distance	1991	9

Source: ITU (1999).

distortion, inefficient entrants benefited from the regulatory price umbrella to skim the cream off the market (business users) in central business districts and for specific long-distance services.

Moreover, in recent years, progress in telecommunications technology has demanded huge investments. The advent of high capacity and intelligent networks has multiplied the number of products offered (for example, toll-free or paying numbers, routing of calls, data transfers, home banking, etc.). In addition, digital technology, telecommunications, cable TV, broadcasting and computers are becoming a single industry, posing new challenges for regulatory frameworks. This new environment, along with the gap that most developing countries currently have in teledensity, has required huge infrastructure investments that governments cannot afford. This has pressured governments to introduce incentive regulation and open their telecommunications markets to private investment.

Ownership Trends and Regulatory Changes

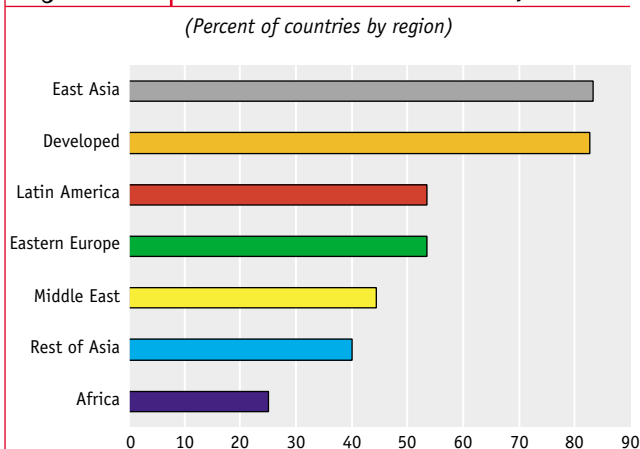
The new technological environment and the demand by consumers for efficient, innovative and inexpensive communications have been the driving forces behind the reform and liberalization of telecommunications regulations around the world.

Typically, this process started with the separation of state-owned postal and telecommunications services from the central government, followed by the corporatization of the telecommunications operator. Separation was usually accompanied by adoption of more commercial forms of accounting and decision-making, as well as by more incentive-oriented regulation and a clear separation of operational and regulatory functions. The next stage typically involved total or partial privatization of the commercial operator. At this stage, some countries allowed competition in the market, whereas others opted for granting a period of exclusivity to the newly privatized incumbent to compensate for investment and coverage requirements (see Table 13.1).

Starting in the mid-1980s, many network industry incumbents in the telecommunications sector became subject to price caps. This regulatory method aimed to head off the practice of passing cost inefficiencies on to prices. Average price caps allow the incumbent to adjust its relative prices to take into account differences in marginal costs and demand elasticities across the different products offered.⁴

Unfortunately, there is a trade-off between incentive scheme regulations and the extraction of monopoly

⁴ See Laffont and Tirole (1994).

Figure 13.3 Privatization of Incumbent Operator

Source: ITU (1999).

rents. This reduced ability of the government to extract monopoly rents from the private operator brings into question the credibility of the price cap: large rents as well as large losses are politically hard to sustain due to political pressures. Moreover, price caps give regulators substantial discretion over the operator's profit. Under this set-up, regulators can either be captured by the regulated firm (regulatory capture) or they can "expropriate" the operator once it has already invested in fixed assets (regulatory taking). These potential problems reinforce the need for two conditions that are difficult to find in

developing countries: regulatory independence vis-à-vis the regulated firm and interest group, and stable rules.⁵

On the other hand, high-powered incentive schemes (price caps) create concerns regarding the quality of service provided. The operator will be willing to reduce quality if the reduction in costs compensates for the fall in demand (which in the case of utilities could be very inelastic). For example, British Telecom reduced its service quality when a price cap was introduced, forcing the regulatory agency to introduce new quality requirements.⁶

Latin America has seen its share of high-powered incentive schemes in the telecommunications industry. Table 13.2 presents the end-user tariff regulation in selected countries of the region for 1999. As mentioned, reforms in this sector have come with private participation. Most countries in the world have privatized in order to attract private and foreign investment, which has dramatically changed the ownership profile of incumbent operators. Latin America has been very active in privatizing telecommunications (see Figure 13.3). More than a decade ago, Chile was the first country in Latin America to sell its state-owned telecommunications company (see Box 13.1). Today, the major telecommunication operator in nearly every country in the region is

⁵ See Levy and Spiller (1996).

⁶ See Newbery (2000).

Table 13.2 End-User Regulation in Selected Latin American Countries

	Type of regulation of end-user tariff	Cross subsidy for long distance
Argentina	Price cap	Yes
Bolivia	Price cap	na
Chile	Price cap	No
Colombia	Cap prices only to operators who have a dominant position or are a monopoly	No
El Salvador	Price cap	No
Mexico	Price cap for services with monopoly or dominant provision	Yes
Panama	Price cap	na
Peru	Price cap	No

Source: ITU (1999).

Box 13.1 Telecommunications Deregulation in Chile¹

At the beginning of the 1970s, state-owned monopolies provided all telecommunications services in Chile. Firms lacked funds for investment, prices were regulated, and there were large cross subsidies. In 1982, the government decided to deregulate the sector in order to introduce competition. The incumbent in each segment (local and long distance) was corporatized, prices were liberalized, and interconnection was made mandatory in order to allow entry. The law established the complete separation between regulation and operational functions.

The deregulation did not produce the desired outcome, however, as only tiny firms entered the market, and the network grew only slightly faster than before deregulation. A possible reason may have been that price freedom was not credible (given the presence of two big state monopolies).

In 1987, the Antitrust Commission determined that local and long distance telephony were not competitive, forcing the regulator to create a mechanism to fix tariffs. The reform reduced government discretion in price setting, thereby increasing private interest in the sector. Indeed, a year later the two big telecommunications companies were privatized.

After 1987, the sector grew rapidly, and phone density increased from 6.7 per 100 persons to 16 in 1997. The new private firms had big increases in efficiency that brought them a high rate of return (around 17 percent and 45 per-

cent for local and long distance telephony, respectively), but did not bring significant reductions in customers' bills. In fact, local phone charges went up between 1987 and 1996.

The rate setting process for local telephony in 1994 did not introduce any substantial decline in prices because, quoting Perry and Leipziger (2000), "[it] appears to have been more the result of bargaining between the authorities and the firm than the outcome of rigorous technical analysis." During this process, the incumbent firm launched a fierce attack on the regulator through the media and did not allow it to have access to all of the firm's cost information (increasing its bargaining power).

The extremely high returns in long distance service created pressure both to reduce the regulatory ambiguities that generated legal entry barriers and to force Telefónica (the main local provider) to divest its share in the main long distance company (Antitrust Agency decision). These reforms, plus the nondiscriminatory access policy to the "local loop" (the market of local calls), induced many new long distance carriers to enter into the market, in turn drastically reducing the returns of both businesses (from 45 percent to less than 10 percent) as well as prices for consumers.

¹Based on Perry and Leipziger (2000) and Serra (2000).

either fully or mainly owned by private capital. In some countries where the main operator still remains under state ownership, there have been attempts at privatization, but these initiatives have been cancelled or postponed indefinitely. In Colombia, the sale of Telecom was announced in 1991, but strong labor opposition led to its cancellation the following year. A similar situation occurred in Uruguay, where a national plebiscite interrupted the privatization initiative in 1991.

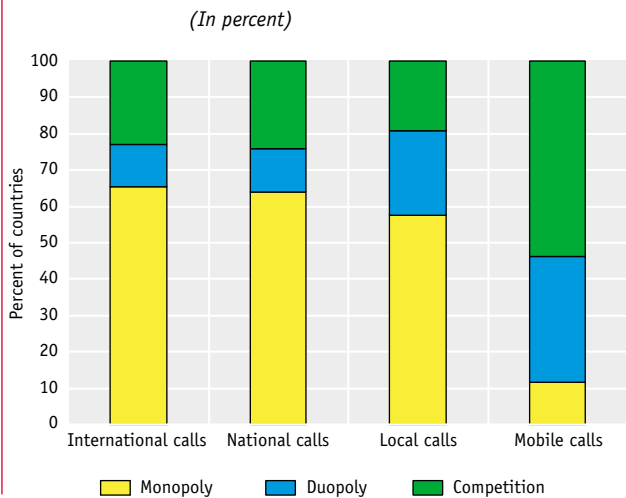
Some countries have already allowed competition in the telecommunications industry, and others have been moving in that direction (see Figures 13.4a and b). Due to technological advances and international experience, it is now widely accepted that entrants should be able to compete in most segments of the telecommunications industry, but competitive providers still need to use part of the local network that is controlled by the incumbent. This is the case with long distance calls, for example. This raises a difficult ques-

tion: how should access charges be set? These charges may represent half of the cost for competitors and a substantial portion of the incumbent's income, implying that these agents would have an interest in affecting the regulator's choice. On the other hand, the standard wisdom regarding the efficiency of price equaling marginal cost does not hold in this situation because access charges must help the incumbent firm to cover its fixed cost.⁷

The prevailing dominant paradigm for setting access is the forward-looking long-run incremental cost. But, as discussed by Laffont and Tirole (2000), it raises some concerns. Since the incumbent does not make any profit with this access charge, it will try to use the bottleneck to increase its market power in the competi-

⁷ Following the Ramsey price rule, access charges should consider the elasticity of demand of the final consumers of competitor firms.

Figure 13.4a Competition in Telecommunications Services in Latin America



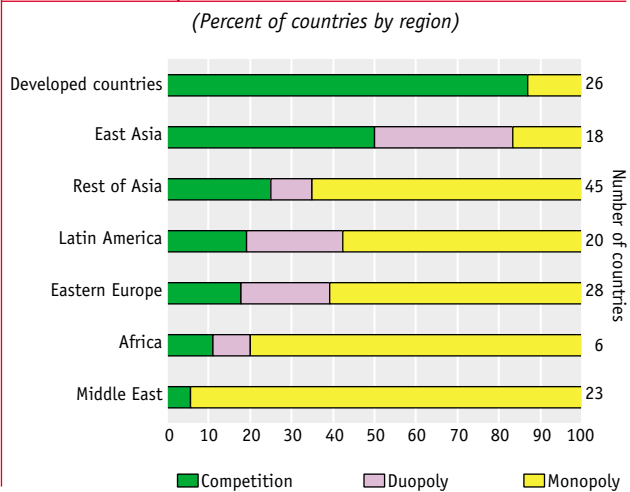
Source: ITU (1999).

incumbent). In addition, these agreements may facilitate tacit collusion between local service providers.

To promote local competition, regulators have followed different approaches to allow entry into this segment. In the United States, the 1996 Telecommunications Act envisioned three types of local entry: 1) facilities-based entry by mobile operators or by fixed-link operators such as cable companies (and perhaps in the future, electricity distribution networks); 2) resale entry in which a third party pays for the right to resell incumbent services; and 3) mixed entry whereby entrants lease some facilities (transmission) and provide others (switches). The latter is entry through unbundled network elements. Table 13.3 presents the advantages of each of these entry procedures as well as the methods used by different countries in Latin America.

Even though Latin America has been one of the two leading regions in the liberalization process, privatization in many countries in the region has been tied to a period of exclusivity ranging between four and 10 years (see Table 13.1). As a consequence, the region has moved forward in the liberalization of new services like mobile telephones and the Internet, but has remained fairly closed in more traditional services (see Figure 13.4a). It is important to mention that some analysts have blamed lack of competition for high prices and depressed demand in the region during the 1990s.⁸

Figure 13.4b Structure of Local Service Market



Source: ITU (1999).

tive segment, restricting competitor entry by using non-pricing methods. Moreover, this method leaves regulators with the power to set individual prices, which gives them much discretion.

In addition to the one-way-access pricing issue, local competition is raising two-way interconnection issues. In this case, each carrier has to buy termination access from the other network. This is the case for mobile telephones. In principle, carriers have a mutual interest in reaching an agreement, but this is not the case if there is a clear dominant local operator (the

The Effect of Reforms

As shown in Figure 13.1, Latin America is far behind developed countries in terms of telephone penetration, but once differences in per capita are considered, the level of penetration is neither especially high nor low for its level of development (see Figure 13.5).⁹ A similar result is found for Internet hosts per capita. Given how far Latin America has come in the process of privatization and regulation, this suggests that reforms have been irrelevant, unless it can be proven that Latin American countries started far behind.

⁸ See ITU (2000).

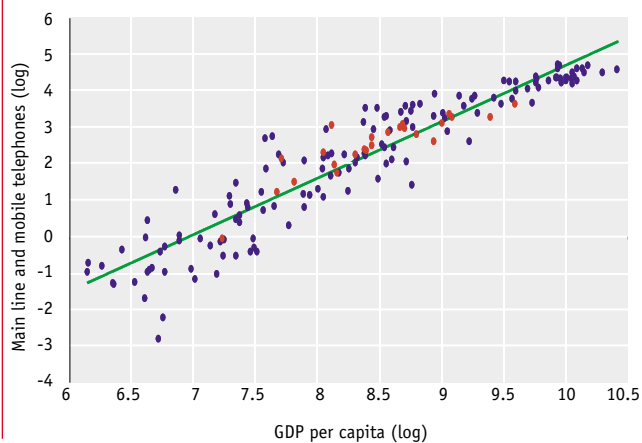
⁹ Regressing the number of main line plus cellular phones (in log) on PPP-adjusted (in log) GDP per capita, a dummy variable for Latin America is not always significant for standard levels. In fact, when we control for GDP per capita in log square and cubic, the Latin American dummies are significant at 6 and 14 percent, respectively.

Table 13.3 Modes to Opening Local Markets

Type of competition	Advantages	Examples
Facilities-based competition	<ul style="list-style-type: none"> • Creates conditions for effective competition • Reduces demand for regulatory intervention • Upgrades networks and services • Pressures incumbent to upgrade network and services 	Argentina, Brazil, Chile, Colombia, Guatemala, Mexico, Peru
Resale	<ul style="list-style-type: none"> • First step in the path towards effective competition • Quick and low-cost deployment of services • Efficient use of existing infrastructure • Not restricted to the places where new entrants have been able to build competing infrastructure • Opportunities for small and medium size-enterprises to serve niche markets without having to build their own infrastructure 	Argentina, Chile, Colombia, Guatemala, Mexico, Peru
Combination method (both approaches)	<ul style="list-style-type: none"> • Includes advantages of both approaches plus the benefit of efficient entry of new carriers; no misallocation of resources due to availability of both approaches to select mode of entry 	Argentina, Chile, Mexico, Peru

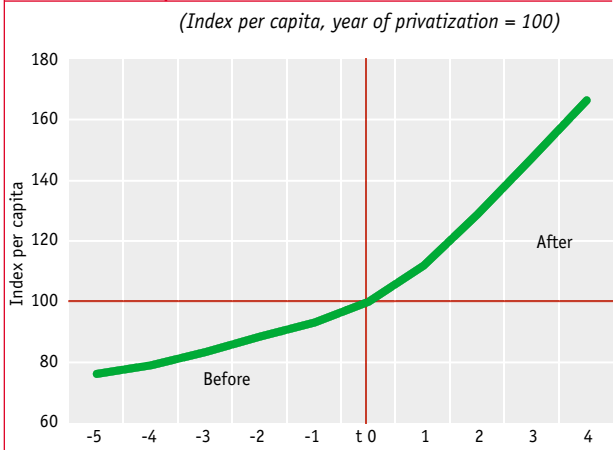
Source: ITU (1999).

Figure 13.5 Telephony Penetration and PPP-adjusted GDP Per Capita



Note: Each dot represents a country. Latin American countries are shown in red. Source: IDB calculations based on ITU (1999).

Figure 13.6 Main Lines and Mobile Telephones

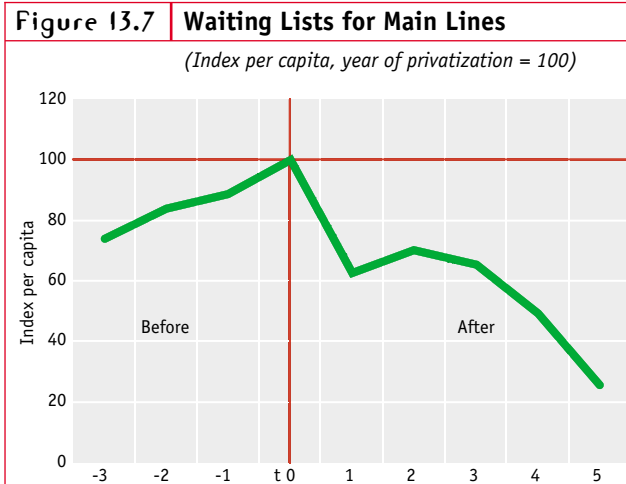


Note: t_0 is defined as the year of privatization of the incumbent operator (the scale is normalized to 100). Countries that had available data on main lines and mobile lines for the period plotted are Argentina, Barbados, Bolivia, Chile, Guyana, Jamaica, Mexico, Peru and Venezuela. Source: ITU (1999).

Figure 13.6 analyzes the evolution of main line plus mobile phones per capita in nine Latin American countries before and after they privatized their incumbent operators. For each country, we normalized the series to be 1 in the privatization year, noted as “ t_0 ” in the figure. On average, after privatization, these countries increased the rate of growth of penetration per capita from around 5 percent to 14 percent per year.¹⁰ This increase in the rate of growth comes with a decline in

the waiting list for main lines. Figure 13.7 shows that after privatization, the waiting list fell by more than 50 percent in the five countries of the region for which data are available. It is interesting to note that the waiting list in these countries was growing before privatization, suggesting that the declining quality of

¹⁰ A similar result is found if we only focus on main lines per capita (result not reported).

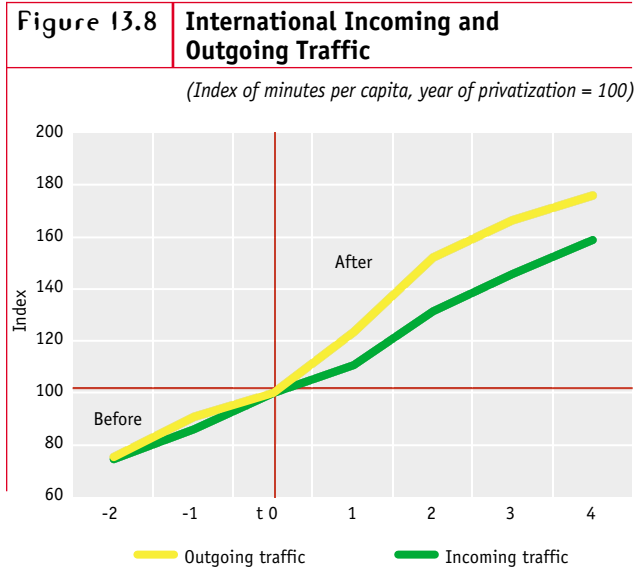


Note: t_0 is defined as the year of privatization of the incumbent operator (the scale is normalized to 100). Countries that had available data on waiting lists for the period plotted are Argentina, Chile, Mexico, Peru and Venezuela.
Source: ITU (1999).

the public incumbent could have fostered the privatization process in these countries. Using other measures of quality, such as faults per main line in use and the percentage of digitalization, produces similar results: there is an increase in the quality of the service provided after privatization of the main incumbent.

Assuming that privatization of the incumbent accompanies the introduction of private capital in long distance service, Figure 13.8 describes the evolution of international incoming and outgoing calls before and after privatization. Interestingly, the international incoming traffic does not show any change, but outgoing traffic shows a clear increase. This result suggests that the relative price of international long distance service for local users falls in relative terms to the one paid by customers in foreign countries.

The econometric analysis in Appendix 13.1 shows that the previous results are a common feature of privatization processes around the world. On average, privatization increases the number of main line and mobile phones by around 7 percent.¹¹ Focusing on quality measures, privatization reduces waiting lists by around 60 percent and the number of faults per line by 30 percent. In addition, the privatization process fosters the rate at which the network is digitalized. These results suggest that privatization increases the quality of service, but also that this is accompanied by an in-



Note: t_0 is defined as the year of privatization of the incumbent operator (the scale is normalized to 100). Countries that had available data on international incoming traffic (minutes) for the period plotted are Argentina, Bolivia, Peru and Venezuela.
Source: ITU (1999).

crease of around 14 percent in the cost of local telecommunications services. Along with the fact that international outgoing calls increase more than incoming calls, this suggests that the price of local calls increases in relative terms to the price of international ones. This might be explained by the reduction of cross subsidies from international to local services.

Consistent with these results, some case studies show that incumbent firms enjoy high returns after privatization. For example, Serra (2000) shows that the local incumbent in Chile had returns over assets of around 20 percent after privatization, and the dominant long distance firm had a return of around 45 percent. In the latter case, these high returns fell to around 7 percent after competition was allowed in 1995. These results show that the asymmetric information between the regulator and the “monopoly” allows firms to enjoy high information rents. These rents vanish or are reduced when rent extraction comes in the form of competition.

The rate of growth of telephony and prices between 1995 and 1999 was analyzed in order to compare the performance across countries with different levels of competition.

¹¹ For main lines, this increase is around 4 percent, and for mobile phones, 50 percent.

The International Telecommunications Union (ITU) provides access to the level of competition in the local and mobile segment for different countries in 1998. Appendix 13.1 shows that competition fosters the mobile market. In fact, countries that have monopolies in their market have an annual rate of growth 20 percent points lower than countries that allow competition in this segment. On the other hand, the ITU competition measure for the local service segment does not appear to be related to either a significant positive effect in the evolution of the number of main lines or to a significant reduction in prices (even though in both cases they have the expected sign). There are two potential explanations for this result. Even though a country has more than one firm providing local services, each firm would tend to be a local monopoly in its area, and, therefore one should not expect a competitive market. A second potential explanation is that many countries imposed initial investments that were compensated for by granting temporal monopolies (see Table 13.1).

New Regulatory Challenges

To date, the main objective of most legislative and regulatory changes has been to pave the way for privatization, establish a regulatory authority, or introduce competition in some segments of the industry. But a recent wave of reforms has aimed at accommodating the sector to the new reality of digital telecommunications in which cable TV, broadcasting, and IT industries are merging into a single industry that must be regulated in a coherent and integrated manner. Under this new scenario, there are a large number of potential new players. Other network operators such as cable companies and railroad, electricity, gas or water utilities can be efficient providers of transmission facilities if the public switched-telephone network is to be duplicated. Moreover, large software companies and media can also play an important role in the industry. This is not the future but the present—there are any number of mergers on practically any given day between telecommunications companies and cable TV, Internet providers, etc. A clear example in Latin America is Telefónica. In addition to its huge share in the conventional telecommunications industry, Telefónica has increased its participation in other businesses such as the Internet (e.g., Terra.com) and cable TV (Intercom in Chile).

This convergence is making traditional regulatory definitions and boundaries out of date. Pressure for parallel convergence in regulation will increase as long as two “different” industries continue to provide services previously provided by the other (e.g., telephone and cable TV). More importantly, these pressures will increase when the Internet’s video and telephony quality improves, making it a clear competitor with the traditional supplier of these services. The Internet presents special problems because it is developing so fast that regulations have trouble keeping up with innovations. These problems become worse when those innovations concern services or products that, if offered by conventional means, would be highly regulated.

To deal with this changing scenario, countries like Malaysia and Singapore in recent years have centralized the telecommunications, broadcasting and computing industries under a single regulatory authority. If a nation still prefers having separate bodies regulating each of these “segments,” great attention has to be paid to cooperation between these agencies to avoid wasteful duplication of effort or, worse still, contradiction and uncertainty.

Besides the challenges posed by the new digital era, old challenges persist as well, particularly in Latin America. Universal access is still a critical issue in the region. Policies have to reduce the huge gap between rich and poor in conventional connectivity, and now they have to address universal Internet access as well. To finance universal service, regulations have to avoid cross subsidies that introduce price distortions. Countries such as Chile, Colombia, Guatemala and Peru have implemented a bidding process in which specific projects are awarded to bidders that offer to provide the services at the lowest subsidy.

Regulations must continue to foster competition and protect consumers from potential monopolies. They have to deal with network access and inter-operability, and reduce obstacles to competition such as the cost and difficulties consumers have in keeping their telephone number if they switch providers. This increases the switching cost to move from one provider to another. The challenge is to develop consistent regulations that treat similar products in a coherent way, encouraging innovation and serving the best interests of all users.

Conclusions

Over the past decade, information technology has become an essential factor in production, inducing a huge explosion in the demand for telecommunications services. This fast-growing demand, plus the new technologies that have burst onto the scene, have put great pressure on the telecommunications industry, which has undergone important transformations in recent years. In general, state-owned monopolies had neither the right incentives nor the funds for investment to address these new challenges. In addition, new technologies in telecommunications have reduced fixed costs, undermining one of the reasons why some segments were thought of as natural monopolies.

Latin America has been one of the leaders in the transformation of the telecommunications industry. Typically, this process starts with the separation of telecommunications services from the central government, followed by the corporatization of the telecommunications operator. Incentive-oriented regulation and a clear separation between the regulatory and operational func-

tions are then introduced. The next step is to bring in private capital, which in some cases must compete from the outset, and in others is granted a period of exclusivity to compensate for initial investments.

In general, these reforms have fostered telephony penetration and improved service quality, but they have increased prices as well. It seems that the efficiency improvements induced by reforms are not fully transferred to final consumers. Some case studies show that privatized firms have high returns in countries where regulated private monopolies remain, showing that informational rents are high. These abnormally high returns seem to decline when competition is introduced.

Despite much progress, Latin America still faces the daunting challenge of closing the gap with the developed countries in terms of access to quality telecommunications services. Furthermore, most countries in the region have to make a particular effort to offer more equitable access to low-income customers and areas. Regulations must be improved in order to protect customers from potential monopolies while at the same time fostering investment and innovation in the sector.

Appendix 13.1

The appendix tables that follow constitute an econometric study of the effect of telecommunications reform on industry performance. Telecom variables come from the International Telecommunications Union database and the PPP-adjusted GDP per capita from the World Bank. Appendix Table 13.1 presents a fixed effect estimation of the impact of privatization on some performance variables. Given the shape of the relationship between telephony penetration and PPP-adjusted GDP per capita (see Figure 13.5), we control our exercise

using a cubic polynomial in the latter variable. In addition we introduce year dummies to take technological progress into account. To see the effect of privatization, we construct a variable that is equal to one if the process has already taken place.

Finally, to study the effect of competition in telecommunications, Appendix Table 13.2 looks at the rate of growth of some performance variables between 1995 and 1999 in cross-section regressions.

Appendix Table 13.1 Effects of Privatization: Panel Regression Results

Independent variables	Dependent variable (logs)						
	Main and mobile lines per capita	Main lines per capita	Mobile lines per capita	Faults	Digital lines ¹	Waiting list	Cost of a one-minute local call
Per capita GDP (log)	-17.85 (-10.58)***	-20.55 (-13.56)***	10.54 (0.61)	-0.33 (-2.01)**	26.65 (9.26)***	-0.48 (-2.56)**	0.41 (2.87)***
Per capita GDP (log squared)	2.39 (11.57)***	2.76 (14.90)***	-0.40 (-0.20)				
Per capita GDP (log ^3)	-0.10 (-12.09)***	-0.12 (-15.78)***	-0.02 (-0.20)				
Post-privatization dummy	0.08 (3.33)***	0.04 (2.10)**	0.51 (4.90)***	-0.30 (-4.50)***	8.62 (5.76)***	-0.67 (-6.04)***	0.14 (2.82)***
Constant	41.40 (9.19)***	48.56 (11.98)***	-61.65 (-1.25)	7.02 (4.27)***	-238.76 (-10.46)***	-5.85 (-4.01)***	-0.06 (-0.07)
R² adjusted	0.99	0.99	0.93	0.89	0.89	0.83	0.99
No. of observations	1,795	1,830	984	842	1,334	1,266	970

¹ Variable in levels.

Notes: All specifications include country and year dummies. Post-privatization dummy takes a value of one for years after privatization and zero otherwise. t-statistics in parentheses.

* Significant at the 10% level.

** Significant at the 5% level.

*** Significant at the 1% level.

Appendix Table 13.2 Effects of Privatization: Cross-Section Regression Results

Independent variables	Dependent variable			
	Per capita growth of:			Cost of a one-minute local call
	Mobile and main lines	Main lines	Mobile lines	
Per capita GDP (log)	5.94 (-0.36)	-18.93 (-1.49)	42.97 (0.70)	0.75 (1.24)
Per capita GDP (log squared)	0.59 (0.31)	2.32 (1.55)	-5.02 (-0.73)	
Per capita GDP(log ^3)	-0.02 (-0.230)	-0.09 (-1.600)	0.21 (0.800)	
Initial amount of main plus mobile lines (1995)	-0.07 (-2.32)**	-0.07 (-3.25)**	-0.33 (-4.09)***	
Dummy of privatization	0.09 (1.51)	0.07 (1.39)	0.44 (2.24)**	0.26 (2.38)**
Dummy of local competition	0.08 (1.17)	0.03 (0.56)	0.82 (3.27)***	-0.06 (-0.64)
Dummy of mobile competition	0.24 (3.70)***			
Constant	0.43 (7.38)***	0.39 (8.11)***	0.96 (4.06)***	-0.02 (-0.18)
R² adjusted	0.17	0.27	0.50	0.08
No. of observations	119	123	96	75

Notes: t-statistics in parentheses. Dummy of privatization equals one if the incumbent operator was privatized sometime between 1995 and 1999. Dummies of local and mobile competition take a value of one if the market is open to two or more enterprises, and zero otherwise. In the case of mobile lines, the data corresponds to the market (analogue or digital) that is more competitive.

* Significant at the 10% level.

** Significant at the 5% level.

*** Significant at the 1% level.

Part IV References

- Ades, A. F., and E. L. Glaeser. 1999. Evidence on Growth, Increasing Returns, and the Extent of the Market. *Quarterly Journal of Economics* 114(3): 1025-46.
- Aghion, P., and P. Howitt. 1992. A Model of Growth through Creative Destruction. *Econometrica* 60: 323-51.
- Amjadi, Azita, and Alexander Yeats. 1995. *Have Transport Costs Contributed to the Relative Decline of African Exports? Some Preliminary Evidence*. World Bank Discussion Paper No. 348, Washington, DC.
- Ariza, Beatriz, et al. 2001. Regulating Transmission. Public Policy for the Private Sector. World Bank Note No. 226.
- Baird, A. 1999. Privatization Defined: Is it the Universal Panacea? Napier University. Mimeo.
- Benavides, Juan, and Israel Fainboim. 1999. Private Participation in Infrastructure in Colombia—Renegotiations and Dispute. Inter-American Development Bank Sustainable Development Department, Washington, DC. Mimeo.
- Bergman, Lars, Gert Brunekreeft, Chris Doyle, Nils-Henrik von der Fehr, David M. Newbery, Michael Pollit and Pierre Régibeau. 1999. A European Market for Electricity? *Monitoring European Deregulation 2*. Centre for Economic Policy Research and SNS, London.
- Bergstrand, J. 1985. The Gravity Model in International Trade: Some Microeconomic Foundations and Empirical Evidence. *Review of Economics and Statistics* 67: 474-81.
- Blumstein, C. 2000. Energy Choices for the Next President. *San Francisco Chronicle*. November 5.
- Borenstein, Severin. 2001. *The Trouble with Power Markets (and Some Solutions)*. POWER Working Paper No. 81, University of California Energy Institute.
- Borenstein, Severin, and James Bushnell. 2000. Electricity Restructuring: Deregulation or Regulation? *Regulation* 23(2).
- Borenstein Severin, James Bushnell, and Frank Wolak. 2000. *Diagnosing Market Power in California's Deregulated Wholesale Electricity Market*. POWER Working Paper PWP-064, University of California Energy Institute.
- Boycko, M., A. Schleifer, and R. Vishny. 2000. A Theory of Privatization. In Mark Blaug and David Parker (eds.), *Privatisation and Corporate Performance*. The International Library of Critical Writings in Financial Economics. Reprint from *Economic Journal*, March 1996.
- Buenos Aires Port. 2000. <http://www.buenosairesport.com.ar/anuari392.htm>
- Burkhalter, Larry. 1999. Privatización portuaria: bases, alternativas y consecuencias. ECLAC. Mimeo.
- Cámara Marítima y Portuaria de Chile. 1999. Memoria annual No. 56.
- Canning, D., and R. Pedroni. 1999. Infrastructure and Long-Run Economic Growth. Paper presented at the 1999 Econometric Society Summer Meeting, Madison, WI.
- Cargo Systems—Latin American Supplement. 2000. *Informa* 27(10). London.
- Central Intelligence Agency. 2000. *The World Factbook*. Washington, DC: CIA.
- Crew, Michael A., and Paul R. Kleindorfer. 1986. *The Economics of Public Utility Regulation*. London: Macmillan Press.
- Dollar, D., and A. Kraay. 2001. *Trade, Growth and Poverty*. World Bank Working Paper No. 2199.
- Easterly, W., and R. Levine. 1997. Africa's Growth Tragedy: Policies and Ethnic Division. *Quarterly Journal of Economics* 112(4): 1203-250.
- Economic Commission for Latin America and the Caribbean (ECLAC). 1998. Modernización portuaria: una pirámide de desafíos entrelazados. Unidad de Transporte. Mimeo.

- Engel, E., R. Fisher, and A. Galetovic. 2000. The Chilean Infrastructure Concessions Program: Evaluation, Lessons and Prospects for the Future. In F. Larraín and R. Vergara (eds.), *La transformación económica de Chile*. Santiago: Centro de Estudios Públicos.
- Esfahani, H., and M. Ramírez. 1999. Institutions, Infrastructure and Economic Growth. University of Illinois. Mimeo.
- Espinasa, Ramón. 2001. Marco institucional de los sectores de electricidad y telecomunicaciones en América Latina. Inter-American Development Bank Research Department. Mimeo.
- Estache, A., and J. Carbajo. 1996. Competing Private Ports: Lessons from Argentina. Public Policy for the Private Sector, Note No. 100. World Bank Group.
- Estache, A., and D. Martinot. 2000. Transaction Cost, Politics, Regulatory Institutions and Regulatory Outcomes. In Luigi Manzetti (ed.), *Regulatory Policy in Latin America: Post-Privatization Realities*. Coral Gables, FL: North-South Center Press, University of Miami.
- Estache, A., and M. Pardini. 1998. Light and Lightning at the End of the Public Tunnel: The Reform of the Electricity Sector in the Southern Cone. World Bank. Unpublished.
- Estache, A., and G. Rus. 2000. *Privatization and Regulation of Transport Infrastructure: Guidelines for Policymakers and Regulators*. Washington, DC: World Bank.
- Fink, C., A. Mattoo, and I. C. Neagu. 2000. Trade in International Maritime Service: How Much Does Policy Matter? World Bank. Mimeo.
- Fischer, Ronald, and Alexander Galetovic. 2000. *Regulatory Governance and Chile's 1998-1999 Electricity Shortage*. Santiago: Applied Economics Center, Universidad de Chile.
- Fischer, Ronald, and Pablo Serra. 2000. Regulating the Electricity Sector in Latin America. *Economía*. Fall.
- Foxley, J., and J. L. Mardones. 2000. Port Concessions in Chile. Public Policy for the Private Sector, Note No. 223. World Bank.
- Frankel, J. A., and D. Romer. 1999. Does Trade Cause Growth? *The American Economic Review* 89(3): 379-99.
- Fuchsluger, Joachim. 2000. An Analysis of Maritime Transport Costs in South America. University of Karlsruhe. January.
- Gaviria, J. 1998. Port Privatization and Competition in Colombia. Public Policy for the Private Sector, Note No. 167. World Bank.
- Gramlich, E. 1994. Infrastructure Investment: A Review Essay. *Journal of Economic Literature* 32(3): 1176-96.
- Green, Richard, and David Newbery. 1992. Competition in the British Electricity Spot Market. *Journal of Political Economy* 100: 929-53.
- Grossman, G. M., and E. Helpman. 1991a. *Innovation and Growth in the Global Economy*. Cambridge, MA: MIT Press.
- _____. 1991b. Trade, Spillovers and Growth. *European Economic Review* 35: 517-26.
- Hart, O., A. Schleifer, and R. Vishny. 1997. The Proper Scope of Government: Theory and an Application to Prisons. *Quarterly Journal of Economics* (November).
- Hennemeyer, Paul. 1998. Energy Reform and Privatization: Distilling the Signal from the Noise. In F. Basañes and R. Willig (eds.), *Can Privatization Deliver? Infrastructure for Latin America*. Washington, DC: Inter American Development Bank.
- Hoffman, Jan. 2000. El potencial de puertos pivotes en la costa del Pacífico sudamericano. ECLAC Transport Unit, *ECLAC Magazine* 71.
- _____. 1999a. Las privatizaciones portuarias en América Latina en los 90: determinantes y resultados. ECLAC Transport Unit. Presented at the World Bank seminar in Las Palmas, Spain.
- _____. 1999b. After the Latin American Ports Privatization: The Emergence of a "Latin American Model." Paper presented at the Fourth World Port Privatization Conference, London. September. http://docs.vircomnet.com/mobility/seacargohandling_vd/pdi1.htm
- Hummels, David. 1999. Have International Transportation Costs Declined? University of Chicago. September.

- Inter-American Development Bank (IDB). 1998-1999. *Facing Up to Inequality. Report on Economic and Social Progress in Latin America*. Washington, DC: IDB.
- _____. 1997. *Latin America after a Decade of Reforms. Report on Economic and Social Progress in Latin America*. Washington, DC: IDB.
- International Monetary Fund. 2000. International Financial Statistics Database. CD-ROM. IMF, Washington, DC.
- International Telecommunications Union (ITU). 2000. *American Telecommunications Indicators*. Geneva: ITU.
- _____. 1999. *Trends In Telecommunications Reform*. Geneva: ITU.
- Jones, Leroy. 1993. Appropriate Regulatory Technology: The Interplay of Economic and Institutional Conditions. Proceedings of the World Bank Annual Conference on Development Economics.
- Joskow, Paul. 2000a. Comments to Fischer and Serra. *Economia* (Fall).
- _____. 2000b. Transaction Cost Economics and Competition Policy. Paper presented at the Annual Conference of the International Society for New Institutional Economics, Tubingen, Germany, 23 September.
- _____. 1999. Deregulation and Regulatory Reform in the U.S. Electric Power Sector. Paper prepared for the Brookings-AEI Conference on Deregulation in Network Industries, 9-10 December.
- _____. 1997. Restructuring, Competition and Regulatory Reform in the U.S. Electricity Sector. *Journal of Economic Perspectives* (Summer).
- Juhel, M. 1998. Globalization, Privatization and Restructuring of Ports. Document presented at the 10th Annual Australasian Summit. World Bank.
- Laffont, J., and J. Tirole. 2000. *Competition in Telecommunications*. Cambridge, MA: MIT Press.
- _____. 1994. Access Pricing and Competition. *European Economic Review* 38: 1673-710.
- Laouyane, A. 1998. The International Dimension of Changes in Telecommunications Technology and Policy. Paper presented at the seminar "Telecommunications and Economic Growth," International Telecommunications Union and Webster University.
- Levy, B, and P. Spiller. 1996. *Regulations, Institutions, and Commitment*. Cambridge, MA: Cambridge University Press.
- Limao, N., and A. J. Venables. 2000. Infrastructure, Geographical Disadvantage and Transport Costs. Mimeo.
- LSU-National Ports and Waterways Institute. 1998. Estudio de fletes para favorecer el comercio exterior de Centroamérica. Final report presented to the Comisión Centroamericana de Transporte Marítimo (COCATRAM).
- McConville, James. 1999. *Economics of Maritime Transport*. First edition. London: Witherby and Co.
- Micco, Alejandro, and Natalia Pérez. 2001. Maritime Transport Costs and Port Efficiency. Inter-American Development Bank Research Department. Mimeo.
- Millan, Jaime. 2001. Deregulated Power Markets Are Facing Problems on Both Sides of the Border, but Are the Problems alike? *Infrastructure and Financial Markets Bulletin* 7(1). Inter American Development Bank.
- Newbery, D. 2000. *Privatization, Restructuring, and Regulation of Network Utilities*. Cambridge, MA: MIT Press.
- Nombela, G., and L. Trujillo. 1999. Privatization and Regulation of the Seaport Industry. Universidad de Las Palmas de Gran Canaria (Spain). Mimeo.
- Pérez, Arriaga, et al. 1999. Formación de precios en generación y diseño del mercado mayorista en el sistema eléctrico colombiano. Study prepared for the Colombian Association of Power Producers (ACOLGEN), Bogotá.
- Pérez-Arriaga, J.I., and Solé-Martín, C. 1999. Formación de precios en generación y diseño del mercado mayorista en el sistema eléctrico Colombiano. Colombian Association of Power Producers (ACOLGEN), Bogota. Mimeo.

- Perry, G., and D. Leipziger. 2000. *Chile: Recent Policy Lessons and Emerging Challenges*. Washington, DC: World Bank.
- Radelet, S., and J. Sachs. 1998. Shipping Costs, Manufactured Exports and Economic Growth. Harvard Instituted for International Development. Mimeo.
- Raven, John. 2000. Trade and Transport Facilitation: An Audit Methodology. World Bank/International Express Carriers Conference. Washington, DC: International Bank for Reconstruction and Development.
- Rivera-Batiz, L., and P. M. Romer. 1991. Economic Integration and Endogenous Growth. *Quarterly Journal of Economics* 106(2): 5331-555.
- Redding, Stephen, and Anthony J. Venables. 2000. *Economic Geography and International Inequality*. CEPR Discussion Paper No. 268, Centre for Economic Policy Research and London School of Economics. September.
- Rodríguez, F., and D. Rodrik. 1999. *Trade Policy and Economic Growth: A Skeptic's Guide to the Cross-National Evidence*. NBER Working Paper No. 7081.
- Romer, P.M. 1990. Endogenous Technological Change. *Journal of Political Economy* 98(5): 71-102.
- Segerstrom, P. 1991. Innovation, Imitation and Economic Growth. *Journal of Political Economy* 99(4): 807-27.
- Serra, P. 2000. Evaluación de los servicios públicos privatizados en Chile. Economic Commission for Latin America and the Caribbean. Mimeo.
- Shleifer, Andrei, and Robert W. Vishny. 1998. *The Grabbing Hand: Government Pathologies and Their Cures*. Cambridge, MA: Harvard University Press.
- Sommer, D. 1999. Private Participation in Port Facilities: Recent Trends. Public Policy for the Private Sector, Note No. 193. World Bank.
- Spiller, Pablo T. 2000. Wholesale Electricity Market Analysis and the El Salvador General Electricity Law. Presentation to the El Salvador Association of Electricity Distributors, San Salvador, 19 September.
- UNCTAD. 1999. *Review of Maritime Transport*. New York and Geneva: United Nations.
- United States Census Bureau, Department of Commerce. Internet Website: <http://www.census.gov/mp/www/rom/msrom8f.html>
- Ventura, J. 1997. Growth and Interdependence. *Quarterly Journal of Economics* 112(1): 57-84.
- Viloria, J. 2000. De Colpuertos a las sociedades portuarias: los puertos del Caribe Colombiano, 1990-1999. Document presented at the II Simposio sobre la Economía de la Costa Caribe, Cartagena, Colombia.
- Viscusi, W., M. Vernon, and J. Harrington. 1997. *Economics of Regulation and Antitrust*. Second Edition. Cambridge, MA: MIT.
- Von der Fehr, Nils-Henrik, and Jaime Millan. 2001. Sustainability of Power Sector Reform: Analytical Framework. Paper prepared for IFM/SDS, Inter-American Development Bank.
- Wolak, Frank. 1997. *Market Design and Price Behavior in Restructured Electricity Markets: An International Comparison*. Working Paper PWP-051. University of California Energy Institute. Berkeley, CA.
- Wolfram, Catherine. 1999. Measuring Duopoly Power in the British Electricity Spot Market. *American Economic Review* 89(4): 805-26.
- World Bank. 2001. Private Participation in Infrastructure Projects. Database. [Http://www.worldbank.org/html/fdp/privatesector/ppidb.htm](http://www.worldbank.org/html/fdp/privatesector/ppidb.htm)
- _____. 2000. Public Policy for the Private Sector. Note Number 215, September.
- World Economic Forum. 1999. *The Global Competitiveness Report*. Geneva: World Economic Forum.
- World Economic Forum and the Harvard University Center for International Development. 2000-2001. *The African Competitiveness Report*. Cambridge, MA and Geneva: World Economic Forum and Harvard University.
- Young, A. 1991. Learning by Doing and the Dynamic Effects of International Trade. *Quarterly Journal of Economics* 106(2): 369-406.