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**Infrastructure**

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# Infrastructure in Latin America and the Caribbean

*Recent Developments and Key Challenges*

Marianne Fay and Mary Morrison



THE WORLD BANK



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# Abbreviations

GDP	gross domestic product
IBT	increasing block tariff
IDB	Inter-American Development Bank
IBRD	International Bank for Reconstruction and Development
IFC	International Finance Corporation
IMF	International Monetary Fund
MIC	middle-income country
O&M	operations and maintenance
OECD	Organisation for Economic Co-operation and Development
OPIC	Overseas Private Investment Corporation
PPI	private participation in infrastructure
PPP	public-private partnership
PRG	partial risk guarantee
PRGF	partial risk guarantee facility
TFP	total factor productivity





# Executive Summary

This report is about infrastructure in Latin America and the Caribbean and the extraordinary transformations that have shaped it over the last 15 years. It is about the false hopes and disappointed expectations that have surrounded private sector participation, and also about the progress made and the lessons learned. It is about an upper-middle-income region whose infrastructure coverage has fallen below the middle-income average, despite its attracting more private investment in infrastructure than any other developing region.

Infrastructure is hampering the region's ability to grow, compete, and reduce poverty. This situation has come about as many governments in the region tried to offload responsibility for infrastructure financing and management to the private sector, or let infrastructure assets deteriorate through neglected maintenance. More than a decade ago, a key conclusion of the World Bank's *World Development Report 1994: Infrastructure for Development* was that public-private partnerships held promise for financing but that government had a continuing, if changed, role to play in infrastructure. This report's analysis reinforces that point, and offers four main messages:

- *The Latin American and Caribbean region needs to spend more on infrastructure.* On average, countries in the region spend less than 2 percent of GDP on infrastructure—while 3–6 percent is needed to catch up or

keep pace with others that once trailed them, such as China and the Republic of Korea. Regardless of the source of financing, infrastructure costs are ultimately borne by users or taxpayers. So, if infrastructure investment is to increase, users must cover more of the costs. This requires changing the payment culture as well as protecting users who really cannot afford to pay. But governments will also need to spend more, both on the poor (though cross-subsidies can help) and on sectors with limited potential for cost recovery.

- *The region also needs to spend better.* Resources should be better allocated between investment and maintenance. New investments must focus on increasing productivity and competitiveness—though that need not be at the expense of social goals, since universal coverage of water, sanitation, and electricity could be achieved within 10 years for less than 0.25 percent of GDP a year. Subsidies must be better targeted to those who need them. And better concession design will ensure that governments do not take on more risk than necessary and are not saddled with large contingent liabilities.
- *Governments remain at the heart of infrastructure service delivery.* Private participation does not reduce the need for public involvement. Governments still have to regulate and oversee infrastructure provision and pay for a large share of investments. They should leverage their resources to attract as much complementary financing as possible. They are also still responsible for setting distribution objectives and ensuring that resources are available and policies in place to provide access for the poor.
- *The private sector is needed, but bringing it back requires learning from the past.* Infrastructure projects with private participation have collapsed to less than a quarter of their peak value in the region and show no sign of recovering, given investors' disaffection with emerging markets. Bringing back the private sector will require improving the balance of risks and expected returns for projects. This involves reducing regulatory risk, improving the framework for private participation in infrastructure (PPI),<sup>1</sup> and strengthening risk mitigation mechanisms. It also means improving public perceptions of PPI, which in some countries are so negative they seriously constrain further private involvement. This, in turn, demands greater transparency, improved transaction design and oversight (to reduce renegotiations and poor performance), and better accommodation of those who stand to lose from restructuring.

This report focuses on the coverage and quality of basic infrastructure services—water, sanitation, electricity, roads, telecommunications—that are generally considered to have the greatest impact on growth, competitiveness,

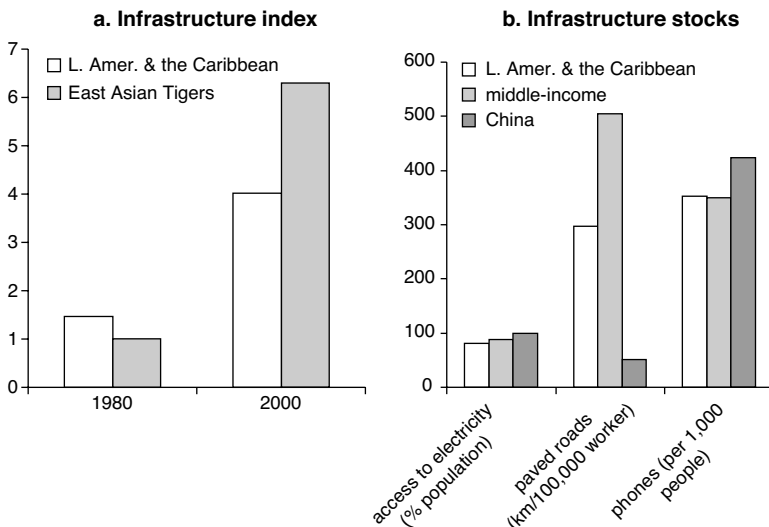
and welfare in both urban and rural areas. Although it is difficult to do justice to the tremendous diversity of the region, which is home to Caribbean islands with fewer than 100,000 inhabitants and Brazil with close to 180 million, and with annual per capita income ranging from \$467 in Haiti to more than \$6,000 in Mexico—this report’s main recommendations apply to most countries, though the best ways to implement them may vary.

## Infrastructure Improvements Have Been Modest in Latin America and the Caribbean Over the Past Decade

Infrastructure coverage and quality have increased in most Latin American and Caribbean sectors and countries over the past decade. There have been major improvements in access to water, sanitation, electricity, telecommunications, ports, and airports. Only in roads has coverage not changed much.

Still, the region has lost ground relative to its competitors and peers. In 1980 it had higher coverage of productive infrastructure such as roads, electricity, and telecommunications than did the countries that later became known as the East Asian tigers. Today those nations lead the Latin American and Caribbean region by a factor of three to two (figure ES.1). The region also trails behind the middle-income average as well as China,

**Figure ES.1. Latin America Has Lost Ground to the East Asian Tigers, China, and Middle-Income Countries**



**Sources:** Calderón and Servén 2004a; World Development Indicators Database.

**Note:** The infrastructure index includes paved roads, electricity generating capacity, and telephones (mainlines and mobile) per worker. The index is calibrated to a value of one for the East Asian tigers in 1980 and is a regional median.

even though it is richer in per capita terms. Water and sanitation are the only sectors (other than mobile phones) in which the region has done comparatively well, at least in terms of coverage.<sup>2</sup> But even in these sectors, there is no room for complacency: 58 million Latin Americans lack access to potable water, and 137 million do not have adequate sanitation.

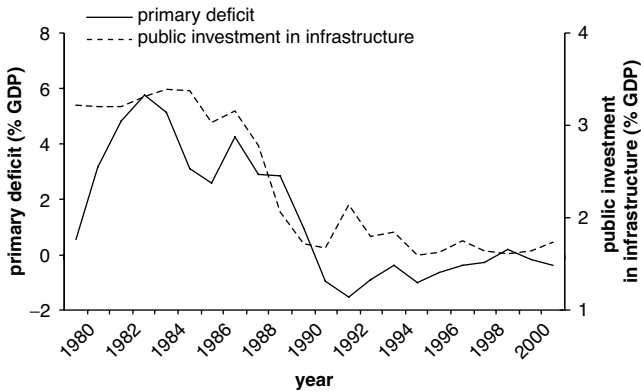
As noted, insufficient infrastructure is hampering economic growth and poverty reduction. Studies suggest that the growth impact is large: improving the region's infrastructure to the level of Korea (the median East Asian tiger) could raise per capita GDP growth rates by close to 4 percentage points. It could also reduce inequality by 10–20 percent, making growth more pro-poor (Calderón and Servén 2004b). But the investment required would be substantial: at least 2.4–5.0 percent of GDP a year over 20 years (appendix B). Poor-quality infrastructure also affects competitiveness. While only 18 percent of private entrepreneurs consider infrastructure a serious problem in East Asia, 55 percent do in Latin America.

### **Private Entry Did Not Make Up for Public Retrenchment**

Two major developments have shaped infrastructure trends in the region over the past 15 years. First, many countries experienced macroeconomic crises that required drastic fiscal adjustment. Second, technical, financial, and regulatory innovations led to a sea change in the infrastructure paradigm, driving the notion that the private sector would become central in financing and provision while government's role would be mostly limited to regulation.

In most Latin American countries, public investment—particularly in infrastructure—bore the brunt of fiscal adjustment. Regionally, public investment in infrastructure fell from more than 3 percent of GDP in 1988 to about 1.6 percent in 1998 (figure ES.2). Politically, this investment was much easier to cut than current expenditures such as salaries and pensions. Brazil, the most extreme case, actually increased current expenditures while cutting investment, especially in infrastructure.

But the region did spectacularly well in attracting PPI. Between 1990 and 2003 it attracted nearly half of the \$786 billion devoted to PPI in the developing world. And private participation did transform infrastructure in the region. In 1990 only 3 percent of telephone and electricity connections were provided by private companies, and almost no water utilities were privately run. By 2003 private utilities managed 86 percent of telephone subscriptions, 60 percent of electricity connections, and 11 percent of water accounts (Andres, Foster, and Guasch 2005).

**Figure ES.2. Primary Deficit and Public Infrastructure Investment in Latin America**

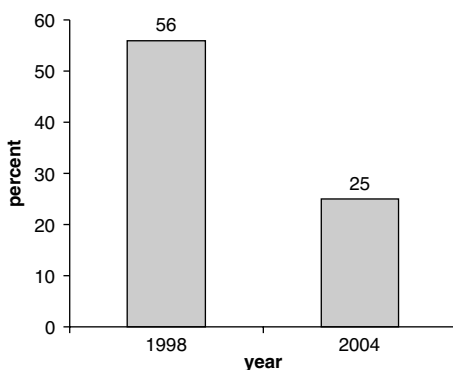
Source: Servén 2005.

Note: Average for Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Mexico, and Peru.

Still, private flows never fully offset the collapse in public investment, though they came close at their peak: in 1998 infrastructure projects with private participation accounted for 1.7 percent of regional GDP. In addition, private investment focused on a small number of countries (six attracted 93 percent of private flows) and sectors (telecommunications absorbed nearly half).

Today public opinion has turned against PPI to such an extent that it is a serious constraint to private infrastructure operation in many countries (figure ES.3). And investors' appetite for emerging markets and infrastructure has waned. Investments with private participation in Latin America and the Caribbean plummeted from \$71 billion in 1998 to \$16 billion in 2003. Moreover, the average number of bidders on power distribution transactions fell from four in 1998 to fewer than two in 2000–01 (Harris 2003).

Public sentiment is at odds with the generally positive evaluation of the outcomes of privatization. In most cases, private involvement has increased service efficiency, coverage, and quality. Labor productivity has also improved, though mainly because of layoffs, at least initially. In addition, most of the restructuring associated with privatization—including job losses and price increases—actually occurred in the transition to privatization, with changes in the five years before usually being much greater than in the five years after (Andres, Foster, and Guasch 2005). Privatization itself has had a generally positive impact on the poor,

**Figure ES.3. Respondents Who Think Privatization Has Been Beneficial**

Source: Latinobarómetro surveys.

mostly because they have been the primary beneficiaries of the coverage increases implemented by (and often required of) private operators.

Contrary to popular perception, concessionaires do not appear to have made excessive profits. Indeed, concessions have proved risky: about 40 percent may never turn a profit, at least on their original terms (Sirtaine and others 2005). Only telecommunications concessions appear to almost always be profitable. These findings should be treated with caution because they rely on estimates of the cost of capital, which are imprecise, and actual outcomes are affected by concessionaires' ability to renegotiate. But the private sector's reduced appetite for PPI in the region testifies to the absence of extraordinary returns.

Popular rejection of PPI may largely be due to poorly managed perceptions and unreasonable expectations. In addition, several researchers have argued that macroeconomic crises lead to blanket rejection of market mechanisms and that people do not distinguish job losses due to recessions from those associated with privatizations. More generally, the perceived transparency and fairness of a transaction are crucial in shaping public perceptions.

The reaction to PPI may also be due to excessive renegotiation and a few well-publicized failures. Guasch (2004) finds that 30 percent of the region's infrastructure concessions have been renegotiated, with the incidence rising to a staggering 74 percent in the water and sanitation sector. Whatever the motivation (opportunistic behavior by governments or concessionaires, poorly designed contracts, exogenous shocks) frequent renegotiations are costly, disruptive, and anticompetitive, and contribute to a perceived lack of transparency.

Many difficulties with PPI have been due to immature regulatory frameworks and institutions. Introducing PPI required sweeping changes to regulations, laws, and institutions, which often were not fully implemented when private participation began. In addition, analysts and reformers were overly optimistic about the ability of reforms and regulations to shield transactions from political influence, and about the appropriateness for the region of models developed for mature, full-coverage infrastructure networks in industrial countries.

In addition, cost recovery has proven elusive. Though it has improved in water, sanitation, and electricity, it has been fully achieved (in most cases) only in telecoms. Yet, except in the region's poorest countries, affordability is a problem only for a minority of the population. Making matters worse, many governments are unwilling or unable to enforce service payments—a common complaint of concessionaires.

Poorly targeted social tariffs hinder cost recovery and do too little for the poor. In most countries social tariffs for water and electricity benefit far too many of the non-poor: 95 percent of Guatemalans and 85 percent of Hondurans benefit from the social electricity tariff. And in Mexico, low electricity tariffs create the need for a public subsidy equal to almost 1 percent of GDP.

Given this background, Latin America and the Caribbean need to address the challenges raised by this report's four main messages.

### **Message 1: The Region Needs to Spend More on Infrastructure**

The amount needed for infrastructure investment depends, of course, on the goal set. Universal coverage for water, sanitation, and electricity could be achieved within 10 years for just 0.25 percent of regional GDP. Maintaining assets in water, sanitation, electricity, roads, rail, and telecom would require about 1 percent of GDP. Under a “business as usual” approach based on modest growth assumptions, another 1.3 percent of GDP would be needed for new investments to satisfy the demand of consumers and firms. (See appendix B for details.)

Combined, these estimates imply that about 2.5 percent of GDP would be enough to respond to expected growth in demand, maintain existing infrastructure, and achieve universal coverage in water, sanitation, and electricity. This is a lower-bound estimate because it does not include the cost of rehabilitation (which is likely to be large) or needed investments in urban transport, ports, and airports.

But much more, about 4–6 percent of GDP, would be required to bring Latin America and the Caribbean to Korea's level of coverage over

20 years or simply to keep up with China. Clearly, infrastructure spending alone will not be sufficient for the region to achieve the kind of growth that these comparator countries have experienced in recent decades. The relationship clearly goes both ways, as strong growth increases the demand for infrastructure (and the available financing). Still, a failure to keep up with other countries' infrastructure can only harm the region's competitiveness. Adding maintenance, a growth and competitiveness enhancing scenario would require annual spending of 5–7 percent of GDP. While ambitious, this is not unrealistic. Similar increases were achieved by China, Indonesia, Korea, and Malaysia between the late 1970s and late 1990s.

This significant spending hike could not be funded solely by the public sector without a massive reallocation of resources. Public expenditures in Latin America and the Caribbean averaged 22 percent of GDP in 2000–01, and public investments, about 3 percent. But PPI amounts to just 0.9 percent of regional GDP, and most of it is in energy and telecommunications.<sup>3</sup>

One implication is that governments need to better leverage their resources to attract more PPI. Another is that greater cost recovery is needed; there is only so much that taxpayers can or should fund. Cost recovery has largely been achieved for telecoms and is not technically achievable for most roads, so not much change can be expected in these two sectors.<sup>4</sup> But there is considerable room to recover more costs from tariffs in water, sanitation, and electricity services—even though cost recovery in these sectors is already higher in the region than in any other developing region—and probably from ports and urban transport.

Higher tariffs are a reasonable policy goal only if they are affordable. But simulations show that affordability is a problem only for a small share of the population, with the exception of some of the poorer countries in the region (Bolivia, Honduras, Nicaragua, and Paraguay) where a utility bill of \$10 a month is already a substantial burden for 30 percent to 50 percent of urban households. Government commitment is critical for greater cost recovery (indeed many private operators complain of a lack of support and enforcement in cost recovery) as is improved targeting of subsidies.

The message of “spending more” must be qualified for some of the small island states of the Caribbean. Many of these have spent heavily, if not always appropriately, on infrastructure in recent years, which has contributed to heavy public debt burdens. This rules out much new government



borrowing for infrastructure in countries such as St. Kitts and Nevis, Jamaica, and Antigua, and implies that the next key message may be the more salient one for these countries.

## **Message 2: The Region Also Needs to Spend Better**

Better subsidy targeting would go a long way toward freeing up resources for investment and maintenance, as well as making higher tariffs socially feasible. In addition, modifying tariff structures, particularly by shrinking the subsidized block of increasing block tariffs, would lower the cost of subsidies, although it would not always improve targeting. While consumption increases with income for electricity, the link is less strong for water. Countries that already have means-based social assistance can use existing databases to identify the poor and their needs. Elsewhere, geographic targeting is an option, though a less accurate one. However, restructuring or abandoning consumption subsidies can be difficult politically. It has been 11 years since Colombia passed a law requiring that base utility tariffs be raised to cost recovery levels, yet the water sector continues to make substantial fiscal demands.

Spending also needs to be better allocated. In particular, not enough is being spent on maintenance. Many countries lack a reliable source of funding to ensure regular maintenance, notably of roads, most of which are publicly funded and therefore subject to the vagaries of the fiscal situation. New investments should focus on strategic goals, such as completing networks. But tackling bottlenecks should not come at the expense of providing service to the poor, which can be done at a relatively low cost. Decentralization and participatory planning can help, though they can also complicate matters.

Expenditures can be made more efficient in other ways. Reliable financial flows would lower the cost of investment programs and enable regular maintenance. In Brazil, for example, payments to road contractors are often disrupted due to budget shortfalls, and contractors sometimes use the disruptions to invoke price escalation clauses. Similarly, governments tend to pay much more for goods and services than the private sector does, reflecting collusion among vendors and other factors. An effective procurement (or competition) agency can significantly cut costs. For small countries, regional procurement agencies may be appropriate.

Finally, a better PPI framework can reduce the costs of attracting PPI and increase its benefits. Regulatory risk raises the cost of capital for infrastructure investment by 2–6 percent (Guasch and Spiller 1999). Andres,

Foster, and Guasch (2005) find that privatization makes a much greater contribution to service quality and efficiency when concessions are awarded competitively and regulators have more autonomy.

The award criteria and regulatory regime matter because they affect the incentives facing concessionaires. Price cap regulation, for example, has been common in the region and has been found to have the largest impact on efficiency improvements. But it is riskier for concessionaires because it does not guarantee profits, thereby increasing the cost of capital. It is also much more prone to renegotiation than other regimes. Renegotiations are costly: financially, in terms of disrupted services, and through their impact on the credibility of the PPI model.

In addition to careful choices for regulatory regimes, strengthening the PPI framework requires improving award processes to ensure transparency and competitiveness. It also requires better concession design, to clearly state events that would trigger renegotiation as well as guidelines for the renegotiation process. Contracts also need to specify information to be disclosed. This, combined with an adequate regulatory accounting framework, is critical for regulators to cope with the asymmetry of information inherent in any concession.

Risks can also be better managed and allocated. Contracts, in particular, should better identify and allocate the risks involved. Although governments need to improve the risk-return ratio of investment projects for outside investors, they must be careful about the risks they assume. Many Latin American governments face enormous contingent liabilities from excessive commitments made in the past.

Third-party guarantees are increasingly necessary. Infrastructure concessions often use project financing, which may require risk protection instruments (particularly against regulatory and exchange rate risk) to attract outside investors. But when a government accepts such risks through guarantees or other structures, lenders and investors become exposed to its sovereign risk and the credit rating that implies. This may be unacceptable to international and even domestic investors, who may already be heavily exposed to sovereign risk, as is the case with many Latin American pension funds and insurance companies, as these often invest mostly in government securities.

A critical remaining difficulty involves institutional reform. While many of the technical improvements discussed above are fairly straightforward, their implementation depends on having in place the right institutions and capacity, a much more difficult condition to meet. It is not realistic to expect a comprehensive set of well-functioning institutions as

a prerequisite for PPI. Institutional advances in infrastructure will unfold at a pace that depends on the political economy of reform, the cultural context, and country-specific ways of securing property rights.

### **Message 3: Governments Remain at the Heart of Infrastructure Service Delivery**

With or without private participation, governments remain responsible for infrastructure reform, for setting and enforcing the basic rules of the game, and for regulation. This includes managing the political economy of reform. Infrastructure reforms are political processes, prone to backlash. Losers from reform may try to recover the benefits they enjoyed in the past, while winners may not feel like they have benefited much because they perceive that current sacrifice will not be rewarded with future gains, or that private firms will eventually capture most of the gains. To push reforms forward, governments and regulators need to find ways to escape “redistribution traps,” where the gains of one group become (or are perceived as) the losses of another. If those who stand to lose have veto power, reforms will not advance.

Governments also remain responsible for social goals. With or without PPI, the design, monitoring, and funding of social policies are public responsibilities (although cross-subsidies can help pay for them, notably in water and electricity). But the private sector can help, such as through output-based aid. In addition, small-scale providers can offer low-cost solutions to provide services for the poor.

Governments are responsible for much of infrastructure finance, directly and indirectly, by helping to structure financing frameworks. A central issue here is how to generate the fiscal space for increased public investments. A number of Latin American and, in particular, Caribbean countries are saddled with large debt burdens. Many (Brazil, Colombia, Peru) suffer from spending rigidities, with more than 90 percent of the budget dedicated to nondiscretionary items (pensions, social security, debt service, wages, transfers to subnational governments). Some have scope for increasing tax collection (Honduras), while others do not. In Brazil, where taxes are around 35 percent of GDP, the negative impact of a further tax increase would more than offset the growth and welfare benefits of increased infrastructure investments (Ferreira and Nascimento 2005).

Several options have been suggested for increasing fiscal space, based on the argument that current rules reinforce the tendency of politicians to cut investments rather than more politically sensitive current expenditures.

One approach could be to adopt alternative rules, such as the “golden rule,” that permit borrowing to finance capital but not current expenditures. Another could be to exempt particular investments from the calculation of fiscal balance based on their social or economic rates of return. The first approach has been rejected by the International Monetary Fund (IMF), while the second is unlikely to create significant fiscal space. The way forward will likely vary by country, based on a combination of reallocated spending, improved spending efficiency, and reliance on increased revenues associated with better growth performance.

Governments can also help by providing a financing framework for long-term infrastructure investments. For example, investors are likely to favor projects with substantial local currency financing. This can be achieved by developing local capital or debt markets or by using local currency loans, hedging products, or creative financing structures offered by private, bilateral, or multilateral financial institutions. Partial risk guarantees (PRGs) from multilateral institutions can protect lenders or bondholders against other perceived risks, providing the credit enhancements that project companies require to raise adequate financing. Governments can play a critical role in structuring these guarantees or even in establishing wholesale facilities for them, such as the Partial Risk Guarantee Facility recently set up in Peru by the World Bank.

Finally, subnational entities need to be able to borrow to fund the infrastructure for which they are responsible. This needs to be done in the context of a prudent intergovernmental framework, and in many countries requires substantial reforms. In the shorter term, multilateral institutions such as the World Bank have instruments that allow countries to borrow and onlend in local currencies to subnational governments.

#### **Message 4: Bringing Back the Private Sector Requires Learning from the Past**

The private sector is critical to improving infrastructure in Latin America and the Caribbean, both for financial resources and for know-how and management skills. A better PPI framework, including stronger concession design and risk management instruments, is crucial for attracting back the private sector. There is also a need for better management of the political economy of reform. Indeed, winning back public opinion is one of the most pressing challenges for PPI in the region.

Improving perceptions of private participation will require a number of changes. Concessions need to be granted in a transparent manner.

Renegotiations need to be less frequent. Finally, governments need to shoulder their responsibilities—on painful reforms, on appropriate safety nets for those who stand to lose from the reform process, and for the poor.

## **Facing the Challenges and Setting Priorities**

In the 1990s the international development community focused on the fight against poverty, which was equated rather narrowly with a need to expand social services. This culminated in the formulation of the Millennium Development Goals, which emphasize reducing poverty and improving health and education. Today Latin American and Caribbean countries spend about 8 percent of GDP on health and education—quite a bit more than East Asia, middle-income countries, or China—and a similar amount on social security and welfare.<sup>5</sup> For infrastructure the thinking was that the private sector could finance much of what was needed, because increased efficiency and cost recovery would ultimately generate sufficient returns.

Today the pendulum has swung back somewhat. The World Bank's recent Annual Review of Development Effectiveness (produced by its Operations Evaluation Department) calls for a renewed focus on infrastructure. It argues that more attention should be paid to the entire growth agenda, and that focusing solely on the social sectors is insufficient to reduce poverty. Similarly, the IMF's Independent Evaluation Office has argued that more attention should be paid to the quality of fiscal adjustment, and that fiscal consolidation has often come at the expense of public investment. The private sector is less enthusiastic about infrastructure projects, especially in emerging markets. And Latin America's people have massively rejected the traditional privatization model.

This report does not argue that governments should slash social spending in favor of infrastructure, but rather that they should take account of all the considerable potential returns to infrastructure investment—not just financial, but also economic and social—when setting budgets. This is not based on a simplistic view that by narrowing its infrastructure gap with East Asia, the region will be transformed into a collection of “tigers.” Common sense and empirical evidence show that infrastructure is necessary for growth and poverty alleviation but is not sufficient. And the returns to infrastructure projects vary with the level of infrastructure already in place and with the quality and efficiency of individual projects, just as for any other investment.

The financial and human resources available for improving infrastructure will remain limited. How, then, should priorities be set among all the competing needs for investment and reform? Our suggestion, for the short term, is to go for the low-hanging fruit—meaning the interventions that are not too costly financially or difficult politically. On the publicly managed infrastructure side this includes improving procurement, maintenance, and the stability of financial flows for investment and maintenance. On the PPI side it means not providing inappropriate guarantees, developing better financial products (particularly ones that tap local financial markets), and applying lessons about contract design.

As for investments, a key argument of this report is that the region can afford universal coverage in water, sanitation, and electricity if appropriate technologies and standards are used. In addition, scarce resources imply that investments need to focus on bottlenecks in existing systems before overall expansion.

## CHAPTER 1

# Infrastructure in Latin America and the Caribbean—Some Progress, But Not Enough

Coverage and quality have improved for most infrastructure services in the region, but gaps remain and ground has been lost relative to competitors. Progress in recent decades has been steady if uneven within and across sectors and countries. Coverage lags behind in rural areas and among the poor, both rural and urban. The poor also suffer more when service quality is low. And progress has not kept up with competitors: other middle-income countries, including China, and East Asia’s “miracle” economies.

Inadequate infrastructure undermines the region’s growth and competitiveness and hampers the fight against poverty, exclusion, and inequality. Infrastructure services account for a significant share of production costs: 16 percent in Colombia, for example. Although similar estimates are not available for the entire region, it is clear that better infrastructure would have huge impacts on competitiveness and growth. Infrastructure is also essential in helping the poor improve their health, quality of life, and ability to engage in productive activities. As a result infrastructure improvements significantly contribute to reducing inequality (Calderón and Servén 2004b).

### **Coverage and Quality Have Improved, But Slowly**

Coverage for most services has improved steadily over the past two decades. Since 1985 most countries in Latin America and the Caribbean

have considerably expanded access to fixed telephone lines, electricity, safe water, and improved sanitation facilities. The past 10 years have seen an explosion in the use of cellular telephones and the Internet. Electricity generation capacity has grown as well, and numerous port concessions have led to substantial modernization. Road coverage has not changed much, however, and rail services have actually shrunk because a number of rail companies were privatized and loss-making routes closed. (Appendix A has more details on the sectoral evolution of coverage.)

However, progress has generally been slower than in other middle-income countries, notably China. The region's per capita income is above the middle-income country average and much higher than China's. Yet its electricity, road, and telephone coverage have fallen behind both (table 1.1). Only in cellular telephony and access to safe water and improved sanitation has the region performed comparatively well, particularly during the 1990s.

The region's infrastructure gap with the seven East Asian "tigers" has widened.<sup>1</sup> This gap—measured by infrastructure stocks per worker—grew by a huge margin between 1980 and 1997. Comparing simple averages for each region, East Asia's advantage over Latin America and the Caribbean grew by 48 percent for fixed phone lines, 91 percent for power generation capacity, and 53 percent for road length (Calderón and Servén 2003).

Quality has generally improved, but also lags behind competitors. Although data on the region's infrastructure quality are thinner, they generally show the same improving trend as coverage. Privatization of electricity distribution caused losses of electricity in distribution to fall from 17 percent in the three years before the change in ownership to 15 percent in the three years after (Andres, Foster, and Guasch 2005). This remains high relative to middle-income countries (12 percent), China (7 percent), and OECD countries (6 percent), though some of the difference may be due to variations in system design. Similarly, a recent study of seven Latin American countries found that because of poor quality, public infrastructure (including privately owned public services) is only about 74 percent as effective as that of industrialized countries (Rioja 2003b). And survey data (discussed in detail below) show that businesses in the region consider infrastructure quality a problem.

Performance varies greatly among countries. Some infrastructure sectors in Latin America and the Caribbean, particularly in the region's wealthier countries, have quality and coverage comparable to OECD levels, while others are closer to Africa's. Less than a quarter of national



**Table 1.1. Infrastructure Coverage in Latin America and the Caribbean, China, and other Middle-Income Countries, Various Years**

	<i>Phones</i>	<i>Paved roads</i>		<i>Access to</i>	<i>Improved</i>	<i>Improved sanitation</i>
	<i>(per 1,000 people)</i>	<i>(km/1,000 km<sup>2</sup>)</i>	<i>(km/100,000 workers)</i>	<i>electricity (%)</i>	<i>water source (%)</i>	<i>facilities (%)</i>
	2002	2001	2001	2003	2002	2002
<b>L. Amer. &amp; the Caribbean</b>	353	36	298	81	91	78
<b>China</b>	424	41	51	99	77	44
<b>Middle-income countries</b>	350	82	504	89	90	80

*Source: World Development Indicators.*

**Note:** Phones include both cellular and mainline telephones. The Latin American and Caribbean region's population density is 26 people per square kilometer compared with 43 in middle-income countries and 137 in China—this explains why its road density ranking changes depending on whether labor force or area is used as a deflator. In 2004, GDP per capita, (in purchasing power parity terms) was \$5,495 in China, \$6,560 in middle-income countries, and \$7,920 in Latin America and the Caribbean (current international dollars).

roads are officially deemed to be in good condition in Brazil, Peru, Mexico, and Nicaragua, while four-fifths are in Argentina. In Costa Rica 98 percent of households have an electricity connection, compared with just 69 percent in Peru. Uruguay has 16 times more fixed phone lines per capita than Haiti. Coverage patterns reflect both the huge income differences between countries and the enormous geographic diversity of the region. For example, road coverage tends to be higher in the small, densely populated island states of the Caribbean than in the larger, more geographically challenging countries of South America.

There is also a sharp divide between rural and urban coverage within countries. Rural areas tend to have much lower coverage for water, electricity, roads, and telecommunications. In 2002 more than 90 percent of the urban population had access to an improved water source in most countries in the region. However, rural access in Brazil (58 percent) and Chile (59 percent) was worse than in several much poorer African nations such as Burundi (78 percent) and Zimbabwe (74 percent) (World Development Indicators).<sup>2</sup> In Colombia one-third of the rural population does not have ready access to the road network, and the average rural household lives 2.5 kilometers from an all-season road (World Bank 2004a). Given that poverty is usually much higher in the countryside, lower rural access rates explain much (though by no means all) of the vast disparities in infrastructure coverage between rich and poor Latin Americans.

Rapid urbanization has put pressure on infrastructure, and access and quality are often inadequate in poor neighborhoods. Among developing regions, the Latin American and Caribbean region is the most urbanized, with around 77 percent of its people living in cities and towns. Rapid urban growth has strained infrastructure. Even though urban poverty rates are much lower than rural ones, about half the region's poor—113 million people, according to World Bank estimates—live in urban areas, often in recently or informally settled areas that lack basic services. Telephony (including cellular), sewerage, and drainage tend to be the most unequally distributed services in cities (World Bank 2004b).

Infrastructure access reflects and reinforces the region's poverty profile and extreme income inequality. Coverage is usually much higher among wealthier groups, particularly in rural areas (table 1.2). In rural Paraguay only 3 percent of the poorest fifth of the population had a piped water connection in the late 1990s, compared with 32 percent of the richest. Although urban coverage is far more extensive—the poorest urban quintile has greater access than the richest rural quintile in all but one of the countries with data—stark differences remain. In

**Table 1.2. Urban and Rural Piped Water Connections in Various Latin American Countries, by Expenditure Quintile**

% quintile

Country	Year	Urban quintiles					Rural quintiles				
		1	2	3	4	5	1	2	3	4	5
Bolivia	1999	76	84	87	93	97	17	25	27	36	50
Brazil	1996/97	63	85	90	97	98	7	30	42	48	37
Chile	1998	97	98	99	99	100	30	39	41	42	40
Colombia	1997	92	97	98	98	99	50	54	58	63	70
Ecuador	1998	52	64	70	73	92	40	42	45	57	47
El Salvador	1998	35	52	66	75	87	19	27	30	41	35
Nicaragua	1998	57	75	83	89	93	13	32	42	44	53
Paraguay	1997/98	30	50	61	72	83	3	13	20	26	32

*Source:* PAHO 2002.

1998 only 35 percent of El Salvador's poorest urban residents had piped water, compared with 87 percent of the richest.

### Slow Infrastructure Gains Imply Reduced Growth and Competitiveness

Infrastructure is critical for economic growth and productivity. There is broad consensus among researchers on this common sense finding. In a survey of 62 recent papers, Calderón and Servén (2006) confirm that the great majority of studies find that infrastructure contributes to increased output and/or decreased production costs. Moreover, the few studies that conclude otherwise are focused on developed, not developing, countries. This is consistent with a survey of 102 papers discussed in Briceño-Garmendia, Estache, and Shafik (2004). The relationship between infrastructure investments and infrastructure assets is affected by spending efficiency (itself dependent on the degree of procurement efficiency, corruption, and project selection). This explains the much less robust relationship that exists between public infrastructure investment and growth.

Overall, returns to infrastructure investments are higher when the existing quantity and quality of infrastructure are lower, so infrastructure investments have higher growth returns in developing countries (box 1.1).

Infrastructure has a significant impact on growth in Latin America. Calderón and Servén (2003) find that infrastructure makes a positive and significant contribution to output and growth in the region. In fact, the authors estimate that the marginal productivity of telecommunications,

**Box 1.1****Infrastructure, Productivity, and Growth:  
What the Literature Says**

A number of empirical studies have found that infrastructure has positive effects on output, especially in developing countries. Returns on infrastructure investments are generally highest during the early stages of development, when infrastructure is scarce and basic networks have not been completed. But returns tend to fall—sometimes sharply—as economies reach maturity. Indeed, some studies of the United States have found that infrastructure investment has negative effects on total output (Briceño-Garmendia, Estache, and Shafik 2004).

In a seminal paper, Aschauer (1989) found that the stock of public infrastructure is a significant determinant of aggregate total factor productivity (TFP). But the economic significance of his results was found to be implausibly large and not robust when more sophisticated econometric techniques were used (Holtz-Eakin 1994; Cashin 1995; Baltagi and Pinnoi 1995). Gramlich (1994) provides an overview of this literature.

More recent empirical literature, mostly using cross-country panel data, confirms that infrastructure makes a significant contribution to output. Such analysis relies on increasingly sophisticated econometric techniques to address reverse causation. (Infrastructure may cause growth, but growth also causes firms and people to demand more infrastructure; failure to take this into account would result in overestimation of infrastructure's contribution to growth.) Notable papers in this vein include Canning (1999), which uses panel data for a large number of countries, and Demetriades and Mamuneas (2000), which uses data for OECD countries. Röller and Waverman (2001), using a framework that controls for the possible endogeneity of infrastructure accumulation, find that telecommunications infrastructure has large output effects. Similar results for roads are reported by Fernald (1999) using data on U.S. industry. Calderón and Servén (2003) present a similar empirical analysis focused on Latin America. They find positive and significant output contributions from three types of infrastructure—telecommunications, transport, and power.

A few papers go beyond measures of infrastructure spending and stocks and consider infrastructure efficiency or quality. Hulten (1996) finds that differences in effective use of infrastructure explain 25 percent of the growth difference between Africa and East Asia, and more than 40 percent of the difference between low- and high-growth countries. Using a large panel data set, Esfahani and Ramirez (2002) report that infrastructure has significant growth effects, but

*(continued)*

that its contribution is affected by institutional factors. Finally, Calderón and Servén (2004b) find that infrastructure quantity and quality both have a robust impact on economic growth and income distribution. The authors use a large panel data set covering more than 100 countries and spanning 1960–2000, and conduct a variety of specification tests to ensure that the results capture the causal impacts of infrastructure quantity and quality on growth and inequality.

*Source:* Adapted from Calderón and Servén 2004b with input from Briceño-Garmendia, Estache, and Shafik 2004.

transport, and power infrastructure is significantly higher than that of non-infrastructure capital. They also find that the region's slower infrastructure accumulation explains much of why it has lagged behind East Asia economically: the differing evolution of infrastructure assets explains 30 percent of the cross-regional gap in GDP over 1980–97.

Improving the level and quality of infrastructure could have considerable growth payoffs. Calderón and Servén (2004b) estimate the potential growth payoffs of improving infrastructure quantity (stocks) and quality. If other Latin American countries were to catch up with Costa Rica, the region's leader in both respects, per capita GDP growth rates would be higher by 1.3–4.8 percentage points depending on the country (table 1.3). Catching up with the median East Asian tiger economy, Korea, would generate even larger gains.

The required investment would be large, but not impossibly so. To reach Korea's level of productive infrastructure, Latin America and the Caribbean would need to invest 4–6 percent of GDP a year for 20 years—two to four times what most countries are investing today.<sup>3</sup> While ambitious, this is not unrealistic.<sup>4</sup> Similar investment levels were achieved by Korea as well as China, Indonesia, and Malaysia over the 20 years from the late 1970s to the late 1990s. Indeed, Korea's infrastructure endowments 25 years ago were substantially worse than those of Argentina, Brazil, and Mexico at the time. If Calderón and Servén are right, increased infrastructure investments in the region would generate enormous payoffs in terms of higher growth and reduced inequality.

Infrastructure is an important determinant of productivity. In developing countries, infrastructure is used almost equally by households as a final consumption item and by firms as an intermediate consumption item (Prud'homme 2004). Good infrastructure makes firms more productive and so more competitive internationally. It is also critical to

**Table 1.3. Potential Increases in per Capita GDP Growth in Various Latin American Countries from Improved Infrastructure Quantity and Quality**

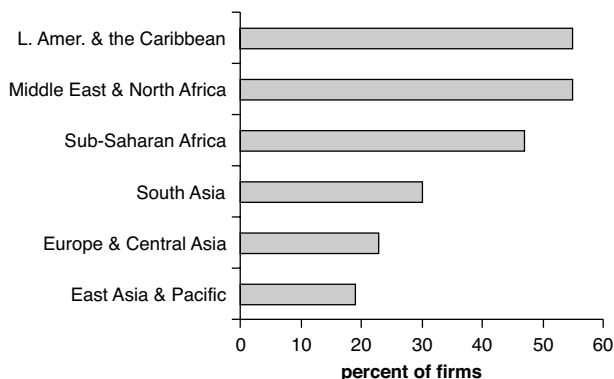
percentage points

Country	Improvement to levels of L. American & Caribbean leader (Costa Rica)			Improvement to levels of East Asian tiger median (Republic of Korea)		
	Quantity	Quality	Total	Quantity	Quality	Total
Argentina	1.3	0.4	1.7	2.2	0.9	3.2
Bolivia	3.8	0.5	4.3	4.8	1.0	5.8
Brazil	1.5	1.4	2.9	2.4	1.9	4.4
Chile	1.3	0.0	1.3	2.3	0.6	2.8
Colombia	1.9	1.2	3.1	2.9	1.7	4.6
Costa Rica				1.0	0.5	1.5
Dominican Republic	1.3	0.1	1.4	2.3	0.7	2.9
Ecuador	2.0	1.0	3.0	3.0	1.5	4.5
El Salvador	1.6	0.4	2.1	2.6	1.0	3.6
Guatemala	3.3	0.4	3.7	4.2	0.9	5.2
Honduras	3.1	1.1	4.2	4.1	1.6	5.7
Mexico	1.4	0.2	1.7	2.4	0.8	3.2
Nicaragua	3.4	1.4	4.8	4.4	1.9	6.3
Panama	1.4	0.2	1.5	2.4	0.7	3.1
Peru	3.0	0.6	3.5	4.0	1.1	5.0
Uruguay	0.7	0.4	1.1	1.7	0.9	2.6
Venezuela, R. B. de	1.1	0.4	1.4	2.0	0.9	2.9

*Source:* Calderón and Servén 2004b.

countries' ability to reap the benefit of trade liberalization, because infrastructure is central to "behind the border" reforms. This is important in Latin America and the Caribbean, where trade liberalization continues to advance in many countries.

Poor infrastructure contributes to the region's low rankings on competitiveness indexes. Several such indexes, aggregating infrastructure variables, have been developed. These include the World Economic Forum's Growth and Business Competitiveness Indexes and the International Institute for Management Development's *World Competitiveness Yearbook*.<sup>5</sup> These indexes use data and firm surveys to rank countries' ability to create and maintain an environment that sustains enterprise competitiveness. The World Bank's investment climate assessments also survey firms about the environments in which they operate, including the performance of infrastructure. More than half of the respondents in the region considered infrastructure a major or severe obstacle to the operation and growth of their business (figure 1.1). That level, shared by the Middle East and North Africa, is the highest among developing regions.

**Figure 1.1. Businesses That Consider Infrastructure a Serious Problem, by Region**

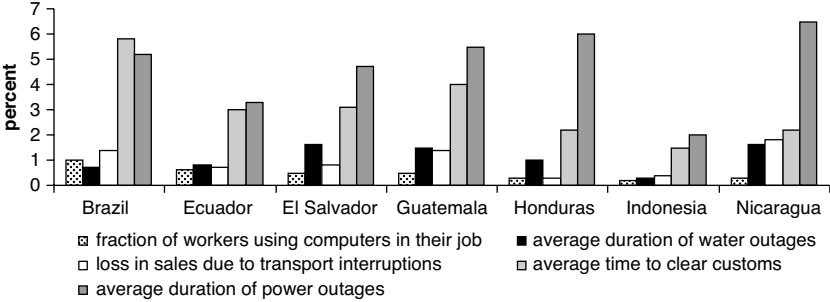
*Source:* World Bank 2004d based on investment climate surveys administered between 2001 and 2004.

*Note:* Shows the percentage of firms that consider inadequate electricity, telecommunications, or transportation to be major or severe obstacles to their operation and growth.

Weak infrastructure undermines productivity and integration in Latin America. Investment climate surveys in Brazil, Ecuador, El Salvador, Guatemala, Honduras, and Nicaragua confirm that most entrepreneurs deem inadequate infrastructure a serious issue. An analysis of the surveys for these six countries plus Indonesia, conducted for this report, supports this finding. Escribano and others (2005) find that infrastructure-related variables account for, on average, 55 percent of total factor productivity (TFP) in Latin American countries. Infrastructure variables with the largest impacts on productivity include poor electricity and, to a much lesser extent, transport services (figure 1.2). Escribano and others (2005) also find that poor infrastructure affects Latin America's integration with global markets. In particular, it hinders firms' capacity to export and countries' ability to attract foreign investment—reducing opportunities for increased international integration and enhanced competitiveness, technology, and innovation.

Poor infrastructure also contributes to high logistics costs and requires large inventories in the region. Logistics costs range from 15 percent of product value in Chile to 34 percent in Peru.<sup>6</sup> The average in OECD countries is 10 percent (Guasch 2002). While part of this difference is due to the higher value relative to weight of OECD products, much can be attributed to differences in infrastructure quality and reliability. Poor quality and reliability require high inventory levels. Whereas U.S. businesses hold inventories equal to about 15 percent of GDP, inventories in Latin America and the Caribbean and other developing regions are often

**Figure 1.2. Productivity Gains from a 20 Percent Improvement in Selected Investment Climate Variables in Various Latin American Countries and Indonesia**



Source: Escribano and others 2005.

twice that (Guasch 2004). Maintaining such levels is expensive because it ties up capital, which has a high cost in most of the region. This significantly increases unit costs, lowering competitiveness and productivity. Guasch estimates that, assuming an interest rate of 15–20 percent, additional inventory holdings made necessary by poor logistics cost Latin American and Caribbean economies more than 2 percent of GDP.

**Inadequate Infrastructure Also Undercuts the Fight Against Poverty and Inequality**

Recent expansion in infrastructure coverage has usually, but not always, benefited the poor. Because poor people, particularly those living in remote rural areas, are usually the last to be connected, the recent gradual expansion of services in Latin America can be expected to have benefited them more than the better off. But country data present a mixed picture. For example, between 1989 and 1996 water access among the poorest tenth of urban Brazilians jumped from 53 percent to 74 percent, against a rise from 92 percent to 97 percent for the seventh decile. But in rural areas absolute increases benefited the seventh decile more, with coverage increasing from 64 percent to 77 percent, but only from 12 percent to 21 percent for the bottom decile. During the same period electricity coverage fell slightly for Mexico’s urban poorest and rural seventh deciles, barely changed for the urban seventh decile, and jumped for the rural bottom decile (Estache, Foster, and Wodon 2002).

Infrastructure access is critical to improving economic opportunities for the poor. When poor people and underdeveloped areas become connected to core economic activities, they can access additional productive



opportunities (Estache 2004). Infrastructure development in poor regions also reduces production and transaction costs (Gannon and Liu 1997). For example, infrastructure expands job opportunities in poor rural areas by lowering the costs of accessing product and factor markets (Smith and others 2001). Moreover, infrastructure access can raise the value of poor people's assets. Recent research links the asset value of poor farming areas—as measured by the net present value of the profits generated by crops—to their distance from agricultural markets. Improvements in roads and communication services imply capital gains for these poor farmers (Jacoby 2002).

Complementarities among infrastructure services suggest the need to promote access to a bundle of services. Chong, Hentshel, and Saavedra (2004) find that urban households with access to more than one service (water, sanitation, electricity, or telephone) do much better economically than those with only one, with the effect of multiple services being multiplicative rather than additive. Escobal and Torero (2005) find similar effects in rural Peru, with multiple services significantly increasing agriculture productivity and diversification outside agriculture. Both studies address reverse causality (richer people buy more infrastructure services), so the net effects they estimate argue in favor of bundling infrastructure services to maximize their impact on households' incomes.

Better infrastructure also affects poor people's health and education levels. Access to clean water and sanitation is crucial to good health. Diseases from drinking contaminated water and a lack of safe water and sanitation for household hygiene are among the leading causes of child mortality (WHO 2002). Galiani, Gertler, and Scharfrodsky (2005) find that in Argentina, child mortality fell by 8 percent in areas where water utilities were privatized (and hence coverage and quality improved), with most of the reduction occurring in low-income areas where the water network expanded the most. More generally, Fay and others (2005) find that providing the poorest quintile in developing countries the same access to basic services as the richest would reduce child mortality by 8 percent and stunting by 14 percent. Infrastructure improvements also generate other, less obvious benefits (see Brennenman 2002). Better transport facilitates access to health care and improves staffing and operation of clinics. Girls' enrollment is helped by increased access to piped water, which otherwise would have to be fetched. Electricity gives students more time to study, while the health impacts of clean water allow them to spend more time in class.

Perhaps as a result, improved infrastructure reduces income inequality. Calderón and Servén (2004b) find that infrastructure access and quality

significantly affect inequality. This is especially important for Latin America because it is the world's most unequal region—with a Gini coefficient that has hovered around 0.5 for at least 25 years (De Ferranti and others 2004)—and reducing inequality is extremely difficult. Calderón and Servén's work suggests that if Latin American countries raised their infrastructure quantity (stocks) and quality to the levels of the region's leader, Costa Rica, their Gini coefficients would fall by 0.02–0.10 (table 1.4). Catching up with the median East Asian tiger economy, Korea, would entail drops of 0.03–0.13. These are significant changes.

In sum, the Latin American and Caribbean region needs to step up its progress on infrastructure coverage and quality. The region has lost ground relative to its peers and to countries whose economic success could be emulated, and has become less competitive. Limited improvements on infrastructure have also meant less progress on reducing poverty and improving the living standards and economic opportunities of the poorest. The next section provides some explanations for the region's somewhat disappointing performance.

**Table 1.4. Potential Reductions in Inequality (Gini Coefficient) in Various Latin American Countries from Improved Infrastructure Quantity and Quality**

Country	Improvement to levels of L. American & Caribbean leader (Costa Rica)			Improvement to levels of East Asian tiger median (Republic of Korea)		
	Quantity	Quality	Total	Quantity	Quality	Total
Argentina	-0.03	-0.01	-0.03	-0.05	-0.02	-0.06
Bolivia	-0.08	-0.01	-0.09	-0.10	-0.02	-0.12
Brazil	-0.03	-0.02	-0.06	-0.05	-0.03	-0.09
Chile	-0.03	0.00	-0.03	-0.05	-0.01	-0.06
Colombia	-0.04	-0.02	-0.06	-0.06	-0.03	-0.09
Costa Rica	—	—	—	-0.02	-0.01	-0.03
Dominican Republic	-0.03	0.00	-0.03	-0.05	-0.01	-0.06
Ecuador	-0.04	-0.02	-0.06	-0.06	-0.03	-0.09
El Salvador	-0.03	-0.01	-0.04	-0.06	-0.02	-0.07
Guatemala	-0.07	-0.01	-0.08	-0.09	-0.02	-0.11
Honduras	-0.07	-0.02	-0.09	-0.09	-0.03	-0.12
Mexico	-0.03	0.00	-0.03	-0.05	-0.01	-0.06
Nicaragua	-0.07	-0.02	-0.10	-0.09	-0.03	-0.13
Panama	-0.03	0.00	-0.03	-0.05	-0.01	-0.10
Peru	-0.06	-0.01	-0.07	-0.08	-0.02	-0.10
Uruguay	-0.02	-0.01	-0.02	-0.04	-0.02	-0.05
Venezuela, R. B. de	-0.02	-0.01	-0.03	-0.04	-0.02	-0.06

Source: Calderón and Servén 2004b.

## CHAPTER 2

# The Issue: Insufficient Improvement in the Management of Too Few Resources

Latin American governments slashed infrastructure investment in the 1990s. This was due to fiscal austerity in many countries and the emergence of a new paradigm for infrastructure provision, as regulatory and financial innovation made it increasingly possible to delegate financing and management to the private sector.

The private sector was expected to make up the financing shortfall and improve performance, but results have fallen short of expectations. Some countries and sectors have been much more attractive to the private sector, and countries have chosen different sectors and approaches for private participation. But cost recovery, essential for private participation without public subsidies, has proven elusive. And regulatory and governance hurdles have been larger than expected.

All this has resulted in possibly excessive disappointment with private participation. In general, private participation in the region's infrastructure has improved quality and coverage. Although prices often increased following privatization or concession, profits of concessionaires were not generally excessive. But the outcomes of private participation are affected by how well it is structured and monitored by governments. Improvements in performance depend on the effectiveness of the regulatory framework, while distributional impacts are largely determined by government decisions on whether to pursue redistribution. Thus the public sector

continues to have an essential role as both a regulator and direct provider of infrastructure.

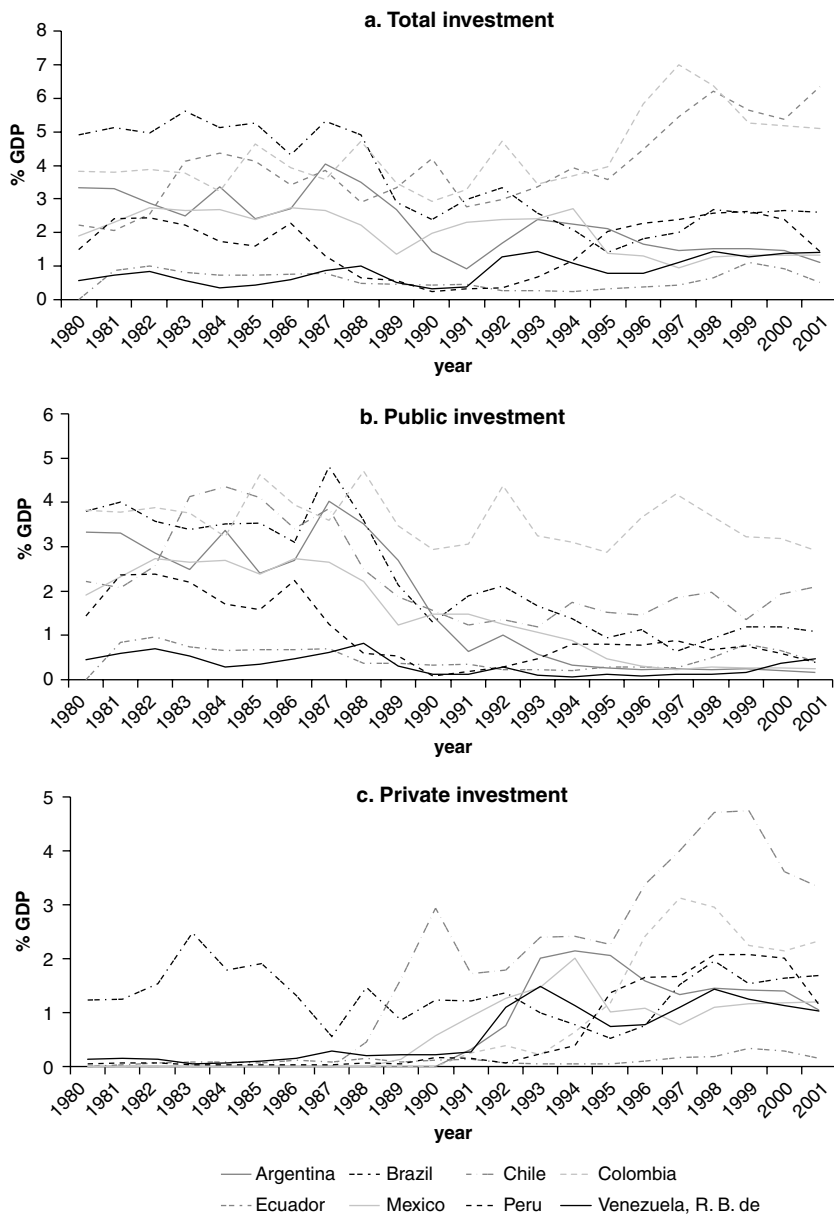
### **Private Investment Has Not Made Up for Public Cutbacks**

In recent decades infrastructure investment has fallen sharply in most of Latin America and the Caribbean. Public investment in infrastructure dropped from 3.1 percent of GDP in 1980–85 to 0.8 percent in 1996–2001 in six major Latin American countries, while private investment rose from 0.6 percent to just 1.4 percent (figure 2.1). Thus, overall investment in these countries fell from a weighted average of 3.7 percent of GDP in 1980–85 to 2.2 percent in 1996–2001. Only Chile and Colombia were exceptions in this group, experiencing substantial expansions since the early 1990s. (Comprehensive data are not available for the Caribbean, but it appears that many islands also maintained high levels of total investment, coming largely from the public sector.)

Public investment has borne the brunt of fiscal adjustment. The drop in state spending on infrastructure has reflected the fiscal austerity forced by macroeconomic crises. Changes in public infrastructure investments and fiscal balances followed remarkably similar paths during the 1980s and 1990s, with contractions in investment accounting for half or more of fiscal adjustments in five of nine economies considered (table 2.1). The reduction in public infrastructure investment was particularly sharp in Brazil, where it fell by much more than the improvement in the fiscal balance, and current expenditures actually increased.

At the same time, the region attracted almost half of the developing world's private participation in infrastructure (PPI). Between 1990 and 2003 nearly half of the \$786 billion of PPI in developing countries went to Latin America and the Caribbean. This can be explained by a combination of factors: the region was a pioneer in opening its infrastructure to private participation, expected growth was reasonably high, the macroeconomic environment appeared stable, and the region was shifting toward greater economic openness (Sirtaine 2005). Average annual private infrastructure investment rose significantly in the 1990s in all the region's major economies except Brazil, where it continued to hover around 1 percent of GDP (see figure 2.1). The increase was particularly marked in Chile, where private investment averaged 3.9 percent of GDP in 1996–2001. Bolivia (not shown) also had a particularly high level of private investment, averaging 4.4 percent of GDP per year over the period.

**Figure 2.1. Total, Public, and Private Infrastructure Investment in Eight Major Latin American Countries, 1980–2001**



Source: Calderón and Servén 2004a.

**Table 2.1. Changes in Public Investment and Fiscal Balance and Contributions to Fiscal Adjustment in Various Latin American Countries, 1995–98 Compared with 1980–84**  
percentages

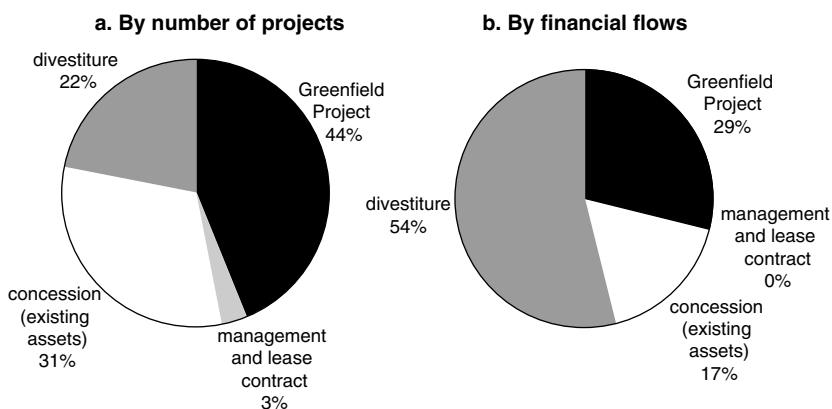
Country	Change in public investment/GDP		Change in fiscal balance/GDP	Contribution of investment reduction to fiscal adjustment	
	Total	Infrastructure		Total	Infrastructure
Argentina	-3.97	-2.85	5.31	74.7	53.8
Bolivia	0.91	-3.10	6.15	n.a.	50.3
Brazil	-2.80	-3.08	1.77	158.1	174.3
Chile	-0.94	-1.41	2.39	39.2	58.8
Colombia	-0.45	0.04	4.69	9.6	n.a.
Ecuador	-1.57	0.68	1.81	87.0	n.a.
Mexico	-6.09	-1.98	6.28	97.0	31.5
Peru	-4.10	-1.51	3.11	132.0	48.6
Venezuela, R. B. de	-3.49	-0.41	-1.88	n.a.	n.a.

Source: Calderón, Easterly, and Servén 2003.

Note: The fiscal balance is measured here as the primary surplus.

Concessions have been the region's most frequent vehicle for PPI, but full privatizations have brought in more money.<sup>1</sup> During 1990–2003 the region was home to 999 projects involving PPI. Concessions accounted for 75 percent (44 percent were greenfield projects and 31 percent involved existing assets), privatizations (that is, divestitures of existing assets) for 22 percent, and management and lease contracts for only 3 percent (figure 2.2). But divestitures generated more than half of the \$374 billion

**Figure 2.2. Forms of Private Participation in Infrastructure in Latin America and the Caribbean, 1990–2003**



Source: World Bank Private Participation in Infrastructure Database.

in PPI, while greenfield projects represented just under a third and concessions of existing assets just under a fifth.

PPI has transformed infrastructure provision. In 1990 only 3 percent of telephone and electricity connections in the region were provided by private companies, and almost no water utilities were in private hands. By 2003 private utilities were managing 86 percent of telecom subscriptions, 60 percent of electricity connections, and 11 percent of water connections (Andres, Foster, and Guasch 2005).

But PPI has been uneven across countries and sectors. During 1990–2003 six countries—Argentina, Brazil, Chile, Colombia, Mexico, and Peru—received 93 percent of the region’s PPI. Most of this investment involved telecommunications (46 percent), followed by energy (32 percent), transport (17 percent), and water and sanitation (5 percent) (World Bank PPI database). This pattern is consistent with Calderón and Servén (2004a), who find that total investment in telecom rose in all six countries in their sample, while investment in power and transport fell in most. It also reflects the uneven pace and depth of reform in these sectors (box 2.1).

Not all PPI has been directed toward new investment. A third of the region’s recent PPI involved payments to governments (license fees,

### Box 2.1

#### The Uneven Pace of Infrastructure Reform Across Sectors

**Privatization has gone furthest in telecommunications.** During the 1980s fixed telephone services were provided by state-owned monopolies in most Latin American and Caribbean countries. Privatization began in Chile (1986), Jamaica (1989), Argentina (1990), and Mexico (1990) and subsequently spread throughout the region. Long-distance services were liberalized under a second wave of reforms starting in Chile in 1994. Only six Latin American countries still have public telecommunications firms: Colombia, Costa Rica, Ecuador, Honduras, Paraguay, and Uruguay. Regionally, 86 percent of fixed phone subscribers were served by the private sector in 2003, up from almost none in 1990. Most countries sold majority stakes in state companies and made new owners commit to expand networks and meet quality standards. In return investors were granted a period of monopoly operation—lasting an average of five years—after which markets were opened to competition. Cellular services have involved significant private participation from the start, and competition

(continued)

has increased gradually. All of the region's large countries have at least three mobile operators.

***Electricity reforms are at different stages.*** Again, Chile was the pioneer, privatizing its main electric utilities in 1986–89. Argentina followed in 1992, then Bolivia, Colombia, and Peru. In the late 1990s Brazil, El Salvador, Guatemala, Honduras, Nicaragua, and Panama introduced reforms, including establishing regulatory boards to set quality standards, oversee tariffs, and monitor compliance by private operators. But a number of countries, including Paraguay and Uruguay, have made few reforms in this area. About 60 percent of the region's electricity connections were served by private distributors in 2003, up from 3 percent in 1990. Recent reforms have focused on unbundling generation, transmission, and distribution activities, privatizing assets (for generation) or management of those assets (for transmission and distribution), promoting competition in the generation market, promoting competition for other markets (typically through bidding for transmission or distribution monopolies), and strengthening regulatory incentives for improved performance.

***Private participation in transport has taken many forms, with concessions being the most common.*** Reforms have varied across transport subsectors. Among ports, stevedore activities have been outsourced in Colombia and Ecuador, landlord port concessions developed in Argentina, Chile, and Panama, and port authorities concessioned in Colombia. In Costa Rica, El Salvador, Guatemala, and Nicaragua port reforms are still pending and private participation remains limited. Private participation in urban transport services (Chile, Colombia) and facilities (Chile) has taken many forms. Concessions for freight rail services have been developed in Argentina, Chile, and Mexico. Competition in road transport services remains low in many Latin American and Caribbean countries due to oligopolistic behavior and resistance to regional integration.

***Reforms and private participation are less widespread in water and sanitation.*** Local governments have increasingly managed water and sanitation services in the region, so there has been less scope for sector restructuring on a national level. Because large-scale water and sewerage provision are network industries with high fixed costs, competition is inherently limited. In addition, safe water's essential role in life and health supports a strong state role in promoting its availability and affordability—while the potential impact on social welfare makes changes in service provision politically sensitive. Some equity sales in the sector have occurred in the region, starting with Chile's EMOS (later Aguas Andinas SA) in 1990. But private participation has usually involved concessions or



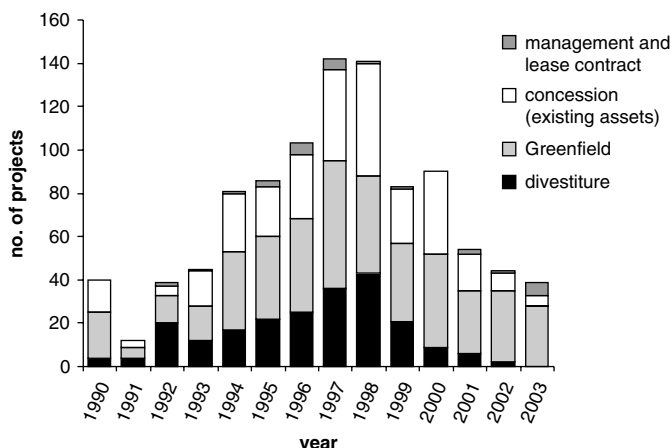
management contracts. Only about 11 percent of the region's water connections were served by private operators in 2003, up from almost none in 1990. In addition to Chile, countries with private participation include Argentina, Bolivia, Brazil, Colombia, Ecuador, Honduras, Mexico, and Trinidad and Tobago. Those without include Ecuador, Peru, and Venezuela.

*Source:* Andres, Foster, and Guasch 2005; Estache and Rossi 2004.

canon payments, divestiture revenues). Thus new investments in facilities totaled just \$255 billion (though this is still 45 percent of the emerging market total for such investments). Moreover, these data represent the total value of projects with private participation, and so include some public investments. As such, the figures overstate private investment in infrastructure in the region. Even at its peak, PPI was nowhere close to satisfying the region's infrastructure needs (Fay 2001).

Since 1998 PPI has collapsed, and shows no sign of recovery. Major divestiture programs have been concluded and investor interest has waned. As a result PPI fell from \$71 billion in 1998 to \$16 billion in 2003. In addition, forms of PPI have changed markedly. In 2003 there were no divestitures; greenfield projects accounted for 72 percent of transactions, and concessions of existing assets for 13 percent (figure 2.3).

**Figure 2.3. Forms of Private Participation in Infrastructure in Latin America and the Caribbean, 1990–2003**



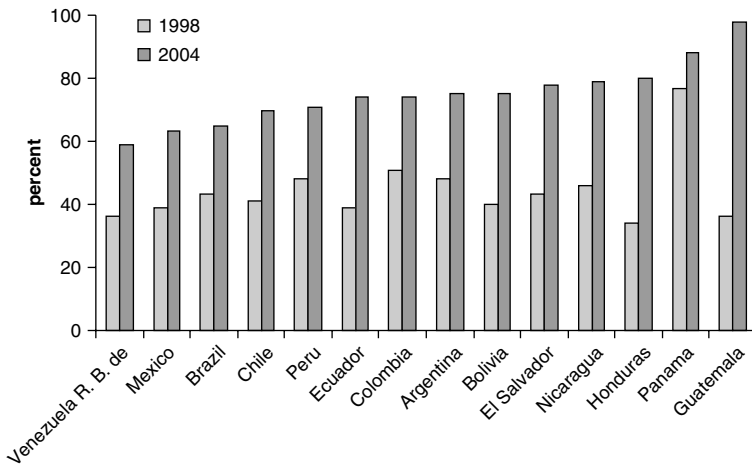
*Source:* World Bank Private Participation in Infrastructure Database.

Moreover, management and lease contracts have grown considerably, with the six signed in 2003 accounting for 15 percent of all deals.

### The Backlash Against Private Participation Is Not Entirely Fair

Public opinion has turned against PPI, and investor interest has waned. In late 2000 over a third of Argentines believed that infrastructure services should be placed back under government control. Today more than three-quarters feel that way.<sup>2</sup> This jump reflects a general trend: in most Latin American countries about 40 percent of the population was unhappy with privatization in 1998; by 2004 the average was closer to 75 percent (figure 2.4). Public opposition has become a serious constraint on PPI in some countries, politically and operationally. At the same time, many private investors seem to have lost their appetite for infrastructure. The average number of bidders for power distribution privatizations in Latin America fell from more than four in 1998 to fewer than two in 2000–01 (Harris 2003).

**Figure 2.4. Population Expressing Dissatisfaction with Infrastructure Privatizations in Various Latin American Countries, 1998 and 2004**



*Source:* Latinobarómetro surveys.

*Note:* The 1998 results reflect survey respondents who disagreed or strongly disagreed with the statement, “privatizations of state companies have been beneficial for the country.” The 2004 data indicate those who were less satisfied or much less satisfied with public services after privatization, in terms of price and quality.

Yet PPI has had many positive outcomes. PPI has generally improved service coverage and quality, and most concessionaires have done reasonably—but not excessively—well. Although concessions are risky, they can generate adequate returns over the long term (Sirtaine and others 2005). So why the widespread popular discontent and private sector disaffection? They may be due to excessive renegotiations and a few well-publicized failures, as well as poor management of the political economy of reform.

### ***The Impact of Private Participation Has Been Mixed but Positive Overall***

Private participation has boosted firms' service coverage and quality. The private sector tends to do as well as (and sometimes better than) the public sector in expanding service and enhancing quality. Expansion often results from increased investment, which allows providers to meet growing demand and serve new consumers and areas (Harris 2003). In La Paz–El Alto, Bolivia, the rate of new water and sanitation connections rose by two-thirds after the private sector entered the market. In El Alto the coverage of sewerage services had not changed for a decade under public ownership but increased 30 percent in the first three years of private participation (Foster and Irusta 2001, cited in Harris 2003). Similarly, a study of 181 privatized utilities in the region finds that private entry significantly accelerated service expansion for telecommunications and to a lesser degree electricity distribution (Andres, Foster, and Guasch 2005). Private entry also considerably improved the quality of fixed telephone, electricity, and water services.

Improvements have occurred across sectors. Andres, Foster, and Guasch (2005) find that for electricity distribution, output and coverage increased following private entry, but that these changes were driven by underlying trends. In addition, quality indicators and distributional losses improved significantly, especially during the transition period (when enterprises being privatized were restructured for the sale). In fixed telecommunications, coverage increased both during and after the transition, exceeding existing trends. Quality, as measured by the share of calls completed, rose 42 percent over the period considered, with most of the change coming after the transition. In water distribution there were significant increases in coverage and subscribers, but these were broadly in line with trends. Quality, reflected in both continuity of service and potability, also showed strong improvements. Most of the change in potability came during the transition, while continuity improvements came afterward.

Labor productivity has risen with reform and private participation, with the biggest change occurring during the transition to private ownership—amid heavy job losses. Estache and Rossi (2004) find that labor productivity increased by about 6 percent a year among privatized Latin American electricity distributors in the post-reform period (1994–2000), and that private firms used 30–45 percent less labor to produce a given bundle of outputs than did public firms. Rossi (2004) argues that these results may be biased by outsourcing, as firms' operation and maintenance costs did not change significantly after the reforms. Andres, Foster, and Guasch (2005) find that labor productivity increased significantly for privatized fixed telephone, electricity, and water services. Most improvements occurred during the transition to private services, and were mainly due to large workforce reductions.

PPI and recent reforms have benefited the poor.<sup>3</sup> In Argentina, Chisari, Estache, and Romero (1999) and Navajas (2000) find that infrastructure privatization may have benefited the poor more than others by increasing their access to services. Moreover, Estache, Gomez-Lobo, and Leipziger (2000) argue that before privatization, the poorest groups did not have access to many services and did not benefit from their expansion. More recently, McKenzie and Mookherjee (2003) review in-depth studies on privatization in Argentina, Bolivia, Mexico, and Nicaragua and conclude that privatization had overall positive effects on the welfare of all consumers, and that inequality fell after privatization in all but one case (electricity in Nicaragua).

The record on employment is mixed. There have been substantial layoffs in privatized firms, with cutbacks ranging from 30–75 percent in the cases reviewed by McKenzie and Mookherjee (2003). But layoffs were small relative to the overall workforce (except in Nicaragua, where they reached 7–9 percent).<sup>4</sup> And layoffs were generally reversed in the medium run. No clear pattern has emerged on how privatization and subsequent labor restructuring affects wage inequality. McKenzie and Mookherjee conclude that the effect of privatization is likely to be small and dominated by other changes in the economy—a claim supported by other researchers (Martimort and Straub 2005).

Contrary to popular perception, concessionaires have not made excessive profits. Analyzing a representative sample of 34 infrastructure concessions in Latin America and the Caribbean, Sirtaine and others (2005) find that financial returns have been modest. It takes 10 years for the average concession to become profitable, likely reflecting large investments in the early years. Moreover, 40 percent of concessions appear too risky to

ever generate attractive returns—a share that rises to 50 percent for energy and transport concessions, and even higher for water concessions. Indeed, only telecommunications concessions seem inherently profitable.

But these results must be treated with caution. Estimated returns are highly sensitive to estimates of capital costs and investments. (Sirtaine and others (2005) attempt to address both concerns; for example, they use realized investments rather than commitments.) In addition, renegotiation can significantly increase the profitability of concessions, which may be why they are more profitable over the long term. And regulatory systems often provide incentives for firms to under-report profits and lack sufficient safeguards to stop them from doing so (see below, in the discussion of regulatory accounting). Still, limited private sector enthusiasm for infrastructure concessions supports the findings of Sirtaine and others (2005).

### ***Excessive Renegotiations and Some Well-Publicized Failures Have Created Challenges***

Too many concessions have been renegotiated. Some renegotiation is inevitable and even desirable, to improve concession design, promote efficiency, and remedy incomplete contracts. But Guasch (2004) finds that during 1985–2000 renegotiations occurred in 30 percent of the more than 1,000 infrastructure concessions granted in the region.<sup>5</sup> Excluding telecom concessions (of which there are relatively few) raises the average to 42 percent, with a rate of 10 percent for electricity projects, 55 percent for transportation, and a staggering 74 percent for water and sanitation. The period between concession award and renegotiation averaged 2.2 years, ranging from 1.6 years for water and sanitation projects to 3.1 years for transportation.

Frequent revisions may reflect opportunistic behavior by operators or governments. Concessionaires initiated 61 percent of renegotiations, often to raise unrealistically low bids (60 percent of contracts awarded to bidders proposing the lowest tariffs were renegotiated, compared with 11 percent of those going to the highest). Almost two-thirds of these renegotiations led to higher tariffs, with negative impacts for consumers. In addition, the high sunk costs of infrastructure investments may tempt governments to try to expropriate more rents, knowing that investors cannot withdraw easily (Guasch, Laffont, and Straub 2005). Government reluctance to raise tariffs may also trigger concession disputes. An example is the cancellation of the La Paz and El Alto water concessions in January 2005, but there are many others (box 2.2).

**Box 2.2****Examples of Government-Induced Concession Disputes**

As of 2005, most of the concessions awarded in Argentina before its 2001 crisis are still undergoing protracted renegotiations. Conflict arose when the government converted dollar-denominated rates to devalued pesos—despite contract clauses that allowed for indexation to the dollar and U.S. inflation—and refused significant subsequent rate adjustment. Despite 62 firms' suits before the World Bank's International Centre for Settlement of Investment Disputes, the government has been slow in responding, arguing its need to protect the interests of its people. It has also argued that international arbitration decisions should be reviewed by local courts, despite the country's agreement to abide by international arbitration, made in the 1990s.

Similarly, the Limeira water concession in Brazil was denied the automatic tariff adjustments allowed by its contract. The local mayor argued that the contract, signed by a previous administration, was unfair and compromised the municipality's long-term interests. Similar behavior affected the Tucuman water and sanitation contract in Argentina. In 1995 a new local government took office and sought to limit pre-agreed tariff increases. As a result the concessionaire abandoned the project in 1996. In the toll road concession in Pernambuco, Brazil, the regional government decided to cut tariffs unilaterally shortly before elections.

Sometimes lack of commitment shows up even earlier, as with the 1999 Matarani port concession in Peru, in which the rules of the tender were changed unilaterally in the awarding period (shortening the duration of the concession from 30 to 15 years).

*Source:* Guasch, Laffont, and Straub 2005.

Renegotiations may also be due to poorly designed contracts, weak regulations, or both. A strong regulator is a desirable counterpoint to political opportunism—particularly if governance is weak—and reduces renegotiations led by both governments and concessionaires. Guasch, Laffont, and Straub (2003) estimate the rate of concession renegotiation to be 61 percent if a regulatory agency is not in place, against 17 percent if one is. Modes of regulation also matter. For example, price caps—which have been common in Latin American concessions—are vulnerable to shocks and often lead to renegotiations.

Whatever their causes, widespread renegotiations are costly. Renegotiations introduce uncertainty and reduce transparency because new terms are determined not through competitive processes, but by the bargaining power of concessionaires and governments. As a result there are costs. In particular, frequent renegotiations raise the cost of capital because investors demand a risk premium to offset the danger that the rules will be changed. Guasch and Spiller (1999) estimate that this premium ranges from 2–6 percentage points depending on the country and sector. Other costs include widespread service disruption or failure to meet expansion goals.

Guarantees have exposed governments to enormous contingent liabilities. Many governments provided guarantees of service demand or exchange rate levels in early PPI contracts for power plants, toll roads, and other projects. Payments under such guarantees, which were often based on overly optimistic projections of service demand, have been triggered in several cases. In Colombia potential payment obligations over the life of PPI contracts are estimated to equal 4 percent of annual GDP. Payment obligations to the new Termopaipa and Termobarranquilla power generation facilities totaled \$1.5 billion in 2003, and were projected to rise to \$3 billion by the time the contract expires in 2014 (World Bank 2004a). The 1997 bailout of Mexico's toll road program cost \$7–12 billion, or 1.0–1.7 percent of GDP (Guasch, Laffont, and Straub 2005).

Though a few privatizations have been outright failures, such cases have not been the norm. One unsuccessful example is the privatization of the electricity sector in the Dominican Republic, where concessionaires' inability to resolve distribution problems more than offset gains from increasing private investments in generation. The result was a power crisis: in September 2002 more than half of the main distribution company's circuits were out of service. Riots resulted, killing 15 people (World Bank 2005a). The sector continues to rely on substantial government subsidies. In some cases mismanagement by the authorities is largely to blame, as with the financial collapse of toll road concessions in Mexico.

### ***The Process Has Suffered from Economic Shocks and Poor Management of the Political Economy of Reform***

Disaffection with emerging markets and setbacks among major investors have curbed private sector interest. In addition to concerns about renegotiation, investor interest has suffered from the general disaffection with emerging markets spurred by the East Asian, Russian, Brazilian, and Argentine crises of the late 1990s and early 2000s. Greater perceived risk

has made infrastructure companies and investors more cautious. In particular, currency depreciations in Argentina and Brazil have made investors wary of projects in which revenues are in domestic currency but financing is in foreign—as is typically the case for PPI projects. Moreover, several major infrastructure investors (Enron, AES, Suez, Vivendi) have suffered commercial losses or seen their share prices fall.<sup>6</sup> Although new entrants have emerged, notably from developing countries, they are unlikely to fill the gap (Harris 2003).

PPI is also highly vulnerable to economic downturns. The risks for private operators increase during economic crises because reduced demand and ability to pay make it harder for investors to pass on project costs to consumers, and make governments less willing to allow them to do so (implying greater regulatory risk). Similarly, foreign exchange pass-through becomes unsustainable when currency depreciation is high. Recent treatment of private contracts, such as during the Argentine crisis, has also reduced investor confidence in contract clauses intended to provide protection against some risks (such as tariff escalation clauses linked to exchange rates and compensation clauses for regulatory changes; Sirtaine 2005). But economic shocks are not responsible for all the setbacks suffered by PPI. Instead, such shocks revealed weaknesses in regulation and undermined the already difficult goal of cost recovery (see below).

Economic downturns also worsen public attitudes toward privatization. Boix (2005) finds that many Latin Americans associate privatizations with poor macroeconomic performance. He argues that the public has limited information about the mechanisms that generate growth and so imputes economic performance to the highly symbolic decisions around which governments build economic policies. Accordingly, when economic performance worsens, so do public views about privatization and similar market mechanisms.

Public perceptions of privatization are also colored by whether the deals are considered fair (Boix 2003; Martimort and Straub 2005). Such perceptions may be based on rational evaluations of the process, or they may be affected by views about its transparency and about corruption in public affairs. Negative perceptions may reflect the fact that many governments have used privatization proceeds for general budgetary processes, rather than to compensate losers (such as workers who lost jobs) or to fund well-targeted subsidies to offset needed tariff increases.<sup>7</sup> Box 2.3 examines possible reasons for social discontent with privatization.

Sometimes disappointment is bred by unrealistic expectations or unreasonable arrangements.<sup>8</sup> Some governments have used private participation



**Box 2.3****Hidden Failures and Perception Management:  
Explanations for Social Discontent with Privatization**

There is a stark contrast in Latin America and the Caribbean between generally positive evaluations of privatization by economists and extreme public rejection of it. Martimort and Straub (2005), in a paper commissioned for this report, review the literature for possible explanations for this paradox. They conclude that either important failures have gone unreported (though clearly not unnoticed by those who have suffered) or there has been a major problem with public perceptions (and so a massive communication failure).

***Hidden failures***

Although assessments of privatization's impact on redistribution and service coverage and quality are generally positive, some negative aspects may have been underreported. First, evidence on quality improvement is partial, and quality may have deteriorated in some cases—or at least failed to improve as much as expected. Some consumers have reported dissatisfaction with quality (telecommunications in Mexico; electricity in Brazil and Chile). In addition, quality improvements have not always been sufficient to compensate for price increases.

Second, the redistributive impact of price increases may not have been sufficiently mitigated by subsidies (which are often administered inefficiently). The modality and speed of price adjustments have also generated criticism. Third, privatization has clearly caused job losses, though it is argued that these have generally been reversed in the medium term. But it is possible that, for all but the most-skilled workers, this transition resulted in lower-quality employment. Moreover, there is evidence that wages held steady or rose because working hours increased.

***Perceptions and the political economy of privatization***

Negative perceptions of privatization may be due to economic downturns (Boix 2005). In particular, it is not clear if and how the public distinguishes job losses due to recessions from those due to privatizations. Second, public discontent may be linked to disappointment that outcomes have not matched expectations. Third, it is unclear how the public perceives frequent renegotiations and (rare but well-publicized) cancellations—but this must have a significant effect on general sentiment.

Fourth, the perceived transparency of the privatization process is crucial in shaping public perceptions. Boix (2005) confirms the Lora and Panizza (2002)

*(continued)*

finding that negative views of privatization are stronger where corruption is perceived as more common. Corruption has a destructive effect on privatization because it affects competitive bidding and allocates rents to a specific group. Corrupt deals may also be used to maintain monopoly power and impede the introduction of competition in privatized sectors—in which case post-privatization profits may be the result of monopoly rents rather than efficiency gains. Manzetti (2000) argues that this was the case for telecoms in Argentina and electricity in Chile. Overall, it is unclear if corruption has increased or decreased as a result of privatization. One argument is that petty corruption is easier in public utilities, but that privatization creates opportunities for large-scale corruption.

Fifth, privatizations have often been perceived as unfair, rightly or wrongly. Game theory shows that people would rather gain nothing than agree to a deal in which they feel they gain less than their fair share. This seemingly irrational result, combined with a common perception that concessionaires or governments may have benefited disproportionately, may be a key part of the privatization paradox (Shirley 2004).

More generally, it is extremely difficult to determine the gains and losses from any given privatization because neither the public nor researchers have a proper counterfactual against which to judge performance. The implication for governments is that perceptions of fairness must be carefully managed. That means not only that transactions must be transparent and above board, but that the proceeds of privatization be used in a way that offsets any possible sense of injustice. In many cases where transactions were in fact clean, governments directed the proceeds of privatization to the general fiscal account, making them “disappear” rather than using them for direct and visible redistribution.

*Source:* Adapted from Martimort and Straub 2005, with additional information from Boix 2005.

to help finance needed investments in services that were underpriced or to offload responsibility for sector reform to the private sector. The electricity privatization in the Dominican Republic mentioned above is a case in point: distribution companies were expected to cut losses and improve tariff collection without adequate support from the authorities.

Private participation does not change the fact that someone—taxpayers or consumers—must pay for the services, or assets will be depleted. Some governments have assumed that the efficiency gains resulting from private participation would offset the need for price increases. Others have overestimated their ability to weather the political fallout from price increases.

In addition, some investors have overestimated governments' ability or determination to abide by their commitments.

### **Government Has a Crucial Role to Play—With Regulation, Cost Recovery, and Redistribution**

Successful PPI requires effective regulation and cost recovery—or, if cost recovery is impossible or inappropriate, well-designed subsidies. Many of the disappointing outcomes with infrastructure in Latin America and the Caribbean are due to government failures at regulation and redistribution, because the resulting problems are similar whether the private or public sector is delivering the service. If service costs are not recovered from users, taxpayers will have to pay or assets will be depleted.<sup>9</sup> Natural monopolies, public or private, should be regulated or otherwise supervised and controlled. And redistribution goals should be set by governments regardless of how they are implemented and funded (which will be either by taxpayers or by users through cross-subsidies.)

### ***PPI Has Sometimes Occurred Amid Incomplete Reforms and Immature Regulatory Frameworks***

Introducing private participation required sweeping changes in the region's institutional, legal, and regulatory frameworks. Alterations were needed to allow and accommodate private investment and to transform the government's role in many sectors from owner and operator to facilitator, overseer, and regulator. Infrastructure services typically address people's basic needs and are natural monopolies. Because of these characteristics—the original justification for government provision—effective regulation of some sort is required to protect consumers and discipline private participants. Regulation is also essential to protect investors from arbitrary or politically motivated government intervention, the risk of which is increased by the high sunk costs of many infrastructure projects (because such costs make investors unlikely to withdraw, even if conditions deteriorate).

Reforms have typically sought to clearly separate the functions of policymaker, regulator, and service provider. Policymaking functions usually remain in the relevant ministry, but new systems of regulatory oversight have been created. State companies have typically been placed on a more independent and commercial footing, with many utilities incorporated as public enterprises (“corporatization”) prior to private participation. Within many sectors, horizontal or vertical unbundling has occurred, to separate

out activities most suitable for private involvement and to promote competition where feasible. (In network industries the potential for competition may be limited to competing for the right to operate a monopoly.) Most reform programs have sought to increase efficiency and quality and reduce costs, in addition to attracting private investment. But patterns of change have varied considerably across sectors and countries.

Analysts and reformers were overly optimistic about their ability to restructure sectors, establish regulation, and design concessions. Moreover, they did not recognize that regulation could not provide complete insulation from political influence. To be effective, regulation must be part of a comprehensive package that also includes proper industry structure, technical support, incentives, and well-designed community participation.

There was a tendency to adopt models developed for other settings. Many of the regulatory and pricing models had been developed for European or North American situations, where the goal was to lower costs and prices, rather than expand coverage. Thus the independent water regulator model adopted in Argentina was based on the one for the United Kingdom, which has mature, full-coverage infrastructure networks for water and sanitation, while Argentina does not.

The first generation of reforms did not always create the institutional and policy frameworks needed. Regulators often lack autonomy—financial, operational, and political. Indeed, many countries do not even have independent regulators. And many ministries in charge of infrastructure lack policymaking capacity. Sector laws and overall strategies, while not essential, can help establish coherent policies and allocate responsibilities and functions. More critical is a national policy framework for tariffs and subsidies. Mexico illustrates the need for this: infrastructure tariffs are set by a large array of federal, state, and municipal stakeholders. In the absence of a national policy framework for tariffs and cost recovery, there is wide variation in tariff levels, tariff structures, and cost recovery among sectors and regions.

Insufficient competition policies and antitrust agencies are partly to blame for the disappointing outcomes of infrastructure reforms. Although some segments of infrastructure sectors are natural monopolies, most sectors also have segments that support competition. Yet privatized companies often enjoy a dominant position, with insufficient efforts to level the playing field for new entrants. Furthermore, conflicts between sector regulators and competition agencies have become a serious issue. In many cases where private firms have tried to merge, the sector regulator and competition agency have disputed who should approve or prohibit these mergers. Lack of dialogue and of political pressure has allowed the rebundling of many

services, undermining actual and potential competition. (This issue is discussed in the context of the transport sector by Estache and Serebrisky 2004 and for telecommunications by Andres, Foster, and Guasch 2005.<sup>10</sup>)

Fiscal and political decentralization has created challenges for reform and PPI, particularly in water and sanitation. In most countries subnational governments are responsible for providing water and sanitation (as well as public lighting, waste management, and to a lesser extent public transportation and regional highways). While decentralization can make infrastructure programs more effective, through better planning and increased accountability, it has created difficulties for private investment. The atomization of the industry can prevent coherent national policymaking, as with water and sanitation. Municipal authorities may lack the technical and legal expertise needed to manage private participation. They usually also have limited access to capital markets, which makes infrastructure financing difficult. Overlapping and conflicting jurisdictions among different levels of government may exacerbate the lack of clear, consistent regulation in many countries, even at the national level. Even where a centralized regulator is in place, it is unlikely to have strong supervisory reach over scores of decentralized firms scattered across the country. In addition, private operators may face greater payment risk if they depend on local governments for revenues (as they usually do). Political and regulatory risks are also likely to be higher (Beato and Vives 2003).

Investors also complain of weak law enforcement and nonpayment for services. Major Spanish investors in Latin American infrastructure identify nonpayment by customers as a serious problem, particularly for water and electricity services (Analistas Financieros Internacionales 2004). Many countries have a culture of nonpayment for services, and distributors may face legal and political difficulties if they demand overdue payments or cut supplies. Moreover, illegal connections are common—frequently offered by well-established intermediaries—and local police may do little to stop them. Because state utilities often tolerated high levels of nonpayment, clampdowns by new operators may be another reason for public opposition to PPI. But cost recovery is a chronic problem for utilities (except telecoms), as discussed below.

### ***Cost Recovery Has Proven Elusive***

The transition toward cost recovery for water and electricity services has been much more challenging than expected.<sup>11</sup> During the 1990s, to reduce the fiscal burden of public services and attract private participation, most Latin American countries passed legislation committing to raising water and

electricity tariffs toward cost recovery levels. Yet that goal remains elusive. Inflation and currency depreciation have eroded real gains from tariff hikes (see below), while public perceptions of high tariffs have contributed to social discontent. A recent survey concluded that average residential water tariffs in 10 large Latin American cities are about 30 percent below costs, while industrial tariffs are 20 percent above (ADERASA 2005).

Although water and electricity tariffs have risen significantly, especially for residential services, inflation and currency depreciation have offset the gains. Between 1997 and 2003 nominal tariffs for water utilities in 15 of Latin America's largest cities (or nationwide, in Costa Rica and Uruguay) rose 8 percent a year for households and 4 percent for industry. But in real terms residential tariffs increased by less than 1 percent a year—and industrial ones fell 3 percent a year. Results were similar among 13 electric utilities in the region: in 1990–2002 average annual tariff hikes for residential service were 22 percent in nominal terms but 2 percent in real terms, and for industrial service 18 percent and –1 percent.

The recent stagnation in residential water tariffs imply half the sample does not even fully cover operation and maintenance, let alone any capital cost. It is not possible from the available data to estimate each utility's cost of providing service. Instead Foster and Yepes (2005) rely on expert estimates of costs (in U.S. dollars) to determine the extent of cost recovery—admittedly a crude proxy, but one that can at least provide information about cost recovery trends. They find that by 2003 all utilities were able to recover at least some operation and maintenance. However, as a result of the real fall in tariffs, the number that could cover capital cost had fallen from 8 to 6 out of 13 between 1997 and 2003. These results are similar to those for the larger sample of utilities shown in table 2.2 (but for which data were available only for 2003).

Still, Latin America's water and electricity tariffs are the highest in the developing world, and above the average for upper-middle-income countries. The region's median residential water tariff is twice those in East Asia and the Pacific, Eastern Europe and Central Asia, and the Middle East and North Africa—and more than six times as high as in South Asia (table 2.2). Its median residential electricity tariff is also twice those in most other developing regions (table 2.2). But tariffs in both sectors remain far below OECD levels.

And Latin America recovers more costs through residential water tariffs than any other developing region. Its performance is also much better than that of upper-middle-income countries as a whole, and is close to that of OECD countries (see table 2.2). Though cost recovery rises with

**Table 2.2. Residential Water Tariffs and Cost Recovery Levels, by Income Group and Region**

<i>Income group/region</i>	<i>Mean</i>	<i>Median</i>	<i>Degree of cost recovery (% utilities)</i>		
	<i>(US\$/m<sup>3</sup>)</i>	<i>(US\$/m<sup>3</sup>)</i>	<i>None</i>	<i>At least some O&amp;M</i>	<i>All O&amp;M and at least some capital</i>
World	0.53	0.35	39	30	30
<i>Income group</i>					
High-income	1.00	0.96	8	42	50
Upper-middle-income	0.34	0.35	39	22	39
Lower-middle-income	0.31	0.22	37	41	22
Low-income	0.11	0.09	89	9	3
<i>Region</i>					
East Asia & Pacific	0.25	0.20	53	32	16
E. Europe & Central Asia	0.13	0.16	100	0	0
<b>L. Amer. &amp; the Caribbean</b>	<b>0.41</b>	<b>0.39</b>	<b>13</b>	<b>39</b>	<b>48</b>
Middle East & N. Africa	0.37	0.15	58	25	17
OECD	1.04	1.00	6	43	51
South Asia	0.09	0.06	100	0	0

*Source:* Foster and Yepes 2005.

*Note:* Mean and median tariffs are based on monthly consumption of 15 cubic meters. Data are for utilities serving 131 major cities worldwide, with 47 in OECD countries, 24 in South Asia, 23 in Latin America and the Caribbean, 19 in East Asia and the Pacific, 12 in the Middle East and North Africa, and 6 in Eastern Europe and Central Asia.

a country's income level, even in OECD countries only half of water utilities have tariffs high enough to make a substantial contribution to capital costs.

The share of residential electricity tariffs that cover all operation and maintenance (O&M) costs has almost doubled since the early 1990s, to nearly two-thirds. The average residential electricity tariff in 19 Latin American countries rose from \$0.07 a kilowatt-hour in 1990 to \$0.10 in 1996, falling back to \$0.09 in 2002. Bearing in mind the limitations of the methodology, this suggests that between 1990 and 2002 the share of countries recovering all O&M and some degree of capital costs rose from one-third to about two-thirds, while the share of countries with residential electricity tariffs below O&M costs fell from 16 percent to none. Industrial tariffs showed similar improvements.

Electricity tariffs are also closer to cost recovery levels in Latin America than in its developing and upper-middle-income peers. But the region lags behind OECD countries, where more than 80 percent of residential electricity tariffs cover at least some capital costs (see table 2.3).

**Table 2.3. Residential Electricity Tariffs and Cost Recovery Levels, by Income Group and Region**

<i>Income group/region</i>	<i>Mean</i>	<i>Median</i>	<i>Degree of cost recovery (% utilities)</i>		
	<i>(US\$/KwH)</i>	<i>(US\$/KwH)</i>	<i>None</i>	<i>At least some O&amp;M</i>	<i>All O&amp;M and at least some capital</i>
World	0.08	0.07	15	44	41
<i>Income group</i>					
High-income	0.12	0.11	0	17	83
Upper-middle-income	0.07	0.06	0	71	29
Lower-middle-income	0.06	0.05	27	50	23
Low-income	0.05	0.05	31	44	25
<i>Region</i>					
East Asia & Pacific	0.05	0.05	29	65	6
E. Europe & Central Asia	0.06	0.04	31	38	31
<b>L. Amer. &amp; the Caribbean</b>	<b>0.09</b>	<b>0.09</b>	<b>0</b>	<b>47</b>	<b>53</b>
OECD	0.12	0.11	0	17	83
South Asia	0.04	0.04	33	67	0
Sub-Saharan Africa	0.05	0.06	29	71	0

*Source:* Foster and Yepes 2005.

*Note:* Data are for 84 countries, with 23 OECD, 19 in Latin America and the Caribbean, 18 in Eastern Europe and Central Asia, 13 in Sub-Saharan Africa, 8 in East Asia and the Pacific, and 3 in South Asia.

As with water, there is a strong relationship between cost recovery and income level, though the range of tariffs is much narrower and the extent of cost recovery is far higher for electricity services.

### **Poorly Designed Social Tariffs Hinder Cost Recovery and Do Too Little for the Poor**

Cost recovery requires well-designed social tariffs.<sup>12</sup> The acceptability and feasibility of raising tariffs high enough to approach cost recovery depend on the existence of social tariffs that protect poor consumers. Although social tariffs are widespread for water and electricity in Latin America and the Caribbean, even well-designed social tariffs are no silver bullet. First, they still leave out unconnected poor households. Second, new connection rates are much lower for poor households even when connections are subsidized.

Increasing block tariffs (IBT), the most common type of social tariff, are only effective when income and consumption are closely related. Under IBTs, consumers pay a concessional rate for the first block of consumption, and increasing rates for additional blocks. In theory this structure offers an



implicit social safety net because the first block should provide all households with a subsistence level of service for less than the full economic cost. It should also allow utilities to recover the costs of service provision by charging above cost for higher consumption blocks. But to be effective in targeting the poor, IBTs require a close and positive correlation between income and consumption. But while low-income households do tend to consume less electricity than richer ones, this pattern is less clear for water consumption (Komives and others 2005).

In addition, IBTs for water services are often badly designed. IBTs are almost universal among the 17 water utilities in eight Latin American countries surveyed by ADERASA (2005) and most share several flaws. First, subsistence blocks are generally too large, averaging 25 cubic meters a month. Most residential consumers use less than these concessional “subsistence” amounts.<sup>13</sup> Second, tariff structures are generally quite flat, so tariffs cover costs only at extremely high rates of consumption. Indeed, in more than half of the utilities, tariffs never reach the cost recovery level, so IBTs effectively subsidize all residential water consumers. Third, high fixed charges and minimum consumption thresholds raise average tariffs for light consumers. Nearly all the utilities surveyed have fixed charges, averaging \$2.66 a month, and 40 percent apply minimum consumption thresholds.

Social water tariffs based on socioeconomic data perform somewhat better. Three-quarters of the utilities surveyed also offer separate social tariff schemes for customers meeting poverty criteria based on neighborhood or individual characteristics. Most of these schemes are simply parallel IBT structures offering more concessional terms and financed through internal cross-subsidies. These schemes offer an average discount of 67 percent on what would be paid under the normal tariff, but they often do not target well. Although Argentina, Chile, Colombia, and Paraguay have developed more sophisticated social tariff schemes, the estimated error of inclusion ranges from 26 percent in Paraguay to 51 percent in Colombia—while the error of exclusion runs from 13 percent in Colombia to 96 percent in Chile.<sup>14</sup>

A much greater variety of tariff structures is used for electricity. While eight countries surveyed use IBTs, six others rely primarily on linear tariff schedules for residential electricity customers.<sup>15</sup> The three utilities serving Buenos Aires are the only ones to offer a declining block structure. Residential tariff structures are almost always based solely on volume; Chile and Uruguay are the only Latin American countries that apply time sensitive and load-based charges to residential customers.

Electricity tariffs tend to be better designed. IBTs generally have smaller subsistence blocks for electricity than for water, averaging about 90 kilowatt-hours a month. (Subsistence is usually considered about 40 kilowatt-hours in rural areas and 120 kilowatt-hours in urban areas.) They also tend to have steeper gradients: in nearly half, tariffs reach cost recovery levels well within the typical residential consumption range. Finally, electricity IBTs have lower and fewer fixed charges and minimum consumption thresholds. About two-thirds of the utilities surveyed have fixed charges, averaging just \$0.66 a month, while just 11 percent apply minimum consumption thresholds.

Still, targeting is not always effective for electricity, even where parallel social tariffs exist. Nine of the countries in the sample offer parallel social tariff schemes, mostly based on IBT structures, even when the main residential tariff is linear (examples include Brazil and Colombia). Eligibility for social tariffs is usually limited to households consuming below a certain level, about 200 kilowatt-hours a month on average.<sup>16</sup> But some of these thresholds are too high, making the subsidy programs highly regressive. For example, the schemes in Guatemala and Honduras have a monthly consumption threshold of 300 kilowatt-hours—nearly three times average household consumption.<sup>17</sup> Thus 95 percent of Guatemalan households and 85 percent of Honduran households are eligible for the social tariff. As a result 60–65 percent of subsidy recipients are not poor, and 80–90 percent of subsidy resources go to the non-poor. And because only around 50 percent of poor households in both countries have an electricity connection, 55–60 percent of the poor fail to benefit from the social tariff. Smaller errors of inclusion and a less regressive distributional impact are evident in social tariff programs that use additional eligibility criteria, such as the household's socioeconomic characteristics (as with Argentina's provincial social tariff schemes) or its neighborhood (as with Colombia's cross-subsidy scheme).

Overall, badly designed cross-subsidies and other social tariffs that cover too many people imply greater government support for utilities. This is the case in Colombia, where 80 percent of residential water customers qualify for cross-subsidies (box 2.4). More generally, a narrow base of overtaxed cross-subsidizers (usually large or industrial users) can cause an erosion of the revenue base because they end up opting for self-provision, through the use of generators or wells.

**Box 2.4****Colombia's Experience with Raising Residential Water Tariffs**

In 1994 Colombia passed the Public Services Law, which required reference utility tariffs to be raised to full cost recovery levels. The law also limited cross-subsidies between consumers, requiring that poor households pay at least half the full cost of services and better-off households pay no more than 20 percent above the full cost. A two-year deadline was set to complete this tariff rebalancing.

The tariff increases required to meet these goals were extremely large and regressively distributed. To fully recover costs, the reference tariff had to be increased by 50 percent. And because cross-subsidies had historically been large, tariffs for the poorest households would have had to be raised by 400 percent in real terms. Given the social and political difficulties, the deadline was extended twice, first by five years (to 2001) and then by four more (to 2005). In addition, the share of service costs required from poor households was cut from 50 to 30 percent.

Reference tariffs have now reached cost recovery levels. But higher-income consumers continue to pay surcharges of 30–60 percent to cover cross-subsidies. Moreover, 80 percent of residential customers qualify for these subsidies. So, despite progress toward the tariff goals set in the 1994 law, the water sector continues to require substantial fiscal support. Between 1998 and 2001 the Colombian government gave municipal water utilities \$240 million a year—80 percent of investment in the sector.

**Source:** Adapted from Foster and Yepes 2005.



## CHAPTER 3

# Key Challenges for Infrastructure in the Region

The key challenges for infrastructure in Latin America and the Caribbean include raising social and economic returns, better leveraging private investment through more effective management of private participation in infrastructure (PPI), and developing new sources of financing.

### **Raising Social and Economic Returns**

Efforts to raise social returns from infrastructure should focus on developing new and better ways to increase affordable access for poor people. To boost economic returns, public spending on infrastructure should be made more efficient.

### ***Finding Better Ways to Extend Affordable Services to Poor People***

Most Latin American and Caribbean countries use extensive subsidies and other programs to promote service expansion, yet too many people—especially among the poor—still lack basic services.<sup>1</sup> Access rates have been improving in the last decade, especially among the poor. But growth has been slow, and at current rates it may be 15–20 years before more than 90 percent of the region’s population has safe water. Speeding up service provision to the poor does not necessarily require additional

public resources. Rather, it calls for more effective use of existing funds, particularly for subsidies. (Mexico, for example, already spends nearly 1 percent of GDP on poorly targeted power subsidies.)

For policy purposes it is important to identify whether households lack a service because it is not available in the community or because it is not affordable or convenient. Expanding coverage requires supply-side interventions, while demand-side measures may be more appropriate for increasing affordability and accessibility. In Guatemala about 60 percent of households in the lowest income decile live in communities with access to electricity. But only half of these households (30 percent of the poorest households)—are connected, suggesting that affordability and other demand-side issues are the main factors preventing connections (Estache, Foster, and Wodon 2002).

Private operators may have little incentive to expand coverage to poor or rural areas. Tariffs are unlikely to cover the full cost of providing services to poor or rural customers. Extending infrastructure to remote or geographically challenging areas is technically challenging and therefore expensive. In addition, commercial risks and billing costs are higher for customers with limited ability to pay. For example, revenues per connection are likely to be lower because the poor tend to consume less. (Although as noted, the correlation between income and consumption may be fairly weak for water; see Komives and others 2005.) But incentives to expand may differ for incumbent providers and industry newcomers, because the latter may have different cost structures and a greater need to expand their client bases.

Well-designed service obligations and connection targets can ensure that private operators expand coverage. Many governments in Latin America and the Caribbean include universal service obligations in concessions and other contracts. But these obligations are often vaguely worded or impractical. Limited network coverage may make it physically impossible to fulfill an obligation in the short term. And even in communities linked to a network, unaffordable connection charges may render a service irrelevant. Thus there is a need for universal service obligations to be clearly defined, including how they are to be financed when consumers lack the ability to pay. Connection targets are often clearer in defining the numbers and groups of customers to be served. But they can be met only if customers sign up for the service—which they may not because of high connection charges or because, for example, they do not appreciate the wider social benefits of connecting to a sewerage system.

Output-based aid can also be effective. Several countries in the region provide subsidies to the private sector to expand rural networks. Concessions are typically awarded based on competitive bidding for the minimum subsidy required per connection, below a preset ceiling. Typically, most of the subsidy is paid only after services have been delivered. Such output-based aid is critical for developing public-private partnerships (PPPs) that increase services for poor households, particularly when accompanied by credit guarantees that cover the risk of nonpayment by government agencies. Chile has used minimum subsidy concessions since 1994 to expand electricity and public telephones in rural communities. Peru has such a program for rural pay phones, while Guatemala has one for electricity. And in Paraguay a recent initiative pioneered output-based subsidies to expand water services in rural areas and small towns in the country (box 3.1).

### Box 3.1

#### **Paraguay's Pilot Program Using Output-Based Aid to Expand Water Coverage**

Paraguay's *aguateros*—small, private water companies—serve 9 percent of the country's population, or 17 percent of those with piped water supply. Over the past 20 years the companies, which average about 300 connections but can have as many as 3,000, have constructed piped water systems without state funding, mainly in peri-urban Asunción. A recent World Bank-funded pilot program seeks to attract *aguateros* and construction firms active in the water sector to unserved rural areas and small towns by providing output-based subsidies, awarded through competitive bidding.

Under the program, communities (through water user associations) contract private operators to build and operate water supply systems under 10-year permits. Operators' bids are based on the connection charge for new customers. The subsidy is fixed at \$150 a connection, which is much less than the subsidy required for new rural connections to the state water utility. The government's rural water agency manages the construction phase and arbitrates between communities and operators during the operational phase. The winning bidder for the first phase, to operate four systems, was awarded a contract in August 2002. A second bidding phase was opened for three more towns in 2004.

**Source:** Adapted from Drees, Schwartz, and Bakalian 2004.

Using cheaper technologies and a range of service levels can lower the costs of network expansion and make services more affordable. Accordingly, regulators must avoid prescribing universal quality standards, requiring specific technologies, or assigning exclusivity rights to the main operator. In Chile and Paraguay small water operators that receive output-based subsidies have been given some flexibility on the technology they use. And in Bolivia the large concessionaire in La Paz and El Alto was allowed to introduce a low-cost technology that made water and sewerage connections more affordable for low-income households, using community labor to install the system. This approach lowered the cost of installing water and sewerage systems by 40 percent—savings of \$98, or 80 percent of monthly household income in poor neighborhoods.

Cross-subsidies intended to increase affordability have often been badly designed. As discussed, the cross-subsidy schemes used by many utilities in Latin America and the Caribbean tend to do a bad job of targeting, benefiting too many non-poor people and not enough poor. Indeed, Komives and others (2005) find that increasing block tariffs (IBTs), volume-based tariffs (the two most common cross-subsidies), and utility subsidies in general tend to have a regressive impact not just in Latin America and the Caribbean but worldwide. And though these schemes should have the advantage for governments of not requiring state funding—because better-off customers should be paying higher rates to subsidize the poor—average tariffs are so low that significant state support is usually necessary. Such schemes may also discourage operators from expanding coverage in poor areas if they cannot charge enough to recoup costs.

Changing the tariff structure and the groups to which it applies can better target the poor. Modifying the structure of tariffs (for example, by shrinking the first block of an IBT) will slightly improve targeting performance. But a truly progressive distribution is possible only when a significant portion of households is not subsidized, which would require slashing the consumption thresholds below which utilities subsidize services. Moreover, such a change strategy rests on the assumption that low-income groups consume less, which is not always the case. A more effective approach may be to introduce administrative selection into subsidy allocation. Means-tested subsidies, as used for water services in Chile and Paraguay, distribute benefits progressively. So does geographic targeting in Colombia, though to a lesser extent (Komives and others 2005). These methods are more complex administratively as well as costlier. Thus efforts should be made to piggyback on means testing systems where they already exist.



Overhauling or abandoning consumption subsidies is likely to be politically difficult. Because most electricity and water subsidies benefit too many people, efforts to redirect, reduce, or eliminate subsidies will likely result in higher bills for a significant part of the population. This will be unpopular despite the potential benefits of putting utilities on a stronger financial footing, including higher service quality and lower fiscal pressure.

Connection subsidies can be a more efficient way to help the poor, given that consumption subsidies provide no benefits to unconnected households. Thus connection subsidies may be preferable, especially in areas where water and electricity services are available but take-up is low. Targeted connection subsidies for households are rare in Latin America and the Caribbean. But the subsidies given to utilities (whether explicit or hidden) often reduce initial charges to well below actual costs for all customers, which has much the same effect but is a less efficient use of resources in welfare terms because much of the benefit goes to the non-poor. As with consumption subsidies, means testing (and sometimes geographic targeting) improves the targeting performance of connection subsidies. Komives and others (2005) conclude that the long-term benefits of connection subsidies generally exceed the cost of the connection, largely because networked water and especially electricity tend to be cheaper than the alternatives.

Financing arrangements can also make it easier for low-income groups to pay for connections and services. Many low-income groups lack savings to pay for connections upfront and have limited access to credit. Providing credit facilities in tandem with network expansion programs or requiring operators to divide charges into installments can make connections more attainable. Colombia, for example, requires that connection costs for customers from lower socioeconomic groups be spread over three years. Such a system has the advantage of lower financing costs, because utilities' cost of capital is likely to be much lower than that of poor customers. In addition, the lack of collateral of many low-income customers need not be an obstacle to borrowing, because utilities can use the threat of service disconnection to enforce loan repayment. Similarly, poor customers may find it difficult to pay large, infrequent service bills. More frequent billing, flexible payment plans, and prepayment of services (such as through electricity meters) are among the means of facilitating service expansion.

### ***Making Public Infrastructure Spending More Efficient***

Decentralization and participatory planning can make infrastructure spending more responsive to local needs, but only if carefully implemented.

Involving stakeholders and consumers in the prioritization of infrastructure investments helps tailor provision to community needs and encourages stronger ownership of projects. Peru's Rural Roads Projects are successful examples (box 3.2). But increasing the number of players can exacerbate conflicts of interest between government levels, consumers, and taxpayers, which can result in excessive spending or misallocation of resources across districts, as well as make accountability harder to enforce. Thus effective decentralization and community-based initiatives depend on an enabling institutional environment. That requires, among other elements, government commitment and much stronger accountability to communities by outside leaders than is often the case in developing countries.<sup>2</sup>

Regional approaches can help make services cheaper and more reliable in small countries. Electricity prices tend to be lower for larger power plants (although size does not fully explain prices), and interconnections can improve the reliability of both demand and supply. That was the rationale behind the Central American Interconnection System (SIEPAC), which created a wholesale electricity market and a regional grid. While the geographic separation of the Caribbean islands makes such a system unworkable there, other economies of scale could be exploited in the region. Regional procurement agencies, which would have greater bargaining power, are one option that has been discussed (Jha 2005).

Many countries should spend more on maintenance. In Latin America and the Caribbean, as in other developing regions, maintenance of existing infrastructure has been neglected in favor of new, highly visible projects. In addition to being extremely costly, this approach has a detrimental effect on network quality. A new road should not require resurfacing for 10–15 years, but lack of maintenance can cause severe deterioration, requiring resurfacing in as little as 5 years. There is a strong case for countries in the region to secure budget resources for maintenance, such as through road funds financed by earmarked taxes in El Salvador and elsewhere.

Reallocating funds from new projects to maintenance could boost GDP growth. There is considerable evidence that maintenance has a higher economic return than does new public investment. In an analysis of seven major Latin American countries, Rioja (2003a) estimates that reallocating 1 percent of GDP from total public investment, to roughly double infrastructure maintenance, would increase GDP by 1.9 percent.<sup>3</sup>

Predictable flows and aggressive procurement practices would make public spending much more efficient. Unreliable resource flows make

**Box 3.2****Peru's Rural Roads Projects**

Three-quarters of rural Peruvians live in poverty, two-thirds of them (meaning half the rural population) in extreme poverty. In rural parts of the Andean mountains, nonexistent or inefficient transport infrastructure limits access to local markets, schools, and health centers. In 1995, Peruvian authorities began designing, and are now implementing, an innovative approach to road management in the poorest rural areas, with help from the World Bank and Inter-American Development Bank. The Second Rural Roads Project (drawing on a \$50 million World Bank loan approved in 2001) has built on the success of the first, expanding its scope and reforms.

The two projects have focused on empowering the rural poor in the process of selecting rural roads for rehabilitation. Through community workshops, about 100 provincial participatory road plans have been prepared. These plans identify road segments that are most critical to the needs of the poor and most likely to spur productive activities. The projects have considered all the main transport modes of the rural poor: roads, pedestrian paths, and even fluvial transport for communities living in Amazonian regions. In addition, a "local development window" was created to help identify productive activities that became feasible thanks to better transport.

Building on Peru's decentralization reforms, management of rural roads has been progressively handed over to provincial municipalities, along with budget resources and technical expertise. In all, 38 provincial road institutes have been created, overseen by provincial road boards that include all the mayors from the province. The institutes contract road maintenance to micro-enterprises created by men and women from the poorest rural communities. This approach has made maintenance more efficient, helped develop entrepreneurial capacity, and reduced poverty. More than 500 micro-enterprises have been created, providing 5,700 employment opportunities for poor men and women (30 percent of workers are women).

By 2005, 13,000 kilometers of rural roads had been rehabilitated under the projects and were receiving routine maintenance. The technology used for rehabilitation (gravel roads) is about one-quarter the cost of other alternatives (such as paved roads), and communities consider it sustainable and cost-effective. The 2005 mid-term evaluation of the Second Rural Roads Project highlighted its contributions to improvements in transport conditions, access to schools and health

*(continued)*

centers, agricultural productivity, and rural income. Trends in poverty and extreme poverty indicators were also better in project zones, relative to areas not covered. This effect on poverty was expected to grow stronger over time.

*Source:* Contributed by Nicolas Peltier, *Economist*, World Bank.

efficient maintenance difficult. They also make investments much more costly, because payment disruptions can result in stop-and-go investment programs. In addition, governments usually end up paying more than the private sector for the same goods and services, including infrastructure. An aggressive procurement or competition agency that monitors government contracts with the private sector can substantially reduce collusion among vendors and corruption in general.<sup>4</sup>

More use should be made of small local providers and cheaper technologies. Technological advances, such as inexpensive water systems and solar and other electricity generators, facilitate small-scale local provision of some services. Similarly, micro-enterprises have been used to “micro-privatize” services, including road maintenance, in Colombia, Ecuador, Guatemala, and Nicaragua. Peru’s Rural Roads Projects have rehabilitated roads using gravel instead of more expensive paving, and contracted local micro-enterprises to do the work. In Nicaragua roads have been resurfaced using concrete blocks, which are cheaper than paving but durable and effective. Similar projects have been implemented in other countries.

## **Managing Privatization and Other Private Participation More Effectively**

To better manage PPI, governments should properly sequence related reforms, pursue new types of public-private partnerships, improve concession design and award processes, strengthen risk management and allocation, enhance the capacity of regulators and other institutions, and choose the right regulatory regime.

### ***Properly Sequencing Reforms and Private Participation***

PPI has often not worked well if it has occurred before adequate legal and institutional frameworks were in place. Establishing regulatory credibility takes time, and involves more than just setting up the institutions needed. For example, Colombia’s regulation is not bad, but there are still many

inefficient water (and other) companies. Regulation is too new to be trusted, with the track record of independent decisions by young institutions still limited.

Sector restructuring should advance as far as possible prior to concession awards. This provides an opportunity to overhaul and reorganize the sector, which becomes much more difficult once private investors have entered and property rights been established. Sector laws can be an effective way to establish a coherent framework for a sector, by clearly assigning functions and responsibilities.

Painful reforms are best implemented well before privatization. In many Latin American and Caribbean countries the tariff hikes, subsidy cuts, and job losses implied by reform came to be associated by the public with the move to private ownership. For private involvement to gain public support, governments must make such changes clearly ahead of concessions, and convey that PPI is not responsible for ill effects, without creating false expectations.

### ***Pursuing New Forms of Public-Private Partnership***

In the basic model of public-private partnership (PPP) the government contracts with the private sector to deliver services on its behalf.<sup>5</sup> After competitive selection among proposals, a private firm is created to deliver these services, which often involves building new infrastructure. The firm has to build, operate, maintain, and finance the asset and provide the service over the long term (often 25–30 years) in exchange for regular payments. At the end of the contract period, operation of the asset reverts to the public sector.

While this arrangement can deliver satisfactory results, fiscal and judicial weaknesses can undermine it in Latin America and the Caribbean. Success requires that two institutional conditions be met. First, credible fiscal arrangements are needed to ensure that government payments are made on time and in full. Second, the judicial system and dispute resolution mechanisms must be strong enough to deter opportunistic behavior from the contracting parties after a contract has been awarded. These two conditions are difficult to meet in most Latin American countries. Fiscal arrangements are frequently unstable. And judicial and legal systems are often weak, making it easier for concessionaires to maximize project profits, including through legal disputes and renegotiations with granting authorities. At the same time, a weak legal framework creates the risk of “creeping” expropriation of a firm that has made a specific, sunk investment. This has often been a concern of concessionaires in the region.

Different types of PPPs can be used to avoid these problems. The appropriate model will depend on the fiscal situation of the sector, the degree of contract enforcement, and the project's stand-alone profitability. Partnership forms that may work better than the basic version include:

- Profit-sharing, if a project is highly profitable but the courts cannot be relied on to protect the property rights of private operators. By sharing profits, the government has less incentive to expropriate from the investor.
- A civil works scheme, including private contractors for construction and other works, if project profitability and contract enforcement are weak but fiscal space is ample.
- Concessions supplemented by exclusive land use rights for road projects, if there is no fiscal space and the project is otherwise unprofitable, but the courts are credible.

### ***Improving Concession Design and Award Processes***

Better concession design would discourage frivolous renegotiation, improve sector performance, and better identify and allocate risks.<sup>6</sup> Renegotiation would sometimes still be necessary. But contracts should clearly state events that would trigger renegotiation, with guidelines for the process and outcomes. Contracts should also specify the events that would lead to tariff adjustments and the extent of those adjustments. (Risks are addressed in the next section.)

Concessions should be awarded through transparent, competitive processes, based on carefully chosen bidding criteria. If possible, governments should avoid direct adjudication and bilateral negotiations when awarding contracts. Relying on a single criterion to determine the winning bidder is preferable because use of multiple criteria is less transparent and more susceptible to manipulation, corruption, and being contested by losers. Most contracts in Latin America and the Caribbean, particularly for water and toll roads, have been awarded based on the lowest proposed tariff or a combination of a technical evaluation and the proposed tariff. But both approaches are deficient. Tariffs do not provide a firm basis for a concession because they are usually subject to periodic adjustment. And technical proposals are unlikely to remain relevant or appropriate over the life of a long concession, and their evaluation is somewhat subjective. Thus it may be preferable to set tariffs in advance, along with clear rules on adjustment, and award concessions to qualified bidders prepared to make the highest concession payments or accept the lowest subsidies (where services are unprofitable). Prequalification can be used to eliminate bidders lacking adequate technical proposals or experience.

Contracts should specify the information to be periodically disclosed by concessionaires. Since the late 1970s economic theory has looked at the relationship between regulators and firms as a game in which information—or rather, asymmetry of information—plays a key role.<sup>7</sup> Practitioners initially thought that price-cap regulation would free them from having to rely on information provided by regulated companies, but this perception is rapidly vanishing (see below). Effective regulation requires reliable, standardized information about regulated firms, including costs, revenues, prices, investments, and performance and output indicators. Contracts have too often been vague about such needs, and the data generated have too often been of poor quality or presented inconsistently.

A clear regulatory accounting system is essential to produce the information that regulators need. Concession contracts should define the regulatory accounting norms to be used. In addition, regulatory accounting should address questionable practices, including efforts to charge excessive management fees (often equivalent to half of a firm's net profits), contract subsidiaries or related companies to provide services or equipment at above-market prices, inflate investment proceeds, transfer accumulated profits or capital from other areas to the regulated capital base, and value privatized assets at replacement cost. But combating such distortions is extremely difficult, even in OECD countries. Guasch (2004) argues that applying strict regulatory accounting to 1991–92 reported results would raise the return on capital from 9.7 to 22.5 percent for U.K. electricity distributors and from 0.9 to 18.3 percent for water companies.

### ***Better Managing and Allocating Risks***

Project financing generally requires risk protection instruments to make risk-return ratios attractive to investors.<sup>8</sup> Project financing is riskier than some other types of investments because lending is provided against a project's anticipated cash flows, with no or limited recourse to its sponsors. Although investors in developing country infrastructure have been willing to accept greater risks in exchange for higher potential returns, they have been reluctant to bear some types of risk because they cannot manage them well and significant potential losses may be involved. But while guarantees may be needed to attract investors, governments must be wary of assuming too much risk and of promising excessive compensation if guarantees are triggered.

Contracts must allocate risks carefully. Risk allocation has a major impact on capital costs and tariff levels. Two principles should guide allocation: the party that is responsible for or has more control over a risk factor should bear the risk, and the party that is better able to bear

the risk (less risk-averse) should do so (Guasch 2004). Table 3.1 identifies the main risks in a typical infrastructure project, who usually bears them, and what instruments have been used to allocate them. However, arrangements have differed between countries and sectors.

**Table 3.1. Main Project Risks in Emerging Market Infrastructure**

<i>Risk</i>	<i>Description</i>	<i>Usually borne by</i>	<i>Instrument used to allocate</i>
Construction	Risk of construction cost overrun or delay	Private sector	Project contract
Operational	Risk of operational cost overrun, substandard performance, etc.	Private sector	Project contract
Force majeure	War, natural disaster or other such cause of damage or delay beyond company control	Private sector	Insurance, project contract
Commercial	Risk of insufficient demand, private supplier or purchaser contracts not being honored, etc.	Private sector (sometimes host government partly)	Project contract (sometimes minimum revenue guarantee)
Financial	Risk of interest rate fluctuations, funding risks, etc.	Private sector	Project contract, financing structure
Political	Risk of expropriation, permit revocation, asset confiscation, currency inconvertibility or nontransferability, war, riots, etc.	Host government or third party	Political risk guarantee or insurance
Regulatory	Risk of changes in laws and regulations, tariff setting rules, and taxation, and of public supplier or purchaser contracts not being honored, etc.	Host government or third party	Project contract, partial risk guarantee
Exchange rate	Risk of currency devaluation or depreciation	Host government (sometimes private sector or third party)	Project contract, foreign exchange guarantee, or financing structure

*Source:* Adapted from Sirtaine 2005.



Financial investors and operators are increasingly requiring that regulatory and exchange rate risks be borne by third parties in addition to host governments. When a government provides guarantees or other structures, investors become exposed to its sovereign risk and credit rating. That may be unacceptable to foreign and even domestic investors, who may already be heavily exposed to sovereign risk—as with many Latin American pension funds and insurance companies, which mainly invest in government securities. In such cases guarantees from third parties, including multilateral institutions, are likely to be needed to diversify exposure. Even in an investment grade country such as Chile, most road concessions have required third-party guarantees or insurance to cover certain project risks. Such guarantees may also offer the advantage of raising the project's credit rating above the country ceiling.

### ***Enhancing the Capacity of Regulators and Other Institutions***

Strong regulation can reduce renegotiation and improve sector performance.<sup>9</sup> Where regulatory capacity is weak, highly detailed and more rigid contracts may be appropriate—requiring more frequent renegotiation. Ineffective regulation may also tempt governments or private operators to behave opportunistically. Accordingly, effective regulation is critical wherever industries, private or public, are monopolistic and therefore not disciplined by competition.

Reducing regulatory uncertainty can lower concessionaires' cost of capital, which lowers required returns on investments. It can also provide significant benefits for governments, by allowing lower tariffs or subsidies and higher proceeds from concession awards. Establishing regulatory credibility requires not just reforms but also time to establish confidence in new frameworks.

Regulatory frameworks are stronger when grounded in laws. Many governments, particularly incoming administrations, have tried to change existing concessions and regulations, often for political rather than technical reasons. Argentina (water), Bolivia (various sectors), Brazil (water, electricity), Panama (electricity), and Peru (various sectors) are among the countries where such outcomes have occurred, interfering with budgets, salary scales, and the like. The possibility of such interference raises regulatory risk, and therefore the returns that operators must generate (and often the tariffs they will seek to charge). However, regulatory frameworks and agencies are much harder to change if they are established in laws rather than decrees, contracts, or administrative procedures.

Regulatory agencies should be independent. To ensure decision-making autonomy—free from the influence of operators, consumer groups,

and government—regulators should be formally detached from their corresponding ministries and have sufficient financial resources. Their operating budgets should not be part of general government budgets, but should instead come from levies on regulated industries, usually ranging from 0.5 to 2.0 percent of companies' gross revenues. Finally, their terms should not coincide with election cycles, and they should be removed from office only for proven neglect, noncompliance, conflicts of interest, or unethical behavior.

Accountability is also essential. This requires transparency, including open decision-making, publication of decisions, and justifications for them. Regular public reporting should include information on appeals of regulators' decisions, performance scrutiny by public audit offices, and budget scrutiny by the state legislature. Institutionalizing public hearings and consultation processes also promotes accountability.

Regulators require competent staff. Members of regulatory boards should have appropriate technical expertise, without being engaged in activities that would represent a conflict of interest. Salaries should be high enough to attract outstanding professionals, even if this means exceeding usual public sector pay scales.

Small countries can benefit from regional approaches to regulation and closer collaboration more generally, to attract larger private operators. The Eastern Caribbean Telecommunications Authority (ECTEL), which regulates telecommunications for five Eastern Caribbean states, is a good example of how to promote effective regulation despite limited national capacity (Jha 2005). This model could be applied to water and electricity. There is ample scope for information sharing and benchmarking across the Caribbean's ports, airports, and water and electricity utilities. Some of these efforts could be coordinated by the Organization of Caribbean Utility Regulators (World Bank 2005b). In general, closer collaboration and alignment among the sectoral institutions of different islands could facilitate multi-country investment, which could be of a large enough scale to attract major international operators. Just as Cable & Wireless operates telecommunications services across much of the Caribbean, there may be scope for building regional operations for water, for example (Jha 2005).

Many countries need to build capacity in ministries and local governments. Ministries should be able to develop sector policy as well as understand, shape, and oversee the legal, financial, and technical aspects of concessions, including risk management. This is especially the case for regional and municipal authorities, which control a growing share of infrastructure as a result of advancing decentralization, but have fewer

resources and less institutional capacity than do national governments. It is also crucial that competition and antitrust agencies be strengthened in many countries.

The importance of strong public institutions has increased with the growth of concessions and (especially) public-private partnerships. In addition to leaving governments with more responsibility, control, and influence than do asset sales, concessions and public-private partnerships require a more extensive regulatory role. This is due to the more extensive conditions and obligations involved, which make an adequate institutional framework all the more important.

### ***Choosing the Right Regulatory Regime***

Price-cap regulation, which creates incentives for efficient service provision, has been widely used in Latin America and the Caribbean. Among the more than 1,000 concessions in the region in 1985–2000, 56 percent operated under price-cap regulation, 20 percent under rate of return regulation, and 24 percent under hybrid systems (Guasch 2004). Under traditional approaches regulators seek to limit the profits of monopoly firms, primarily through rate of return systems. Those systems set prices based on firms' operating expenses and capital costs. Besides providing few incentives for good performance, such systems depend on the accuracy of firms' accounting data, and are susceptible to manipulations of these. Price caps, by contrast, limit the prices that utilities can charge but not their profits, although the level may be set to generate a reasonable return to a model efficient company.

The choice of regime significantly affects performance, with price caps achieving the best results. Estache and Rossi (2004) find that the type of regulation had a significant impact on the labor productivity of private electricity distributors in Latin America between 1994 and 2001. Those operating under price cap and hybrid schemes used 55 percent and 25 percent less labor, respectively, to produce the same output as public firms, given the same capital input. Distributors operating under rate of return regulation performed about the same as public firms.

But price cap regimes have proven riskier for concessionaires because profits are not guaranteed, leading to a higher cost of capital, and many have been renegotiated. When renegotiated, such systems have usually been replaced by hybrid arrangements. The new designs often recognize that some types of costs will be automatically passed on to users. The share of costs enjoying automatic pass-through (and the degree to which this weakens efficiency incentives) varies by sector but is dominated by activities subject

to exchange risks (such as imported inputs and foreign debt service) or to negotiated long-term arrangements (such as labor contracts).

In addition, price caps have not achieved the best results for consumers. Most efficiency gains have been captured by governments or firms, rather than shared with consumers through lower tariffs. Indeed, consumers have been doubly penalized relative to rate of return regimes because the higher cost of capital translates into higher tariffs. Moreover, renegotiation tends to work against consumers because of the lower investment levels and higher tariffs often agreed. Given that price cap regulation has not been a great success in the region, hybrid—or in some cases, rate of return—regimes may be preferable.

### **Developing New Sources of Financing**

Financing for infrastructure can be increased by adjusting user charges, improving risk coverage to attract private investors, drawing on local capital markets, expanding public investment, and strengthening local governments' access to financing.

#### ***Recognizing the Scope for Further Funding through User Charges***

Possibilities for cost recovery vary by sector and subsector.<sup>10</sup> User charges are not a feasible financing mechanism for infrastructure with strong public good characteristics, such as rural roads. Only in telecommunications is full cost recovery through user charges not only possible but in fact the norm in Latin America. This largely explains why it has been easier to attract private investment in telecoms and why governments have sometimes been unwilling to divest highly profitable companies in the sector. Although cost recovery is technically feasible and economically attractive for water and electricity, it is difficult to achieve, politically and practically.

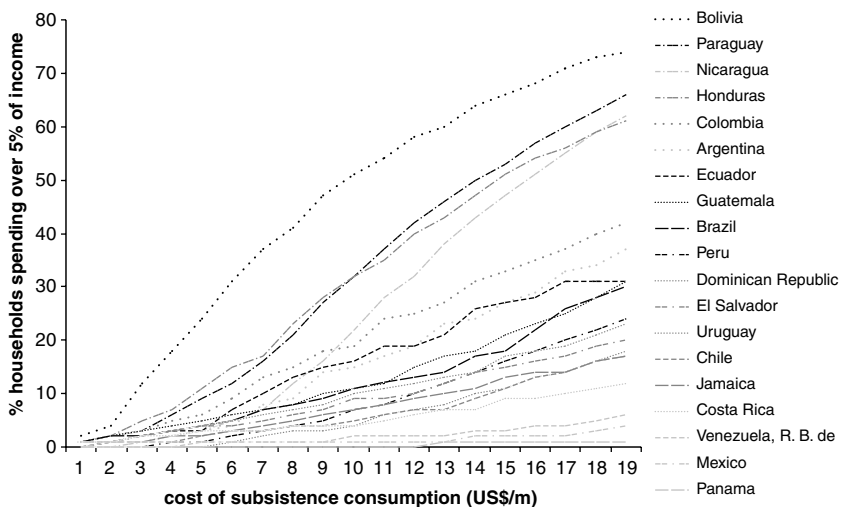
Affordability is not a serious constraint in most Latin American and Caribbean countries, indicating that tariffs could be raised toward cost recovery levels. Foster and Yepes (2005) calculate the cost recovery value of basic services for water to vary between \$6 per month to satisfy very basic needs and \$13 per month for a level of consumption more typical of modest urban consumption; for electricity, the range is between \$4 and \$11. They then look at the share of households for whom various levels of water or electricity bills would each represent more than 5 percent of income—an amount commonly set as an affordable share of income to spend on water or electricity.<sup>11</sup> They find that only in low-income countries such as Bolivia, Honduras, and Paraguay would cost recovery tariffs create significant affordability problem (figure 3.1). In upper-middle-income

countries such as Mexico and Venezuela less than 10 percent of these households would face genuine affordability problems at any of the levels considered. The affordability problem is even smaller if purchasing power parity is used (a more appropriate method if the utility cost structure is predominantly driven by local rather than international costs): utility bills of up to \$15 would be affordable to more than 90 percent of the population in all but the poorest three countries in the sample (Bolivia, Honduras, and Paraguay).

Affordability problems are much more limited in Latin America than in other, poorer regions. Foster and Yepes also compute regional figures for Latin America, East Asia, Africa, and India. They find that whereas only 10 percent of Latin American households would have trouble affording utility bills of \$10 a month, about 35 percent of East Asian households and 55 percent of Indian and Sub-Saharan African households would face affordability problems at this level. The extent of the affordability problem and the differences between regions shrink when the same exercise is conducted in PPP terms.

Raising tariffs to cost recovery levels would have a noticeable effect on poverty incidence in only a few countries in the region. By raising the cost of essential services, tariff hikes effectively reduce real income, drawing

**Figure 3.1. Urban Households Facing Affordability Problems at Different Monthly Cost Levels, by Country**



Source: Foster and Yepes 2005.

more people under the poverty line or exacerbating existing poverty. But analysis of household income by Foster and Yepes (2005) shows that doubling utility bills from \$3 to \$6 or from \$6 to \$12—two plausible scenarios for Latin America—does not have a major impact on the region's poverty indexes (headcount ratio, poverty gap, or FGT index).<sup>12</sup> The exceptions are countries such as Bolivia and Guatemala, where the headcount poverty ratio could rise by as much as 2 percentage points.

### ***Expanding Risk Coverage to Attract Back Private Investors***

To attract both private investors and operators will require changing traditional project structures and financing to offer more risk protection.<sup>13</sup> As noted, recent crises in emerging markets and the mixed record of infrastructure projects in Latin America and the Caribbean have made international private investors more risk averse. Most are applying stricter investment criteria (higher country risk premiums and lower country investment concentrations) and seeking to minimize their exposure to currency and government-related risks. They are also increasingly likely to require that government undertakings be backstopped by multilateral agencies or other third parties. The risk coverage required to attract institutional investors will depend on each country's circumstances and each project's characteristics. The higher the political uncertainty, the weaker the regulation, and the more volatile the currency, the greater will be the need for political, regulatory, and exchange rate protection, respectively. Governments, however, should be wary of covering risks not under their control.

The best way to address currency risk is to secure funding from domestic sources. Revenues from infrastructure projects are typically in local currency, while private financing must often be serviced in dollars or other foreign currency, a mismatch that creates significant risk. The obvious solution is to develop domestic capital markets and debt instruments, to generate more sources of funding (see below). Although this process is advancing in Latin America and the Caribbean, local financing capacity remains limited, especially relative to the needs of large infrastructure projects.

Multilateral institutions offer some local currency funding to address currency risk in infrastructure investments. The International Finance Corporation (IFC) offers local currency loans and hedging products to private investors in developing markets, while the International Bank for Reconstruction and Development (IBRD) provides loans in a number of developing country currencies to governments in public-private

partnerships. The Inter-American Development Bank (IDB) also offers local currency loans to governments in the region, notably Mexico (2004) and Colombia (2005). But local financing by international financial institutions requires fairly well-established currency swap markets. And the paradox is that where those exist, as in Brazil, Chile, and Mexico, interventions by international financial institutions are less likely to be needed.

Financing structures can also protect against foreign exchange risks, but effective instruments are still not readily available in Latin America and the Caribbean. Where local financing capacity is insufficient—where markets are too small or underdeveloped, as in Bolivia, Paraguay, and Uruguay, or where a project is particularly large, such as Peru's Camisea (for natural gas exploitation and transport)—instruments can be used to mitigate foreign exchange risk for private financiers and sponsors. But few such instruments are in use, and international development banks could do more to develop them. One interesting example is the Liquidity Facility developed by the Overseas Private Investment Corporation (OPIC) in 2001 to protect bondholders against foreign exchange risks in an energy distribution project in Brazil (box 3.3). The structure, which has not been used again, has some flaws. In particular, it may not work in cases of extreme foreign exchange shocks. However, providing the project company with liquidity would still be enormously useful because it would allow operations to continue, although if tariffs are not ultimately adjusted to the new exchange rate, the project company would still not be able to repay its loans. But it appears that this facility was a one-off exercise.

Despite their shortcomings, financing structures of this type potentially offer substantial benefits. First, they improve the project company's credit profile by significantly reducing the risk of default or renegotiation of the project contract. Second, the project's credit rating is not constrained by the sovereign ceiling, which may allow the project longer-term financing at lower cost. Third, linking the project's output prices to the local inflation rate rather than the U.S. dollar exchange rate avoids price shocks for consumers for the basic services provided by infrastructure projects and enhances long-term sector stability. Fourth, the financial situation and local currency rating of the output purchaser(s) are not burdened by contractual commitments to buy the project's output at prices indexed to the dollar. Finally, the foreign exchange facility costs much less than a currency swap (in the rare cases where such swaps are available for a sufficiently long tenor).

**Box 3.3****OPIC's Liquidity Facility to Protect Bonds in Brazil from Foreign Exchange Risk**

In 2001 the Overseas Private Investment Corporations (OPIC) developed a Liquidity Facility to guarantee against foreign exchange risks in Brazil's AES Tiête project. The facility provides a revolving credit line that becomes available if depreciation of the Brazilian currency (the real) makes the project company unable to meet its debt service obligations. The \$30 million foreign exchange liquidity facility supports \$300 million in financing.

The coverage in effect establishes a floor in U.S. dollar terms for the company's revenues, which are in domestic currency. Claims are to be paid when revenues fall below the floor value, at which point they would be insufficient to pay scheduled debt service. Coverage is structured to isolate currency risks from operational risks. The claim is met in the form of a loan subordinated only to the project's senior lenders, with an interest rate that reflects the subordinated nature of the claim. Senior lenders remain exposed to all operational risks. (A pro forma calculation is performed to determine the extent to which the revenue shortfall is due to currency movements, which give rise to a claim under the devaluation coverage, as opposed to negative operational results, which do not.)

The facility was well received by rating agencies and institutional investors. AES Tiête became the first electricity project to achieve an investment grade rating in a sub-investment grade country; its bond issue was placed at the longest tenor ever achieved by a Brazilian corporate issuer, and priced to yield 237 basis points less than Brazilian sovereign debt. That it received a better rating and was placed at a lower yield than sovereign instruments indicates that the bond was considered less risky than other investments in the country—a sign that credit analysts believed the project had been largely insulated from Brazil's macroeconomic risk.

*Source:* Sirtaine 2005.

Partial risk guarantees (PRGs) from multilateral institutions can protect lenders and bondholders against other perceived risks, providing the credit enhancement that project companies need to raise sufficient financing. An example is the guarantee provided by the IFC for a 2003 bond issue by Colombia's Triple A (box 3.4). The IFC and IDB have also made extensive use of partial credit guarantees to support long-term local currency bonds in Latin America and the Caribbean. Such guarantees significantly reduce



**Box 3.4****IFC Partial Risk Guarantee for Bond Issue by Triple A, Colombia**

In 1993 the Sociedad Acueducto, Alcantarillado, y Aseo de Barranquilla (Triple A) was awarded a 20-year concession (later extended to 2033) to provide water, sewerage, and solid waste services to the city of Barranquilla, the fourth-largest city in Colombia. The concession required the company to extend water and sewerage services in the southwest of the city, connecting 350,000 low-income inhabitants to the network. These investments were initially financed through short-term and foreign currency debt, which created serious mismatches of maturity and currency on the project company's balance sheet.

In 2003 Triple A wanted to strengthen and stabilize its financial position, so it sought credit enhancement from the International Finance Corporation (IFC) to improve the rating of a proposed bond issue and allow a bond maturity of up to 10 years in the local capital market. The enhancement was in the form of a partial risk guarantee for up to 25 percent of the principal of the bond issue of \$63 million equivalent. The bonds were rated AAA on the national rating scale by both Duff and Phelps of Colombia and BRC Investor Services—a three-notch increase over the company's corporate rating. The issue was fully subscribed by more than 15 domestic institutional investors. It was the first bond issue by a Colombian corporation with risk rated below AA and contributed to the development of the domestic capital markets.

the cost of debt for infrastructure projects and allow longer tenors, by providing higher credit ratings. And such ratings can open up local capital markets, and a broader range of investors, to infrastructure project companies.

Governments can facilitate the access of private infrastructure investors to PRGs by establishing wholesale facilities for these instruments. A pioneering example is the Partial Risk Guarantee Facility (PRGF) established in April 2005 to issue World Bank PRGs in support of Peru's large infrastructure concession program. The facility aims to maximize the attractiveness of infrastructure projects to private investors by protecting project debt (both bonds and loans) from political and regulatory risk and backstopping government obligations under these PPPs, thus reducing the public contributions required for such projects. World Bank guarantees issued through the facility are set to make financing for infrastructure companies

cheaper, longer term, and more broadly based (in terms of its source). By encouraging bond issuance and expanding the range of highly rated investments available to institutional investors, the PRGF should also contribute to the development of local capital markets.

### ***Drawing More from Local Capital Markets***

Most private investment in infrastructure in Latin America and the Caribbean has come from abroad. When seeking private participation, governments in the region have focused on foreign investors, mainly because domestic capital markets have been unable to generate the significant long-term capital required by major infrastructure projects. But given foreign investors' reluctance to enter or expand their involvement in the region's infrastructure, governments need to tap other financing sources. This is particularly crucial for small projects—including many administered by island states or by local authorities in large countries—which are rarely of interest to international companies. As noted, local financing may also be preferable because it avoids the currency risk that can add significantly to the cost of capital for infrastructure projects.

Local capital markets could potentially provide much more funding, particularly by channeling pension fund resources. Local capital markets remain small in most Latin American and Caribbean countries. In addition, national savings rates are low, especially relative to East Asian competitors. But recent growth across the region in private pension funds—as well as insurance companies, investment funds, and other institutional investors—has created a pool of resources that infrastructure projects could tap to a greater degree. Many institutional investors in the region have high liquidity levels and large holdings of government debt and foreign securities, reflecting in part the dearth of attractive local investment alternatives. Many domestic institutional investors would like to diversify their portfolios away from sovereign exposure, but have low-risk investment profiles. Infrastructure projects can appeal to them if the risks are well mitigated, such as through the multilateral guarantees discussed above, and sovereign exposure were transferred to third parties. If they can broaden the range of attractive domestic investment options, infrastructure projects offer a way for countries to reduce foreign savings (capital flight), a serious issue in the region.

Greater efforts are needed to develop the instruments and markets needed to channel local savings into infrastructure investments. Infrastructure bonds should be developed that ideally have long tenors, are

denominated in local currency, carry fixed coupon rates, and have limited recourse to sponsors. Instruments such as guarantee facilities can make local bonds more marketable, as discussed above. Developing foreign exchange derivatives (swaps and forward-related products) will also facilitate funding from abroad.

Bond issues, particularly domestic ones, have played a minor but growing role in project financing in Latin America and the Caribbean. Most project finance debt comes from syndicated bank loans, despite some advantages of debt sales through capital markets. Infrastructure bonds issued in emerging markets averaged \$5 billion a year between 1996 and 2001, or just 6 percent of total infrastructure issuance. But the value of these emerging market issues grew at a compounded annual growth rate (CAGR) of 38 percent over this period, against 45 percent for developed markets. Yet of the 45 new issuers among emerging market infrastructure companies in the period, only 13 were from Latin America.

Chile has been an exception, with infrastructure concessions tapping local debt markets for much of their financing. Between 1996 and 2003 infrastructure bonds issued in Chile averaged about \$1 billion a year—more than half the country's total issuance. But most of the bonds were issued by established energy corporations, with few from project companies. When Chilean project companies have attracted significant capital market participation, they have generally benefited from government revenue guarantees and in some cases foreign exchange guarantees. In addition, in nearly all cases political and regulatory risks have been insured by a multilateral institution (such as the IDB) or private insurer (such as the MBIA). Many of the resources mobilized have come from local pension funds (box 3.5).

### ***The Case for More Public Investment in Infrastructure***

Though resource needs vary depending on the goal, they remain significant. About 1.3 percent of GDP should suffice to respond to expected demand for infrastructure services from individuals and firms (assuming a modest GDP growth scenario). As for social goals, universal service for water, sanitation, and electricity could be achieved within 10 years at a modest 0.24 percent of GDP per year. Maintenance of existing infrastructure stocks would require an additional 1 percent of GDP. In other words, an annual investment of about 2.5 percent of GDP should be sufficient to respond to expected demand, achieve universal service delivery, and maintain existing assets. Appendix B discusses spending needs in more detail.

**Box 3.5****Tapping Pension Funds to Finance Infrastructure in Chile**

To increase investment in infrastructure in the early 1990s, Chile's government introduced a concession program to attract private capital to the transport sector, for roads, highways, bridges, tunnels, and airports. The program has attracted more than \$3.6 billion of private investment.

Chile became the first Latin American country to allow pension funds to invest in infrastructure projects. In 1981 Chile replaced its bankrupt pay-as-you-go retirement system with a fully funded system of individual retirement accounts managed by the private sector. By 2001 more than 95 percent of the country's workers had joined the system and the pension funds had accumulated \$36 billion in assets, achieving an average real return of nearly 11 percent a year.<sup>a</sup> Initially, pension funds were legally constrained from investing in infrastructure projects. A lack of investment grade bonds and other financial instruments issued by concession companies was also an obstacle.

To facilitate investments by pension funds and insurance companies, in 1995–96 legal changes were made to financial and infrastructure regulations. Among other things, these reforms allowed pension funds and insurance companies to invest in new bond issues. As a result a new long-term financial instrument, the infrastructure bond, was created. The typical infrastructure bond is a 20-year fixed rate bond denominated in Unidades de Fomentos (UFs), an inflation-adjusted unit of account used in Chile with a AAA local rating and a monoline guarantee. The bonds are sold exclusively to local private investors, including pension funds, and have been oversubscribed in every offering. Among the country's 16 toll road concessions, 11 have been financed through infrastructure bonds (3 have been financed by bank loans and 2 have not decided their financing structure).

Development of the infrastructure bond market was assisted by Chile's 1995 achievement of an A- credit rating, which created an opportunity for monoline insurance of bond issuances. In 1998 the consortium handling the upgrade of the Talca-Chillan stretch of the nation's main thoroughfare, Route 5, issued the first \$150 million in infrastructure bonds. By mid-2002, \$963 million in infrastructure bonds had been issued in five offerings. The concession program is now being expanded to fund private investment in jails and urban infrastructure.

**Source:** Jha 2004b.

a. For more statistical information, go to <http://www.safp.cl>.

Keeping up with China or catching up with Korea would require doubling or trebling current investment levels. As mentioned earlier, Latin American countries would have to invest amounts varying between 2.4 and 4.7 percent of GDP for 20 years to reach a level of infrastructure per worker equivalent to that of Korea. Adding maintenance and universal service delivery implies an annual financing need of 4 to 7 percent of GDP per annum. While large, this estimate is not unreasonable—similar increases were achieved by Korea and China over long periods of time.

Even if user charges are increased and the private sector brought back in, public investment will still be needed in infrastructure. As discussed above, there are limits to how much can be raised through user charges, especially in water, most roads, and to a lesser extent, power. So public funding will still be needed, even with private sector involvement and financing. And private investment falls far short of the amounts needed: In 1998, the peak year for private investment in infrastructure, the value of projects involving private participation (including public commitments) totaled only about 1.7 percent of GDP. In 2003 it was just 0.9 percent.

Creating fiscal space for such investment is essential. A number of Latin American and Caribbean countries are saddled with heavy debt, and those that are not are wary of adopting expansionary policies for fear of reverting to fiscal and financial instability. In addition, spending rigidities leave many countries with little room to cope with cyclical shocks or expand investment. In Brazil more than 90 percent of federal spending is nondiscretionary (including wages, transfers to regional governments, interest payments, pensions, and spending on other entitlement programs) and rigidities are also high at the subnational level.

Slashing investment is not an efficient way of controlling spending, though it is politically easier. Cuts in investment have long-term growth impacts and so affect long-term solvency by reducing governments' future fiscal revenues. Thus it is inappropriate to apply the same debt rules to productive and unproductive expenditures (Servén 2005). Of course, not all investments are productive (and not all current expenditures are unproductive), but fiscal rules that apply the same principles to investments and other expenditures only reinforce the natural bias to cut investments instead of more politically sensitive expenditures, such as pensions and salaries.

Proposals for increasing fiscal space include the use of alternative rules, an option that has been rejected by the International Monetary Fund (IMF). Alternative fiscal rules include the "golden rule," which is used in the

United Kingdom and states that over the economic cycle, the government is to borrow only to finance capital and not current expenditures. Another example, used in New Zealand, is net present value of wealth accounting, which looks at the solvency of the overall public sector. But neither is a panacea: the first can encourage creative accounting, and the second is complex to apply.<sup>14</sup>

Other options include allowing exceptions for particular investments, but these are unlikely to be significant. One option is to exclude commercially run public enterprises from fiscal accounts to free them from borrowing ceilings. But in Latin America it was found that this would actually reduce fiscal space given that profitable public enterprises are typically used as fiscal cash cows. Another option is to improve the treatment of public-private partnerships to include or exclude them from public accounts as appropriate. Again, in Latin America, closer analysis shows that better accounting for these partnerships would result in reduced fiscal space because more (rather than less) contingent liabilities would be uncovered. A final idea is to make an exception, when calculating fiscal ceilings, for projects financed by multilateral institutions, based on the argument that these are more likely to lead to productive investments. While that argument may have merit, multilateral flows to Latin America and the Caribbean represent less than 1 percent of GDP and most are not for infrastructure, so they are unlikely to solve the problem of fiscal space.

The debate continues, as governments in the region need to increase investments. In the longer term, some countries (such as in Central America) with low taxes relative to GDP may have the option of raising revenues, but others need to address the issue of expenditure rigidity. In Brazil, where taxes are a whopping 35 percent of GDP, an analysis of alternative fiscal rules for infrastructure financing finds that the negative impact of increasing taxes would offset the growth and welfare benefits of increased infrastructure investments. The growth- and welfare-enhancing scenario is that of a reallocation of consumption expenditures in favor of investments (Ferreira and Nascimento 2005). In addition, the IMF and other institutions are placing more emphasis on the quality of fiscal adjustment. In the shorter term, more efficient public investments may yield some space. Fundamentally, however, governments need to make politically difficult decisions about the allocation of expenditures.

### ***Improving Local Governments' Access to Funding***

Local governments' access to private capital depends on their creditworthiness.<sup>15</sup> No amount of credit enhancement or financial engineering can

substitute for a sound inter-governmental fiscal framework. Factors that often reduce the creditworthiness of local bodies include an inadequate accounting and risk management framework for asset-liability management, lack of autonomy to set realistic tax rates and tariffs or user charges for basic services they provide, and inflexible wage structures and employment policies. Box 3.6 lists best and worst practices for financial management of subsovereign bodies, providing a useful checklist of financial management reforms for local governments.

The moral hazard of a federal government bailout is a major impediment to the development of subnational credit markets. But implementing a

### Box 3.6

#### Best and Worst Practices with Significant Rating Value for Financial Management of Local Governments

<i>Best practices</i>	<i>Worst practices</i>
Cash reserve policy /working capital reserves /budget cushions.	Cash basis accounting
Multi-year financial forecasting	Qualified audit opinion for material weakness
Monthly or quarterly financial reporting and monitoring	Deficit financing for two of past five years
Contingency planning policies	Debt retirement speed
Policies on nonrecurring revenue	Unfunded accrued pension liability
Depreciation of fixed assets	Short-term borrowing growing significantly faster than annual spending
Debt affordability reviews and policies	Debt reprogramming that defers a small share of current debt service
Pay-as-you-go capital funding policies	Over-reliance on nonrecurring revenue
Debt retirement speed	Aggressive investment policy for operating funds
Five-year capital improvement plan integrating operating costs	Pension contribution deferral in the current budget year
	Budget impasse beyond legal completion date
	Lack of capital improvement plan
	Excess borrowing from related entities, with no capacity to repay in near future

Source: Fitch Ratings 2002.

credible no-bailout policy is easier said than done. Inman (2003) points out that it took about 70 years—and the refusal to bail out eight defaulting states and the territory of Florida in the 1840s—for the principle of hard budget constraints for U.S. states and local governments to be generally accepted. Mexico and South Africa have both formulated rules where the federal government does not guarantee subsovereign debt. In Mexico the capital risk weighting of bank loans to local governments is linked to local credit ratings. South Africa has established a Municipal Financial Emergency Authority for technical assistance, resources, and legal remedies to local governments in distress (Weist 2002). A related legal issue is the need for orderly bankruptcy and workout procedures as well as a time-bound procedure for foreclosure. In 1995 Hungary introduced a U.S.-style Chapter 11-type bankruptcy procedure to regulate debt clearance procedures in cases of default by local governments. Since the law was introduced, eight small cities have gone through the procedure and are now in stable financial condition (Noel 2000).

Local and regional governments face additional obstacles when trying to access capital market financing. Weaknesses in fiscal decentralization often limit local government autonomy, imposing large mandated expenditures and limiting freedom to set tax rates. Deficiencies in the legal and regulatory framework for subnational bond issues, such as different regulatory and tax treatment of subnational bank lending relative to bond issues, may lead to regulatory arbitrage and distortions in market competition. Similarly, an uneven playing field in subnational finance may be created by state-managed (and usually state-subsidized) credit lines and can hamper the emergence of a private subnational bond market. Finally, most Latin American and Caribbean countries have insufficient subnational bond enhancement instruments.

Structural reforms are needed but in the meantime several mechanisms can facilitate access to infrastructure bond markets and other funding for local governments' infrastructure investments. Long-term efforts to ensure that subnational entities have greater access to financial markets require capacity building, governance advisory, and regulatory and legal reforms. But to help funding in current conditions, multilateral institutions (such as the IBRD) have instruments allowing countries to borrow for onlending to subnational infrastructure projects, for instance, in local currencies. These include currency conversion options in fixed spread loans, currency swaps, and rolling forward. Other instruments—such as the World Bank's Municipal Fund, which provides financing and credit enhancement to subnational public entities—can open up financing



alternatives for local infrastructure even without sovereign support. The fund's objective is to enhance capacity and creditworthiness without central government guarantees.

Pooling credit risk of small and medium-size local governments offers great potential for enhanced access to infrastructure finance. A common method of credit risk pooling is to set up a bond bank that sells its own securities and on-lends the proceeds to local governments. A common feature of bond banks is that they rely on their member municipal governments to repay their issued debt but also provide a number of credit enhancements to lower the cost of borrowing. In Denmark (KommuneKredit) and Sweden (Kommuninvest i Sverige Aktiebolag) bond bank debt is secured by the obligation of member municipalities to pay the debt, in case an individual member defaults. Japan's Finance Corporation for Municipal Enterprises, Norway's Norges Kommunalbank, and Finland's Municipality Finance Plc are other examples of such pooling mechanisms (Moody's Investor Services 2001).

Policy makers can do a great deal to strengthen municipal primary and secondary bond markets. Nearly 50 percent of U.S. municipal bond issues (75 percent of BBB, A, or better) are covered by bond insurance (El Daher 1997). Policy makers could consider setting up a bond insurance facility either in the private or public sector to facilitate access by small issuers, considered less creditworthy, to domestic markets for high investment grade debt. Leigland (1997) offers several ways of promoting the secondary market in subsovereign debt. Among direct measures, countries are exploring ways to facilitate the listing of bonds on domestic stock exchanges and to encourage pre-indication posting or other municipal finance information systems similar to those used in the United States to support placement and sales function (such as Blue List and Munifax). Among indirect measures, removing minimum holding requirements by institutional investors for government securities, including municipal bonds, eliminates the bias toward private placement inherent in the system and increases incentives for institutional investors to trade. Municipal assets are an often underused and overlooked option for enhancing municipal bonds. Municipalities in China and Poland have used public land as collateral for raising money, then successfully disposed of the assets at higher prices on completion of the project.

Experience with municipal development funds has been mixed. More than 60 countries have created specialized financial intermediaries or municipal development funds to raise capital for onlending to subnational governments. But few of these funds have evolved into market-oriented credit suppliers capable of mobilizing private savings (Peterson 1996).

Common features of successful funds—such as MUFIS in the Czech Republic and FINDETER in Colombia—include transferring credit risk to the private sector, unbundling functions like payment collections and credit analysis to specialized private sector firms, separating subsidies from lending, and providing technical assistance and capacity building for project preparation. A successful, if unconventional, example of a fund that focuses on capacity building in municipalities is Paranacidade in Brazil (box 3.7).

Increased local currency financing and better mitigation of foreign exchange risk will be important for enhancing access to capital for subnational governments. Subnational governments often lack capacity to manage and mitigate foreign exchange risk. The macroeconomic fragility and

### **Box 3.7**

#### **Paranacidade: Linking Municipal Finance to Capacity Building**

Parana is one of Brazil's fastest-urbanizing states, with 78 percent of its 9 million people living in 399 municipalities. The municipalities are grouped into 18 regional associations that are autonomous juridical entities, with each electing a mayor from among those of the member municipalities. The state has managed urban development using an innovative institutional structure called Paranacidade.

Paranacidade was created in 1996 as a nonprofit corporate entity of public interest that provides institutional and technical services to municipalities in Parana and collects and invests financial resources in the state's urban and regional development. It operates in a highly decentralized manner, with one central and five regional offices and about 100 staff.

Paranacidade manages the State Urban Development Fund, which makes loans to municipalities at tenors ranging from 8 years for urban infrastructure to 10 years for social infrastructure. The fund charges a below-market rate, with a 3.5 percentage point spread over its inflation-adjusted cost of borrowing, and in the process absorbs foreign exchange risk. The fund has \$330 million in assets. Its delinquency rate is zero because of stringent debt absorptive capacity criteria for municipalities set by the federal government and because value added tax transfers to municipalities are used to guarantee loans.

One of the main reasons for Paranacidade's success is its support for capacity building for municipalities. It has helped municipal associations evolve from political organizations to providers of key technical inputs to municipalities. The associations

are supported by a small technical staff that helps municipalities unable to hire specialized personnel because of their size or scant resources. As a result the associations are able to analyze projects worth up to \$200,000, monitor the bidding process, and follow up on works. Associations receive a fee for these services. Other projects have been developed to help municipalities with tax codes, cadastres, land use plan reviews, hardware and software purchases, and cartographic databases. *Paranacidade* also provides municipal training. The associations' technical staff was trained in project analysis, bidding processes, works supervision, borrowing capacity determination, and the tax system. Municipalities that had received cartographic databases were trained how to use them. *Paranacidade* has also set up an independent technical audit unit to verify the quality of the works and the accuracy of the measurements and to develop a follow-up and monitoring program. All the associations are online, which makes it possible to track the status of any work, service, or good acquired under the urban program.

*Source:* Dunin 2000.

external debt overhang of the 1990s has left ministries of finance wary of taking on additional foreign debt, much less the contingent claims of subnational government debt. But local currency debt in Latin America is characterized by short tenors, volatile interest rates, and an absence of deep and liquid secondary markets.

Recent developments have improved the outlook for subnational access to finance. The maturing of domestic pension funds and other institutional investors has created a sophisticated investor class looking for local currency debt instruments all along the yield curve. Subnational governments offer such investors an opportunity to diversify their portfolios. Countries like Mexico have improved their legal and regulatory framework for securitization, which mitigates interest rate and credit risk—creating demand from investors previously uninterested in simple debt offerings from subnational governments. Credit enhancements by international financial institutions, such as local currency partial credit guarantees, will further deepen local currency debt markets. Box 3.8 presents an innovative structure used in Mexico to finance local governments' infrastructure needs in local currency, while passing on foreign exchange risk to banks.

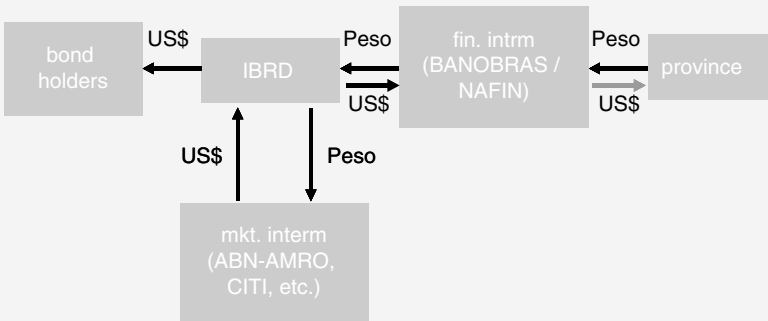
**Box 3.8**

**Local Currency Financing for Mexico’s Subnational Infrastructure Needs**

Mexico’s Decentralized Infrastructure Reform and Development Project established a facility—using IBRD financing of \$108 million—to finance local governments’ infrastructure investments in local currency, while passing on the foreign exchange risk to private banks. The facility resembles a line of credit in dollars, to be drawn down, serviced, and repaid in pesos. The transaction has a maturity of 18 years, with a 3-year grace period, and was structured as follows (and illustrated in the figure below):

- The IBRD lends money to two local intermediary banks, Banobras and Nafin, for onlending to states. (Mexican law requires states to borrow in local currency only and directly from local entities.)
- When the Mexican government submits a request to withdraw funds from the loan (for onlending to a province), the IBRD executes, with a market counterparty, an amortizing U.S. dollar–Mexican peso swap for the same maturity as the loan.
- The pesos are then disbursed to Mexico, which services and repays the amount withdrawn in pesos.

The pricing charged to Mexico depends on the pricing that the IBRD gets from the market when each swap occurs; the currency risk is assumed by private market players. The funds can be used by creditworthy local governments to finance financially viable projects.



Source: Sirtaine 2005.

## APPENDIX A

# Infrastructure Coverage and Quality in Latin America and the Caribbean

Infrastructure in Latin America and the Caribbean is discussed by sector below. Comparisons are usually drawn with the entire universe of 93 middle-income countries (which includes most of the region) and two Asian nations: Korea, now a high-income country but one whose per capita income was very close to the Latin American and Caribbean average in 1985; and China, whose rapid recent growth arguably represents the greatest competitive challenge for the Latin American and Caribbean region. For quality and efficiency indicators, an OECD (Organisation for Economic Co-operation and Development) average is also included where possible, as an indicator of best practice. Data on comparators' GDP are provided at the end of the appendix, along with a list of the countries in the regional and income groups.

### **Transport**

In 1985 Latin America and the Caribbean had more roads than East Asia and the middle-income average, but this has since been reversed. By 2001 road density, normalized to adjust for country size, had barely grown, while those of both Korea and middle-income countries had. The road network is particularly extensive in a few smaller countries, led by Jamaica and Costa Rica. These are also the two countries with the greatest expansion in their

road networks over the period of analysis. In contrast, El Salvador and Guatemala show slight declines, possibly related to the civil conflicts they suffered during this period. If the road network is measured instead relative to the labor force, the regional leaders are Costa Rica and Brazil. On that alternative basis, all Latin American and Caribbean countries saw a decline in the extent of their networks over 1980–2001. Today, road density (paved and total) is much lower in Latin American and the Caribbean than in middle-income countries and China, but roads per worker are still higher in the region than in China (table A.1).

The quality of Latin America's roads is generally poor. Less than a third of the national road network is in good condition in most countries for which data are available (table A.2). In fact, only two countries come above this threshold: Argentina, at 80 percent, and Guatemala at 75 percent (a figure that appears optimistic, although the establishment of a roads fund has improved road conditions). Even fewer regional than national roads are in good condition (except in Nicaragua). And while few data are available for the rural and local roads that make up the remainder of the network, conditions seem to be even worse, with only 8 percent in good condition in Peru and Ecuador, for example. Pavement rates are also low: in 1999, 27 percent of the roads in Latin America and the Caribbean were paved, compared with 54 percent in middle-income countries and 75 percent in Korea. This proportion had risen faster in Latin America and the Caribbean since 1990, when the rate was 22 percent, compared with 51 percent for middle-income countries and 72 percent for Korea.<sup>1</sup>

**Table A.1. Road Density Is Much Lower in Latin America and the Caribbean Than in Middle-Income Countries or China**

	<i>km/1,000 km<sup>2</sup></i>	<i>per 10,000 workers</i>
<i>Total roads</i>		
Latin America & the Caribbean	148	110
China	177	22
Middle-income	180	180
<i>Paved roads</i>		
Latin America & the Caribbean	36	30
China	41	5
Middle-income	82	50

Source: Calderón and Servén 2004b.

Note: Data are for the latest year available (2000 or 2001). GDP per capita in PPP international dollars is now (2004) \$5,495 for China, \$6,560 for middle-income countries, and \$7,920 for Latin America and the Caribbean. In current US\$ the difference is much starker: \$1,272 for China, \$2,453 for middle-income countries, and \$4,013 for Latin America and the Caribbean.

**Table A.2. Quality of Roads in Selected Latin American and Caribbean Countries, Based on Government Assessments**

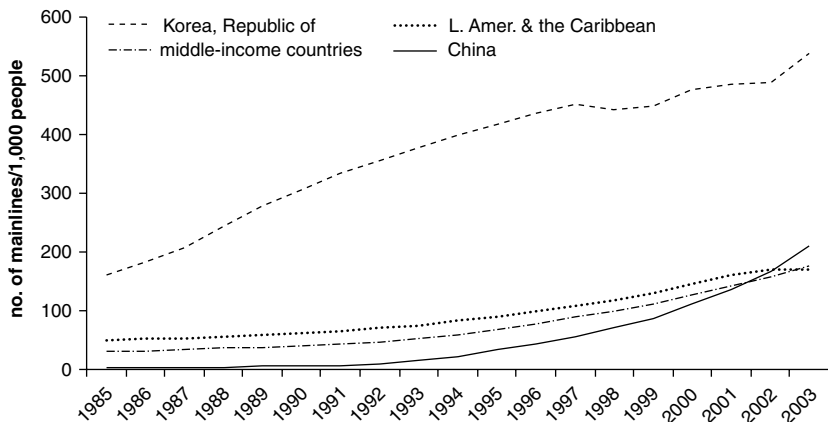
	<i>Length of total road network (km)</i>	<i>National roads (% of total)</i>	<i>National roads in good condition (%)</i>	<i>Regional roads (% of total)</i>	<i>Regional roads in good condition (%)</i>
Argentina	630,000	6.0	80	30	78
Brazil	1,611,000	4.5	24	14	—
Colombia	166,233	10	29	40	—
Ecuador	43,200	20	26	26	10
Guatemala	26,000	15	75	12	45
Haiti	3,400	20	16	44	4.0
Mexico	302,000	16	23	27	—
Nicaragua	18,950	9.2	24	3.4	26
Peru	78,200	22	23	18	15

Source: World Bank data.

Note: — = not available.

## Telecommunications

Despite strong performance by some countries, the region has fallen behind all comparators for telephone mainline coverage since 2002. In 1985 the region was well ahead of both China and middle-income countries in general, but already far behind Korea (figure A.1). But in 2003 the region's teledensity at 170 lines per 1,000 people was below China's (209)

**Figure A.1. Telephone Mainlines per 1,000 People**

Source: International Telecommunication Union.

and the middle-income countries average (178), and had fallen much further below Korea's (538). The 2003 range within Latin America and the Caribbean spanned from 17 in Haiti and 37 in Nicaragua to 251 in Costa Rica and 280 in Uruguay. (See table A.3 for fixed and cellular subscription data by country.)

Mobile phone expansion has made up for slow fixed line growth, although China is still ahead for total telephone subscriptions. In 2003 cellular penetration was higher in Latin America and the Caribbean, at 246 per 1,000 people, than in middle-income countries (225) and China (215). Korea was even further ahead, at 701 (figure A.2). Within Latin America and the Caribbean the lowest levels were 2 (in 2002) in Cuba, 38 in Haiti, and 49 in Honduras. However, countries at the top end—such as Chile (511) and Jamaica (535 in 2002)—compare for cellular density with some

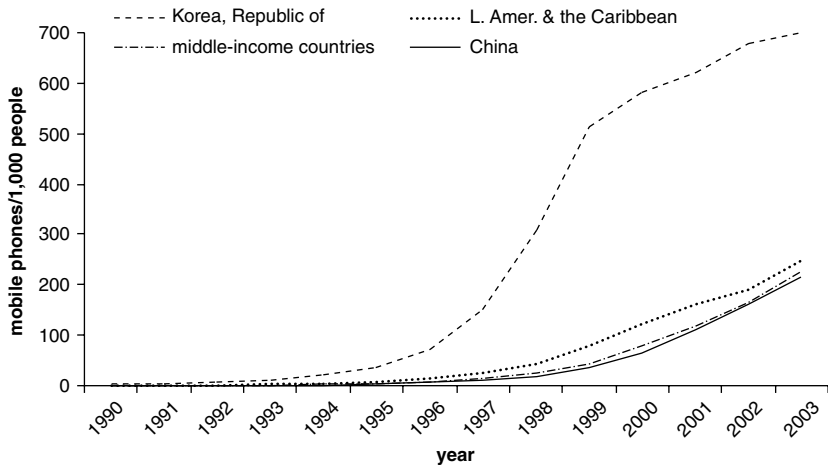
**Table A.3. Telephone Subscriptions in Latin America and the Caribbean per 1,000 People**

Country	1985			2003		
	Mainlines	Mobile	Total	Mainlines	Mobile	Total
Argentina	90	0	90	219*	178*	396
Bolivia	27	0	27	72	152	224
Brazil	53	0	53	223	264	486
Chile	44	0	44	221	511	732
Colombia	57	0	57	179	141	321
Costa Rica	79	0	79	251*	111*	362
Cuba	27	0	27	—	2*	—
Dominican Republic	23	0	23	115	271	387
Ecuador	30	0	30	122	189	312
El Salvador	19	0	19	116	176	292
Guatemala	16	0	16	71*	131*	202
Guyana	23	0	23	92*	99*	191
Haiti	5	0	5	17	38	55
Honduras	11	0	11	48*	49*	97
Jamaica	33	0	33	170*	535*	704
Mexico	50	0	50	158	291	449
Nicaragua	13	0	13	37	85	123
Panama	78	0	78	122	268	390
Paraguay	21	0	21	46	299	345
Peru	21	0	21	67	106	173
Trinidad and Tobago	102	0	102	250*	278*	528
Uruguay	96	0	96	280*	193*	472
Venezuela, R. B. de	71	0	71	111	273	384

Source: International Telecommunication Union (from World Development Indicators Database, World Bank).

Note: \* = 2002 data, — = not available.



**Figure A.2. Mobile Phones per 1,000 People**

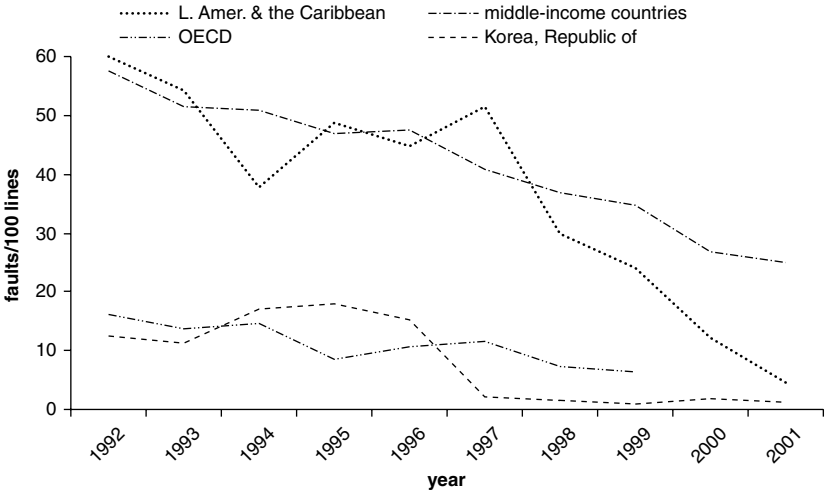
Source: International Telecommunication Union.

much wealthier countries, including the United States (488 in 2002, 543 in 2003). If mobile and fixed lines are added together (which is appropriate since they are partly substitutes and recent cellular growth has apparently come at the expense of fixed line expansion), the regional figure of 416 puts it above middle-income countries (403) but just below China (424). The region now has 45 percent more cellular subscriptions than fixed lines, a margin that is greater than in China (3 percent), middle-income countries (27 percent), and Korea (30 percent).

The quality of fixed telephone service has improved even more dramatically in the region than in comparator countries. Between 1992 and 2001 the number of faults reported per 100 lines fell from 60 to 5 in Latin America and the Caribbean, against 58 to 25 in middle-income countries and 13 to 1 in Korea (figure A.3). In high-income OECD countries the decline was from 18 in 1992 to 6 in 1999, the last year for which an aggregate figure is available. And while the region was still behind Korea in 2001, fewer faults were reported in the region that year than in some OECD countries, including the United States (12 per 100 lines) and Australia (8). In addition, the waiting time for installation of a new line, which stretched to several months in 1985, had fallen to a few days. Technological progress is behind much of this improvement.

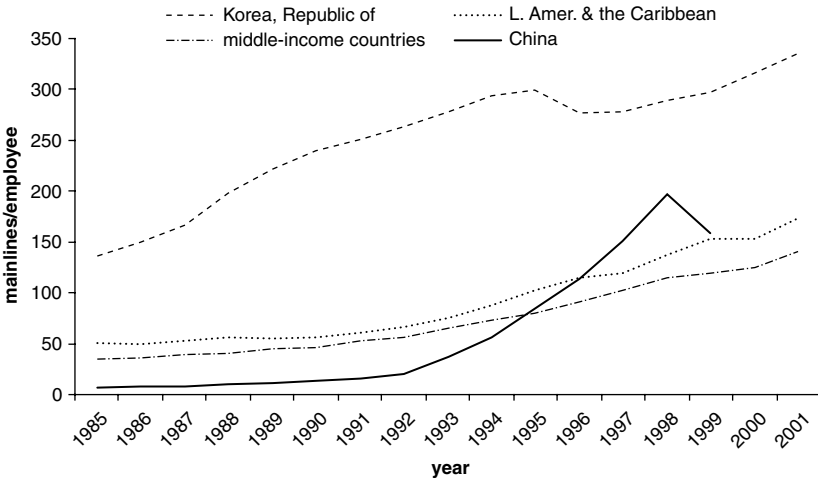
Labor productivity has risen fast in fixed telecommunications. Due largely to technological improvements in telecommunications, the number

**Figure A.3. Telephone Faults Reported per 100 Lines**



Source: International Telecommunication Union.

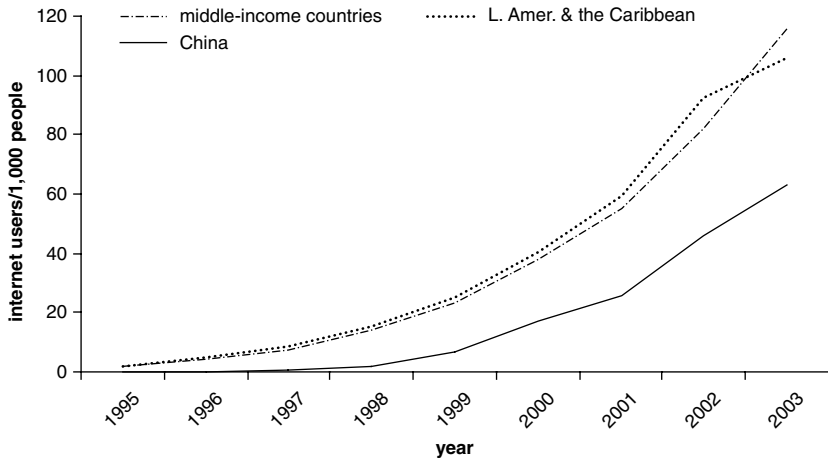
**Figure A.4. Mainlines per Telecom Employee**



Source: International Telecommunication Union.

of fixed lines per telecom employee has risen sharply in the region and worldwide in recent years, and now stands at above the middle-income average but well below Korea and the OECD average (figure A.4).

Internet use has spread fast in the region, but growth has slowed relative to middle-income countries since 2002. In Latin America and the

**Figure A.5. Internet Users per 1,000 People**

Source: International Telecommunication Union.

Caribbean in 2003, there were 106 Internet users per 1,000 people, compared with 116 in middle-income countries, 63 in China (figure A.5), and 610 in Korea (which is not included in the figure due to incomplete data). But the region's growth in Internet use between 2002 and 2003 was much slower, at 15 percent, than in China (37 percent) and middle-income countries overall (41 percent). Within the region, the range stretched from 21 in Paraguay and 81 in Haiti to 272 in Chile.

## Energy

Electricity coverage is close to comprehensive in most urban areas, but remains thin in some rural areas. While more than 90 percent of urban dwellers in Latin America and the Caribbean have access to electricity, in most of the region there are major gaps in rural areas (table A.4). Among countries for which data are available, the urban-rural disparity is most extreme in Peru.

Slower growth in generation capacity has left the region behind middle-income countries in terms of generation capacity. Overall, the region has slipped behind middle-income countries since the 1990s, while the gap with East Asia has widened considerably (figure A.6). There is great variation across Latin America in power generation capacity per worker, which partly reflects geographic characteristics. In 2001 Paraguay ranked far

**Table A.4. Households Reporting Access to Electricity**

percent

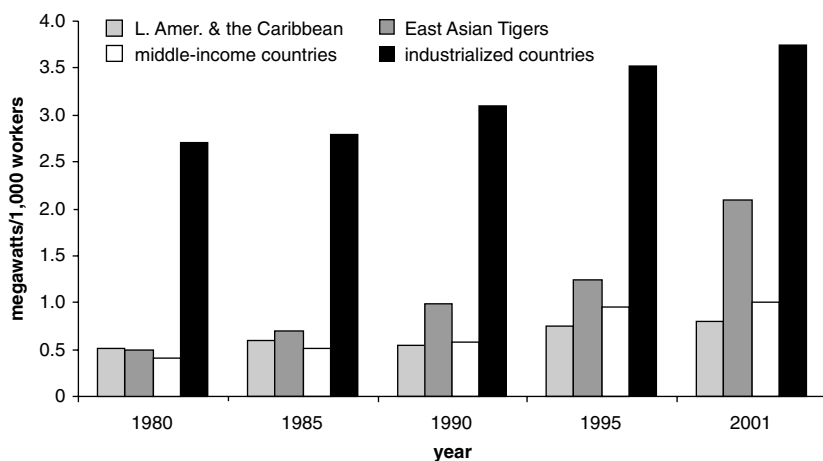
	<i>Total</i>	<i>Urban</i>	<i>Rural</i>
Argentina (2002)	—	100	—
Brazil (2002)	96	99	79
Costa Rica (2002)	98	100	96
Guatemala (2000)	73	95	56
Jamaica (2000)	87	92	79
Mexico (2000)	97	—	—
Peru (2000)	69	92	28

*Source:* Adapted from Ernst & Young country briefs.

*Note:* — = not available.

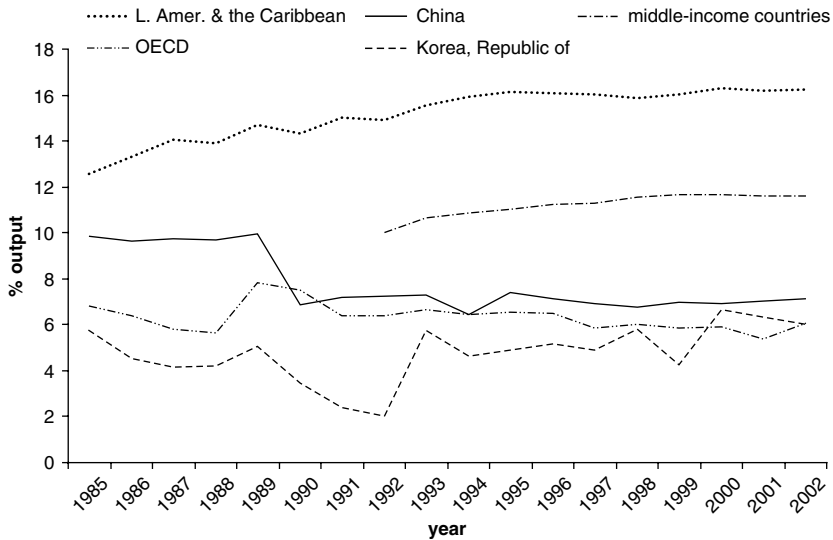
ahead, due to the huge Itaipú hydroelectric project. It was followed by Venezuela and Argentina, with Bolivia at the bottom. Over the period Nicaragua and Peru showed virtually no change in power generation capacity per worker, while Paraguay had the fastest growth, followed by Chile.

Energy transmission and distribution losses have risen in the region and are much higher than elsewhere. At 16 percent in 2002, the level of losses in the region is nearly three times that of OECD countries (6 percent) and Korea (6 percent). The region's losses are also well above the

**Figure A.6. Electricity Generating Capacity, Medians by Region**

*Source:* Calderón and Servén 2003.

*Note:* Sample includes 19 Latin American countries, the 7 East Asian Tigers (Hong Kong [China], Indonesia, Korea, Malaysia, Singapore, Taiwan [China], and Thailand), 64 middle-income countries, and 21 industrialized economies.

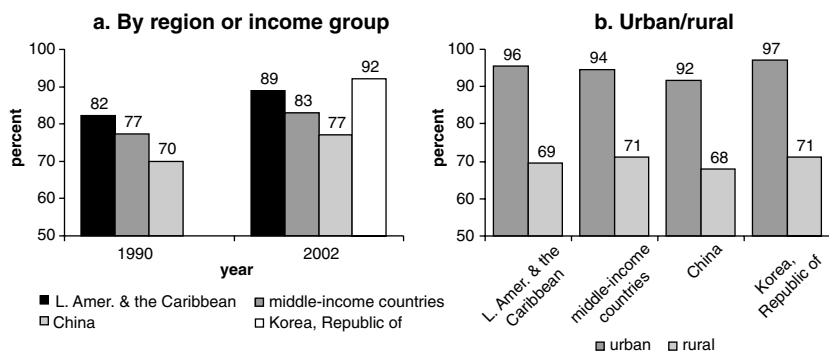
**Figure A.7. Electric Power Transmission and Distribution Losses**

Source: World Development Indicators Database.

middle-income average of 12 percent (figure A.7). Within the region, a few countries show extremely high losses, which signify serious inefficiency: Haiti (51 percent), Dominican Republic (33 percent), Nicaragua (29 percent), and Venezuela (25 percent). The best performers are Paraguay (3 percent) and Trinidad and Tobago (5 percent). Besides these two, only three other countries reduced losses over the period: Chile, El Salvador, and Jamaica.

## Water and Sanitation

In access to safe water, the region surpasses the middle-income average (as well as China), with poorer nations making the greatest gains in the 1990s. The region increased coverage of safe water, from 82 percent of the population in 1990 to 89 percent in 2002 (figure A.8a). Expansion during the period was in line, in percentage point terms, with that in China and middle-income countries in general, but still left the region with lower coverage than Korea.<sup>2</sup> Across Latin America and the Caribbean, the degree of disparity apparently declined over the 1990s, as countries with lower access caught up. The range is still wide, extending from 71 percent in Haiti to 98 percent in Uruguay (2002). In Paraguay access jumped from 62 percent to 83 percent between 1990 and 2002. Ecuador, El Salvador,

**Figure A.8. Population with Access to Improved Water Sources, 2002**

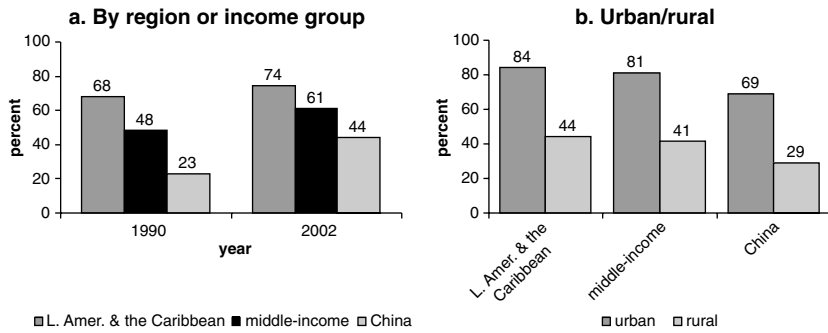
*Source:* World Development Indicators Database.

*Note:* Access to an improved water source refers to reasonable access to an adequate amount of water from an improved source, such as a household connection, public standpipe, borehole, protected well or spring, and rain-water collection. Reasonable access is defined as the availability of at least 20 liters a person a day from a source within a kilometer of the dwelling.

Guatemala, and Haiti also increased levels by 15 or more percentage points. The only country where coverage shrank over the period was Trinidad and Tobago, where the level declined from 92 percent to 91 percent (table A.5).

The region is also well ahead for sanitation coverage, but recent expansion has been relatively slow, and some countries in Latin America and the Caribbean still have a long way to go. Overall, access to improved sanitation facilities rose from 68 percent in 1990 to 74 percent in 2002 (figure A.9a). But by 2002, while 100 percent of the inhabitants of Trinidad and Tobago and 98 percent of Cubans had access, this was true for only 34 percent of Haitians, 45 percent of Bolivians, and 57 percent of those in the Dominican Republic (table A.6).

For both water and sanitation, rural areas are far behind urban, although the gap has narrowed. Whereas in 1990 only 58 percent of the region's rural inhabitants had access to safe water and 35 percent to improved sanitation facilities, these levels had jumped to 69 percent and 44 percent by 2002. For urban areas the increases were slower: from 93 percent to 96 percent for water and from 83 percent to 84 percent for sanitation. But by 2002, the urban-rural gap for safe water access was still larger, in percentage point terms, in Latin America and the Caribbean than in comparators (figure A.8b), while for sanitation the disparity was similar to that in middle-income countries and China (figure A.9b). The largest rural shortfalls

**Figure A.9. Population with Access to Improved Sanitation Facilities, 2002**

Source: WHO and UNICEF.

Note: Access to improved sanitation facilities refers to at least adequate excreta disposal facilities (private or shared, but not public) that can effectively prevent human, animal, and insect contact with excreta. Improved facilities range from simple but protected pit latrines to flush toilets with a sewerage connection. To be effective, facilities must be correctly constructed and properly maintained.

**Table A.5. Improved Water Sources in Latin America and the Caribbean**

% population with access

	1990			2002		
	Urban	Rural	Total	Urban	Rural	Total
Argentina	97	73	94	97	—	—
Bolivia	91	48	72	95	68	85
Brazil	93	55	83	96	58	89
Chile	98	49	90	100	59	95
Colombia	98	78	92	99	71	92
Costa Rica	100	—	—	100	92	97
Cuba	95	—	—	95	78	91
Dominican Rep.	97	72	86	98	85	93
Ecuador	81	54	69	92	77	86
El Salvador	88	47	67	91	68	82
Guatemala	88	69	77	99	92	95
Guyana	—	—	—	83	83	83
Haiti	77	43	53	91	59	71
Honduras	89	78	83	99	82	90
Jamaica	97	86	92	98	87	93
Mexico	90	54	80	97	72	91
Nicaragua	92	42	69	93	65	81
Panama	99	—	—	99	79	91
Paraguay	80	46	62	100	62	83
Peru	88	42	74	87	66	81
Trinidad & Tobago	93	89	92	92	88	91
Uruguay	98	—	—	98	93	98
Venezuela, R. B. de	—	—	—	85	70	83

Source: World Development Indicators Database.

Note: Refer to Figure A.8. — = not available.

**Table A.6. Improved Sanitation Facilities in Latin America and the Caribbean**

% population with access

	1990			2002		
	Urban	Rural	Total	Urban	Rural	Total
Argentina	87	47	82	—	—	—
Brazil	82	37	70	83	35	75
Bolivia	49	13	33	58	23	45
Chile	91	52	85	96	64	92
Colombia	95	52	82	96	54	86
Costa Rica	—	97	—	89	97	92
Cuba	99	95	98	99	95	98
Dominican Rep.	60	33	48	67	43	57
Ecuador	73	36	56	80	59	72
El Salvador	70	33	51	78	40	63
Guatemala	71	35	50	72	52	61
Guyana	—	—	—	86	60	70
Haiti	27	11	15	52	23	34
Honduras	77	31	49	89	52	68
Jamaica	85	64	75	90	68	80
Mexico	84	20	66	90	39	77
Nicaragua	64	27	47	78	51	66
Panama	—	—	—	89	51	72
Paraguay	71	46	58	94	58	78
Peru	68	15	52	72	33	62
Trinidad & Tobago	100	100	100	100	100	100
Uruguay	95	—	—	95	85	94
Venezuela, R. B. de	—	—	—	71	48	68

*Source:* World Development Indicators.*Note:* Refer to Figure A.9. — = not available.

are now in the region's largest countries: in Brazil sanitation access is 83 percent in urban areas but just 35 percent in rural; and in Mexico the corresponding levels are 90 percent and 39 percent.

**Table A.7. GDP per Capita in PPP Terms**

current international \$

	1985	2003
China	823	5,003
Korea, Rep. of	4,354	17,971
Latin America & the Caribbean	4,320	7,400
Middle-income	2,580	6,110
High-income (OECD)	13,800	30,180

*Source:* World Development Indicators.



**Table A.8. Countries in Latin America and the Caribbean and Middle-Income Aggregates**

<i>Latin America and the Caribbean</i>	<i>Middle-Income Countries</i>		
Antigua & Barbuda	Albania	Grenada	Philippines
Argentina	Algeria	Guatemala	Poland
Barbados	American Samoa	Guyana	Romania
Belize	Antigua & Barbuda	Honduras	Russian Federation
Bolivia	Argentina	Hungary	Samoa
Brazil	Armenia	Indonesia	Saudi Arabia
Chile	Azerbaijan	Iran, Islamic Rep.	Serbia & Montenegro
Colombia	Barbados	Iraq	Seychelles
Costa Rica	Belarus	Jamaica	Slovak Republic
Cuba	Belize	Jordan	South Africa
Dominica	Bolivia	Kazakhstan	Sri Lanka
Dominican Republic	Bosnia & Herzegovina	Kiribati	St. Kitts & Nevis
Ecuador	Botswana	Latvia	St. Lucia
El Salvador	Brazil	Lebanon	St. Vincent & the Grenadines
Grenada	Bulgaria	Libya	Suriname
Guatemala	Cape Verde	Lithuania	Swaziland
Guyana	Chile	Macedonia, FYR	Syrian Arab Republic
Haiti	China	Malaysia	Thailand
Honduras	Colombia	Maldives	Tonga
Jamaica	Costa Rica	Marshall Islands	Trinidad & Tobago
Mexico	Croatia	Mauritius	Tunisia
Nicaragua	Cuba	Mayotte	Turkey
Panama	Czech Republic	Mexico	Turkmenistan
Paraguay	Djibouti	Micronesia, Fed. Sts	Ukraine
Peru	Dominica	Morocco	Uruguay
St. Kitts and Nevis	Dominican Republic	Namibia	Vanuatu
St. Lucia	Ecuador	Northern Mariana Islands	Venezuela, R. B. de West Bank & Gaza
St. Vincent & the Grenadines	Egypt, Arab Rep.	Oman	
Suriname	El Salvador	Palau	
Trinidad & Tobago	Estonia	Panama	
Uruguay	Fiji	Paraguay	
Venezuela, R. B. de	Gabon	Peru	
	Georgia		

**Note:** Middle-income economies are those where 2003 gross national income per capita was between \$765 and \$9,385.



## APPENDIX B

# Infrastructure Investment Needs

How much infrastructure investment is needed depends on the objective set, and the objective can be set in a variety of ways. The objective can be to achieve a particular level of coverage or quality of service deemed desirable or attainable. Or it can be an income growth or productivity gain objective for which improved infrastructure is deemed necessary. As such, the term “investment need” should be used in tandem with the question “for what”? Table B.1 illustrates this using the example of Mexico, where this exercise was recently undertaken in the context of a public expenditure review.

### **Setting the Objective Against Which Needs Are to Be Measured**

A first option is to use simple benchmarking. This can entail comparing a country to its peers (as defined, say, by income levels) or to a country that offers a promising example (say, a newly industrialized country such as Korea), and asking how much it would cost to achieve the service coverage or quality of the comparator country. The comparison can be on the basis of coverage or quality or of expenditure flows.

The benchmarking can also be sophisticated, and rely on econometric models. This is what Fay and Yepes (2003) do when they ask how much

**Table B.1. Different Approaches to Estimating Expenditure Needs in Infrastructure—The Example of Mexico**

<i>"Benchmarking"</i>		<i>Set target</i>
Costing exercise	<p><i>Example</i></p> <p><b>Stock target:</b> What would it cost to get Mexico's infrastructure (per capita; per unit of GDP; per km<sup>2</sup>) to the level of the Latin American and Caribbean leader; or to the level of the East Asia median?</p> <p><b>Flow target:</b> How does Mexico's expenditures on infrastructure compare to peers.</p>	<p><i>Example</i></p> <p>What would it cost for Mexico to achieve universal service coverage in water and sanitation, electricity, and access to year-round roads?</p>
Model	<p><b>Econometric models:</b></p> <p><b>Growth:</b> What level of infrastructure coverage is needed to achieve x percent level of growth and reduce inequality by z percent. Model developed by Calderón and Servén (2004b) could be used for this.</p> <p><b>Demand:</b> What level of infrastructure coverage will be demanded by firms and consumers, for given growth projections. This is the approach followed in Fay and Yepes (2003).</p>	<p><b>Engineering-economic models:</b></p> <p>These are "set" targets inasmuch as the target is a particular level of coverage and quality as defined through engineering-economic models.</p> <p><b>Power sector:</b> Well-defined international methodology, applied by CFE in Mexico, which estimates the investment needed to maintain the integrity of the network and satisfy predicted expansion in demand.</p> <p><b>Water/sanitation:</b> Financial model that estimates investment needed to attain the coverage goals set in National Hydraulic Plan.</p> <p><b>Roads:</b> Well-defined methodology for rehabilitation and maintenance expenditures; combined with road sector expert opinion on definition of major corridors and investment needs for their completion.</p>

*Source:* Author elaboration.

investment may be needed to satisfy firm and consumer demand triggered by predicted GDP growth. This is benchmarking inasmuch as the relationship between income level and infrastructure service demand is established on the basis of past observed behavior in a sample of countries and extrapolated to the future using predicted income growth.

Objectives can also be set arbitrarily, on the basis of social desirability for example. The Millennium Development Goals are an example of objectives set on the basis of a combination of social desirability and feasibility.<sup>1</sup> Alternatively, in Mexico the question was how much it would cost to achieve universal coverage of water, sanitation, and electricity.

Objectives can be based on economic-engineering “rules” about networks and their integrity. The electricity sector has sophisticated economic-engineering models that estimate the investments required to maintain the integrity of a network facing demand expansion.<sup>2</sup> In Mexico, road investment needs were based on the estimated cost of rehabilitation needs (bringing the entire federal network to good or fair condition) and the completion of what sector experts defined as major corridors. While it was not as formal a model as in the electricity sector, the investment needs were defined on the basis of recognized methodology for defining major corridors and appropriate quality targets.

In addition, maintenance expenditures must be included in any calculation of expenditure needs. Rather than investment needs, countries should focus on overall expenditure needs, which include maintenance expenditures. Maintenance expenditure standards are well known and result in very predictable annual expenditure outlays when averaged over an entire network. Appropriate, but by no means generous, standards are approximately 2 percent of the replacement cost of the capital cost for electricity, roads, and rail, 3 percent for water and sanitation, and about 8 percent for mobile and fixed lines.

### **Costing the Goal of Bringing Latin America and the Caribbean to Korea’s Level of Productive Infrastructure Coverage**

To reach productive infrastructure coverage levels similar to Korea’s, the region would require annual investments of 2 percent to 5 percent of GDP a year over the next 20 years (table B.2). Using data from Calderón and Servén (2004a), we look at the stocks of roads (paved and total), electricity generating capacity, and telephones (fixed and cellular) required for Latin American and Caribbean countries to reach the coverage level that Korea has today. In the case of roads, the goal is set to one-third the road density of Korea. Korea’s population density is much higher than that of most Latin American and Caribbean countries, so achieving the same road density may not be an appropriate goal. We also assume a rather optimistic growth scenario of 2.7 percent annual GDP growth.

While ambitious, this is not unrealistic. Similar increases were achieved by Korea (as well as China, Indonesia, and Malaysia) over the 20-year period from the late 1970s to the late 1990s. Indeed, Korea’s infrastructure endowments 25 years ago were substantially worse than Argentina’s, Brazil’s, or Mexico’s at the time. And if Calderón and Servén (2004b) are right, the payoffs in terms of growth and decreased inequality would be substantial.

**Table B.2. How Much Would Be Needed for Latin America and the Caribbean to Reach Levels of Infrastructure per Worker Levels Similar to Those of Korea?**

% GDP

Country	<i>Total cost for telephones (fixed and cellular), electricity generating capacity,</i>		<i>Annual cost if spread over 20 years</i>	
	<i>And</i>	<i>And</i>	<i>With all</i>	<i>With paved</i>
	<i>all roads</i>	<i>paved roads</i>	<i>roads</i>	<i>roads</i>
Argentina	39.7	91.4	1.5	3.4
Brazil	71.9	194.2	3.0	7.5
Chile	43.1	104.9	1.7	3.9
Colombia	122.5	200.5	5.2	8.0
Costa Rica	25.6	33.8	1.2	1.5
Mexico	24.8	40.3	1.1	1.6
Peru	155.7	282.6	6.3	10.9
Venezuela, R. B. de	27.1	61.9	1.0	2.3
<b>L. Amer. and the Caribbean</b>	<b>56.8</b>	<b>121.0</b>	<b>2.4</b>	<b>4.7</b>

*Source:* Author calculations based on data from Calderón and Servén (2004b).

*Note:* The cost for roads (total or paved) density is that of reaching a (total or paved) road density equal to one-third that of Korea. This is because Korea's population density is much higher than that of Latin America and the Caribbean. We assume an average GDP growth of 2.7 percent a year over the next 20 years. See table B.5 for detailed country and sector results.

## Universal Water, Sanitation, and Electricity Coverage

Achieving the socially desirable goal of universal water and electricity coverage by 2015 would cost Latin America a mere 0.24 percent of GDP (table B.3). This includes 0.12 percent of GDP for electricity, 0.04 percent of GDP for water, and 0.08 percent for sanitation. These estimates are based on UN population projections and a GDP growth scenario of 2.7 percent a year. It is unfortunately impossible to estimate needed rehabilitation and upgrading, which are likely to be very large—particularly in water and sanitation, given the generally poor maintenance in these two sectors.

These estimates are modest partly because they rely on alternative technologies in circumstances where the price of a connection to the grid or the network would become prohibitive. For electricity the estimates assume an average price of \$1,000 per new connection (and for associated network costs), which implies that households too far from an existing network to be connected at a price less than or equal to \$1,000 would be served by alternative off-grid technologies.<sup>3</sup> For water and sanitation the estimates assume that households in low-density areas would not have access to sewerage connections but alternative sanitation systems (such as

**Table B.3. Investments Needed to Achieve Universal Coverage in Water, Electricity, and Sanitation in Latin America by 2015**

% GDP

<i>Country</i>	<i>Safe water</i>	<i>Sanitation</i>	<i>Total water and sanitation</i>	<i>Electricity</i>	<i>Total water, sanitation, electricity</i>
Argentina	0.02	0.03	0.05	0.05	0.10
Brazil	0.03	0.09	0.12	0.11	0.23
Chile	0.02	0.02	0.04	0.06	0.10
Colombia	0.06	0.13	0.19	0.30	0.49
Costa Rica	0.03	0.05	0.08	0.11	0.19
Mexico	0.02	0.06	0.08	0.05	0.13
Peru	0.08	0.16	0.24	0.28	0.52
Venezuela, R. B. de	0.04	0.09	0.13	0.08	0.21
<b>L. Amer. and the Caribbean</b>	<b>0.04</b>	<b>0.08</b>	<b>0.12</b>	<b>0.12</b>	<b>0.24</b>

*Source:* Author calculations based on World Development Indicators data.

*Note:* See table B.6 for full sample.

latrines) and that a proportion of households would have access to water but not necessarily in-house connections.

## Responding to Firms' and Individuals' Demand for Infrastructure Services

Responding to the derived demand of firms and individuals would require a more modest 1.3 percent of GDP a year (table B.4). Adding maintenance expenditures would increase the annual need for resources

**Table B.4. Investment Needed Over 2005–15 to Respond to Firm and Individual Demand**

% GDP

	<i>Electricity</i>	<i>Telephone (fixed and cellular)</i>	<i>Roads</i>	<i>Rail</i>	<i>Safe water</i>	<i>Sanitation</i>	<i>Total</i>
Investments	0.7	0.3	0.2	0.0	0.1	0.1	1.3
Maintenance	0.4	0.3	0.2	0.0	0.0	0.1	1.1
Total	1.1	0.6	0.4	0.0	0.1	0.1	2.4

*Source:* Author calculations based on Fay and Yepes (2003) methodology, using World Development Indicators data except for water and sanitation, for which the target is the one set for the Millennium Development Goals (halve the proportion of the population without access to water and sanitation by 2015).

*Note:* Assumes 2.7 percent annual GDP growth.

to about 2.4 percent of GDP a year. The Fay and Yepes (2003) approach described above develops an econometric model that estimates the relationship between a number of economic variables (income per capita, urbanization, and sectoral composition of GDP) and infrastructure coverage for electricity, telephones, roads, and rail. This is then used in combination with World Bank and UN population and GDP growth projections to estimate the derived demand for infrastructure services—which in turn is priced.

### **Pulling It All Together**

Annual expenditures of about 3 percent of GDP should suffice to respond to expected growth in demand from firms and individuals, to maintain existing infrastructure, and to achieve universal service for water, sanitation, and electricity over 10 years. This is based on adding the Fay and Yepes projections (1.4 percent of GDP) to maintenance (1.0 percent) and the estimated cost of universal coverage (0.24 percent). Note that this does not include the cost of rehabilitation, nor does it cover urban transport, ports, and airports.

A much higher amount (4–6 percent of GDP) would be required to bring Latin America and the Caribbean to Korea's level of coverage over 20 years and fund adequate maintenance. This is based on the estimated cost of bringing the region to Korea's level (2.4 percent to 4.7 percent of GDP) to which the estimated cost of maintenance (about 1 percent of GDP a year) and universal coverage (0.24 percent of GDP) is added. Again, this does not include the cost of rehabilitation.



**Table B.5. The Cost of Investments Needed for Latin America and the Caribbean to Reach Infrastructure Coverage per Worker Levels Similar to Those of Korea**

% GDP

Country	Telephone mainlines	Mobile phones	Electricity generating capacity	Total road <sup>a</sup>	Paved road <sup>a</sup>	Railroad <sup>a</sup>	Total (excluding rail)		Total (excluding rail) annual investment if spread over 20 years <sup>b</sup>	
							All roads	Paved roads	All roads	Paved roads
							Argentina	1	2	4
Bahamas, The	0	2	0	4	12	5	6	14	0.2	0.5
Barbados	0	3	11	0	0	0	13	13	0.6	0.6
Belize	2	4	31	66	217	50	103	254	4.1	9.5
Bolivia	14	24	148	499	1,227	217	685	1,413	26.4	52.6
Brazil	3	8	38	23	145	26	72	194	3.0	7.5
Chile	1	2	8	32	94	12	43	105	1.7	3.9
Colombia	5	14	64	40	118	23	123	200	5.2	8.0
Costa Rica	1	5	19	0	8	1	26	34	1.2	1.5
Dominican Rep.	5	9	44	1	0	1	59	57	2.6	2.6
Ecuador	7	14	67	28	106	21	116	194	5.0	7.8
El Salvador	6	10	67	0	8	0	83	91	3.8	4.1
Guatemala	6	11	69	13	38	6	99	124	4.4	5.3
Guyana	13	27	113	1,155	2,712	546	1,308	2,865	48.6	104.6
Haiti	36	67	391	16	58	14	511	553	23.0	24.6
Honduras	13	25	133	45	141	25	215	312	9.3	12.8
Jamaica	4	7	38	0	0	0	49	49	2.2	2.2
Mexico	2	3	15	5	21	1	25	40	1.1	1.6
Nicaragua	18	34	185	70	271	56	308	508	13.3	20.5

(continued)

**Table B.5. The Cost of Investments Needed for Latin America and the Caribbean to Reach Infrastructure Coverage per Worker Levels Similar to Those of Korea** (continued)

% GDP

Country	Telephone mainlines	Mobile phones	Electricity generating capacity	Total road <sup>a</sup>	Paved road <sup>a</sup>	Railroad <sup>a</sup>	Total (excluding rail)		Total (excluding rail) annual investment if spread over 20 years <sup>b</sup>	
							All roads	Paved roads	All roads	Paved roads
							Panama	3	5	22
Paraguay	10	12	0	196	522	106	218	544	8.0	19.8
Peru	6	11	56	83	210	42	156	283	6.3	10.9
Suriname	4	8	0	835	1,851	378	847	1,863	30.6	67.2
Trinidad and Tobago	1	3	0	0	0	1	0	0	0.2	0.2
Uruguay	1	4	12	34	68	8	51	85	2.0	3.2
Venezuela, R. B. de	2	3	2	20	55	13	27	62	1.0	2.3
<b>L. Amer. &amp; the Caribbean</b>	<b>3</b>	<b>5</b>	<b>25</b>	<b>23</b>	<b>88</b>	<b>14</b>	<b>57</b>	<b>121</b>	<b>2.4</b>	<b>4.7</b>

*Source:* Author calculations based on data from Calderón and Servén (2004a).

a. The cost for total roads, paved roads, and rail is that of reaching a road/paved road/rail density equal to one-third that of Korea. This is because Korea's population density is much higher than the Latin American and Caribbean region's (187 people per kilometer compared with 26), and the difference is even larger when using labor force rather than population (245 vs. 11). In the few cases where the road density is already higher than this benchmark, the cost is set to zero.

b. This assumes an annual growth of GDP of 2.7 percent a year over the next 20 years.

**Table B.6. Estimated Annual Investment Needed to Achieve Universal Access to Water, Sanitation, and Electricity in Latin America and the Caribbean by 2015**

% GDP

<i>Country</i>	<i>Safe water</i>	<i>Sanitation</i>	<i>Total water and sanitation</i>	<i>Electricity</i>	<i>Total water, sanitation, electricity</i>
Argentina	0.02	0.03	0.05	0.05	0.10
Belize	0.05	0.16	0.21	—	—
Bolivia	0.20	0.47	0.67	0.92	1.59
Brazil	0.03	0.09	0.12	0.11	0.23
Chile	0.02	0.02	0.04	0.06	0.10
Colombia	0.06	0.13	0.19	0.30	0.49
Costa Rica	0.03	0.05	0.08	0.11	0.19
Dominican Republic	0.03	0.09	0.12	0.29	0.41
Ecuador	0.11	0.37	0.48	0.36	0.84
El Salvador	0.10	0.15	0.25	0.31	0.56
Guatemala	0.12	0.24	0.36	0.44	0.80
Guyana	0.07	0.18	0.25	—	—
Haiti	0.68	1.52	2.20	2.20	4.40
Honduras	0.18	0.43	0.61	0.89	1.50
Jamaica	0.07	0.09	0.16	0.10	0.26
Mexico	0.02	0.06	0.08	0.05	0.13
Panama	0.03	0.05	0.08	0.14	0.22
Paraguay	0.18	0.23	0.41	0.60	1.01
Peru	0.08	0.16	0.24	0.28	0.52
Trin. and Tobago	0.02	0.03	0.05	0.02	0.07
Uruguay	0.01	0.02	0.03	0.04	0.07
Venezuela, R. B. de	0.04	0.09	0.13	0.08	0.21
<b>L. Amer. and the Caribbean</b>	<b>0.04</b>	<b>0.08</b>	<b>0.12</b>	<b>0.12</b>	<b>0.24</b>

*Source:* Author calculations based on data from World Development Indicators.

*Note:* — = not available.



# Appendix C

**Table C.1. Infrastructure Investment in Latin America, 1980–2001**

% GDP

Country	Period	Telecommunications			Power			Land transportation <sup>a</sup>			Total infrastructure <sup>b</sup>		
		Total	Public	Private	Total	Public	Private	Total	Public	Private	Total	Public	Private
Argentina	1980–85	0.33	0.33	0.00	1.57	1.57	0.00	0.84	0.84	0.00	2.96	2.96	0.00
	1996–01	0.53	0.00	0.53	0.40	0.03	0.36	0.32	0.15	0.17	1.45	0.22	1.24
	Change	0.20	-0.33	0.53	-1.18	-1.54	0.36	-0.51	-0.69	0.17	-1.51	-2.74	1.24
Brazil	1980–85	0.69	0.32	0.37	3.32	2.53	0.79	0.84	0.47	0.37	5.17	3.64	1.53
	1996–01	1.16	0.30	0.86	0.76	0.37	0.39	0.14	0.04	0.10	2.39	1.02	1.37
	Change	0.47	-0.01	0.49	-2.56	-2.16	-0.40	-0.70	-0.43	-0.27	-2.78	-2.62	-0.16
Chile	1980–85	0.41	0.41	0.00	1.59	1.59	0.00	1.01	1.01	0.00	3.24	3.24	0.00
	1996–01	1.42	0.00	1.42	1.78	0.34	1.44	1.96	1.00	0.96	5.58	1.72	3.86
	Change	1.01	-0.41	1.42	0.20	-1.24	1.44	0.95	-0.01	0.96	2.34	-1.52	3.86
Colombia	1980–85	0.36	0.36	0.00	2.32	2.32	0.00	0.99	0.99	0.00	3.85	3.85	0.00
	1996–01	1.25	0.58	0.67	3.32	1.91	1.41	0.89	0.69	0.21	5.76	3.48	2.28
	Change	0.89	0.22	0.67	1.00	-0.41	1.41	-0.09	-0.30	0.21	1.91	-0.37	2.28

(continued)

**Table C.1. Infrastructure Investment in Latin America, 1980–2001** (continued)

% GDP

Country	Period	Telecommunications			Power			Land transportation <sup>a</sup>			Total infrastructure <sup>b</sup>		
		Total	Public	Private	Total	Public	Private	Total	Public	Private	Total	Public	Private
Mexico	1980–85	0.24	0.24	0.00	0.49	0.49	0.00	1.54	1.54	0.00	2.45	2.45	0.00
	1996–01	0.73	0.03	0.70	0.11	0.11	0.00	0.34	0.08	0.27	1.24	0.27	0.98
	Change	0.49	-0.21	0.70	-0.38	-0.38	0.00	-1.19	-1.46	0.27	-1.21	-2.18	0.98
Peru	1980–85	0.31	0.31	0.00	1.29	1.28	0.01	0.33	0.30	0.03	1.98	1.94	0.04
	1996–01	1.07	0.24	0.83	0.94	0.32	0.63	0.25	0.12	0.13	2.28	0.68	1.60
	Change	0.76	-0.07	0.83	-0.35	-0.96	0.61	-0.08	-0.19	0.11	0.30	-1.26	1.56
Bolivia	1980–85	0.89	0.70	0.19	1.90	1.75	0.14	2.81	2.40	0.41	5.79	5.04	0.76
	1996–01	1.74	0.00	1.74	1.75	0.22	1.53	2.78	2.61	0.17	7.28	2.93	4.35
	Change	0.85	-0.70	1.55	-0.15	-1.53	1.39	-0.03	0.21	-0.24	1.49	-2.11	3.60
<b>Weighted Avg. (by GDP)</b>	<b>1980–85</b>	<b>0.45</b>	<b>0.30</b>	<b>0.15</b>	<b>1.95</b>	<b>1.64</b>	<b>0.31</b>	<b>1.06</b>	<b>0.91</b>	<b>0.15</b>	<b>3.71</b>	<b>3.10</b>	<b>0.61</b>
	<b>1996–01</b>	<b>0.94</b>	<b>0.17</b>	<b>0.77</b>	<b>0.71</b>	<b>0.31</b>	<b>0.37</b>	<b>0.36</b>	<b>0.16</b>	<b>0.20</b>	<b>2.24</b>	<b>0.83</b>	<b>1.41</b>
	<b>Change</b>	<b>0.50</b>	<b>-0.13</b>	<b>0.62</b>	<b>-1.25</b>	<b>-1.33</b>	<b>0.06</b>	<b>-0.69</b>	<b>-0.74</b>	<b>0.05</b>	<b>-1.46</b>	<b>-2.27</b>	<b>0.80</b>

Source: Calderón and Servén 2004a.

a. Land Transportation includes investment in roads and railways.

b. Total investment in infrastructure includes telecommunications, power, roads, railways, and water. In Argentina, it includes also the gas sector.

# Notes

## Executive Summary

1. PPI includes all form of private participation in infrastructure: greenfield investments, concessions of any form and privatization.
2. No readily available, systematic data exist to compare ports, airports, and urban transport infrastructure.
3. Of the 0.9 percent of GDP, 0.43 went to the energy sector, 0.41 to telecom, 0.05 to transport, and 0.01 to water and sanitation.
4. Toll roads require a minimum amount of traffic to be commercially viable. As a result, even in industrial countries toll roads account for just 5–10 percent of the primary network, which represents only 10–20 percent of the overall network (Heggie and Vickers 1998). In the United States, for example, toll roads represent 0.08 percent of paved roads.
5. Health and education spending tends to increase with income, and Latin American and Caribbean countries are richer than these other countries.

## Chapter 1

1. The seven tiger economies are Hong Kong (China), Indonesia, Republic of Korea, Malaysia, Singapore, Taiwan (China), and Thailand.

2. As defined in World Bank (2004c), improved water sources include household connections, public standpipes, boreholes, protected wells or springs, or rainwater collection. Unimproved sources include vendors, tanker trucks, and unprotected wells and springs.
3. This assumes 2.7 percent annual GDP growth, 1.24 percent annual population growth, and an alternative goal of one-third the road density of Korea (reflecting the Latin American and Caribbean region's lower population density). Here infrastructure is defined as telephony (fixed and cellular), electricity generation capacity, and road density. When overall roads are used as the goal, the estimated annual investment over 20 years is 4 percent of GDP; for paved roads the investment is 6 percent. See appendix B for detailed results.
4. Such investment could not be funded solely by public resources (or would require massive reallocation of resources). In 2000–01 total public spending in Latin America and the Caribbean averaged 22 percent of GDP, and total public investment about 3 percent of GDP.
5. See <http://www.weforum.org/> for the World Economic Forum's indices and <http://www02.imd.ch/wcc/yearbook/> for the World Competitiveness Yearbook.
6. Logistics costs—the costs of getting products from factories to markets—are highly sensitive to the quality of infrastructure, especially transport. Unreliable or in-existent infrastructure results in higher losses in transit, the need to hold larger inventories (rather than order just-in-time), and higher transport costs.

## Chapter 2

1. A concession gives a private investor the right to operate a service for a defined period (usually 15–30 years) subject to investment and operating requirements. Concessions are usually awarded through competitive bidding and rarely transfer ownership of the assets used. For greenfield projects, build-operate-transfer (BOT) concessions have been common for power plants and gas pipelines in Latin America and the Caribbean, and have also been used for water and sanitation. In addition, concessions have been used for roads, airports, and ports.
2. El Cronista, “La mayoría cree que los servicios públicos deben volver al Estado,” 18 April 2005.
3. See Estache, Foster and Wodon (2002) for a more in-depth discussion.
4. Mc Kenzie and Mookherjee (2003) report job losses to have been 0.13 percent of the workforce in Bolivia, 1 percent in Mexico, and 2 percent in Argentina. These refer to job losses from privatization in general, not just of infrastructure.
5. The data and discussion on renegotiation in the following paragraphs are also drawn from this source.



6. AES, one of the largest investors in Latin American infrastructure, saw its share price fall from more than \$70 in October 2000 to just above \$1 in late 2001 (Harris 2003). (It has since improved somewhat, to above \$16 in April 2006,) Around the same period the shares of Vivendi and Suez fell by half from peak levels.
7. Although privatization may be beneficial overall, perceptions are determined by individual gains and losses that are likely to differ across groups. In addition, gains are likely to be dispersed (across individuals and over time), while losses are likely to be concentrated (among individuals and in the present, as with job losses).
8. See Harris (2003), on which this paragraph is based, for a more detailed discussion.
9. Grants from international donors are one other source of funding, but only a significant one for a couple of countries in the region, notably Haiti. And even where a project has donor funding in the short term, longer term sustainability usually requires that either users or taxpayers pay.
10. Analyzing the interaction between change in ownership and competition for the fixed telecommunications market, Andres, Foster, and Guasch (2005) find that privatization is the determining factor behind most performance improvements. But competition significantly affects prices.
11. This section is drawn largely from Foster and Yepes (2005). Cost recovery has largely been achieved for telecoms. We therefore focus the discussion here on the remaining utilities—water and sanitation, and electricity.
12. This section is drawn largely from Foster and Yepes (2005).
13. Residential consumption averages about 20 cubic meters a month in most of these cities, while subsistence consumption is 8–16 cubic meters a month. Robles (2001) shows that Paraguay's IBT structure based on a 15 cubic meter threshold delivers only 20 percent of subsidy resources to the poor, but that this percentage would rise to 60 percent if the subsistence threshold was lowered to 5 cubic meters.
14. Or 1 percent in Colombia and 89 percent in Chile if only connected poor households are considered. Errors of inclusion show mistakenly included non-poor, while errors of exclusion reflect mistakenly excluded poor.
15. A total of 44 electric utilities were considered in these 14 countries.
16. In a handful of cases additional eligibility criteria are applied based on household characteristics (some Argentine provinces), neighborhood characteristics (Colombia), or whether the family is a beneficiary of other welfare programs (Brazil).
17. Average monthly household consumption is 102 kilowatt-hours in Guatemala and 108 kilowatt-hours in Honduras.

### Chapter 3

1. This section draws heavily on Estache, Foster, and Wodon (2002), as well as other sources where cited.
2. These are the conclusions of Estache (2004) based on a review of recent literature on decentralization and community-based initiatives.
3. This figure is based on an Easterly and Rebelo (1993) estimate that public investment in the seven countries was about 6 percent of GDP.
4. Competition authorities can help avoid (or at least reduce) collusion in bidding processes—for example, in a road rehabilitation and maintenance project bid out to the private sector and funded by the government. To be effective, competition authorities should be involved early on in the bidding process and have enough resources and power to access information needed to identify the existence of collusion.
5. This section is based on a contribution from Juan Benavides, Senior Infrastructure Specialist, Inter-American Development Bank.
6. This section draws heavily on Guasch (2004).
7. For a summary of key theories, see Rodriguez, Schlirf, and Groom (2005).
8. This section is based on Sirtaine (2005).
9. This section and the next one are largely based on Guasch (2004).
10. This section is based on Foster and Yepes (2005).
11. This threshold is often used for water affordability in Latin America, and household surveys suggest that the poorest quintile of households rarely spends more than this level. No comparable benchmark exists for electricity, but household surveys indicate that the poorest quintile rarely spends more than 6–8 percent of income on electricity.
12. The headcount ratio measures the percentage of the population living under the poverty line. The poverty gap measures the average percentage deviation of the income (expenditure) of those under the poverty line from the level represented by the poverty line. The FGT (for Foster, Greer and Thorbecke index measures the average squared percentage deviation of the income (expenditure) of those under the poverty line from the level represented by the poverty line.
13. This section draws on Sirtaine (2005), with contributions from Ellis Juan, Manager and Jamal Saghir, Director, both at the World Bank.
14. The authors are grateful to Luis Servén for insights on this topic.
15. This section is based on a contribution from Abhas Jha, with additional inputs from Sirtaine (2005).

## Appendix A

1. International Road Federation, from World Development Indicators Database, World Bank.
2. Data for 1990 was not available for Korea, and neither was information on sanitation access.

## Appendix B

1. The one Millennium Development Goal pertaining directly to infrastructure is to “halve by 2015 the proportion of people without sustainable access to safe drinking water and basic sanitation.”
2. Mexico uses the Wien automatic system planning package (WASP IV), a widely used model that analyzes generating system expansion options, primarily to determine the least costly expansion path that will adequately meet the demand for electric power, subject to user-defined constraints. Other similar models are SUPER/OLADE/BID and MPODE, which are used by Colombia and Ecuador, for example.
3. Since there are still some households to be connected that are relatively close to existing grids and could be connected at lower prices (say, \$500 or so), the price that determines a switch to alternative off-grid technologies could be somewhat above \$1,000. However, what is certain is that an average price of \$1,000 per connection would not allow universal connection to a grid.



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