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ABSTRACT

This study analyzes the main approaches to infrastructure financing in developing countries and their evolution. It places the discussion in the context of the importance of infrastructure investment and maintenance needs to achieve growth and broader social objectives. It summarizes the evidence on the efficiency, equity and fiscal consequences of the main public and private financing options commonly used to achieve these goals in these countries. It shows the limits of the role of the private sector as a source of financing of infrastructure and the wide underestimation of public-sector financing support needed to serve the poorest and ensure that services are offered at prices consistent with their ability to pay. It concludes with forward-looking lessons from roughly 20 years of efforts to diversify the sources of infrastructure finance in developing countries.

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Infrastructure finance in developing countries: An overview

1. Introduction

This study offers a policy-oriented overview of the main approaches to infrastructure finance in developing countries since the early 1990s. The main purpose of the analysis is to draw forward-looking lessons from roughly 20 years of efforts to diversify the sources of development infrastructure finance. To set the context, it discusses the importance of infrastructure needs to achieve growth and broader social objectives. It also summarizes the evidence on the evolution of the relative importance of private sources of financing in the sector as well as some of their economic consequences.

The decision to diversify the sources of infrastructure finance in developing countries, and in particular to open up the opportunities to private-sector financing, started to be common among governments and development agencies around the mid-1990s.¹ It was the delayed outcome of a very specific set of historical policy choices that had taken place 10-15 years earlier. Indeed, it was a late response to the cuts in public infrastructure spending that had resulted from efforts to cut fiscal deficits during the 1980s macroeconomic structural adjustment programmes.

Policy makers were slow to realize the consequences of the blind fiscal cuts. The infrastructure “collateral damage” of the efforts to address the deficit problems only started to be deemed undesirable in the early 1990s when policy makers realized that infrastructure bottlenecks were slowing economic growth. Moreover, investment in basic infrastructure was, by then, hardly catching up with population growth. Many governments were caught in a “catch-22” situation in which they knew they needed to spend more on infrastructure to promote growth and, hence, their tax base, yet they could not afford the fiscal costs of the much-needed increase. The short-term fiscal concerns prevailed and investments were not being made.

By the mid-1990s, closing the infrastructure gap started to become part of the political speeches again but it did so with a twist. The twist was that the public sector should not have the monopoly over infrastructure investment. In a continued context of fiscal discipline, but with a growing volume of liquidity available on international financial markets, the case for a potential role of the private sector was increasingly easy to make. In a nutshell, this is the sequence of events that explains the push for an increase in the relative importance of private financing in the sector that has now lasted for the last 15 years or so.

The debate on the realism of the expected take-over of private finance of the sector started then and it still continues to this day. The speeches announcing the stimulus packages prepared to pull the world out of the 2008-2009 crisis were quite revealing about entrenched political convictions. Many bet on the private sector to be a key player in the implementation of these packages.

The conviction that private financing is the way to go, is, however not unanimous and has not been so for a while now. In contrast to the continued political optimism, the public emotions towards the



Antonio Estache

¹ It is hard to forget that this is not the first time in history the private sector was expected to play a major role in infrastructure. During much of the 19th century, key infrastructure developments were actually privately financed. Interestingly enough, many of these original private infrastructure projects already required government subsidies and guarantees. For a brief longer-term historical perspective on infrastructure finance, see Eichengreen (1995).

Popular support for a bigger role of the private sector has given way to anger about an unfair distribution of the benefits from infrastructure reform.

role of the private sector have fluctuated in developing countries.² The initial popular support, from the mid-1990s to the early 2000s, for an increased role for the private sector, resulted from the deterioration of infrastructure quality that had prevailed under public management. It was also the outcome of the increasing rationing of access to services by the low-income classes, and increasingly the middle class as well, resulting from investment levels lagging behind population growth and social mobility.

The situation changed by the mid-2000s. The low and the middle classes started to be unhappy again. The perception – and in many instances the evidence as well – of an uneven distribution between users and investors of the gains from infrastructure reforms has progressively fuelled a rejection of a significant role for the private sector in many countries. The Bolivian and Venezuelan re-nationalization experiences are only the most obvious illustrations of this unhappiness. They are, however, symptomatic of a sustained malaise.

The emotional dimensions associated with the distribution of responsibilities between the public and the private sector in the financing of infrastructure need to be taken seriously – more seriously than some of the political speeches seem to care to do. But it is just as crucial to have a cold look at the facts as well. Almost 20 years after the launch of the Argentinean infrastructure reforms that kick-started the opening of a role for private large-scale financing of infrastructure in developing economies, there is enough evidence of the efficiency, equity and fiscal effects of adopting this policy option. This means that reasonably objective lessons on the most realistic financing and management options for the sector are possible from an economic, social and political viewpoint. This is what this article attempts to do.

The main challenge to the discussion of the forward-looking lessons from this evidence, however, comes from the timing of this stock-taking exercise. First, the world has not yet settled down following the financial crisis. Any current assessment is still subject to a lot of uncertainty, limiting some of its forward-looking value. We are all still learning from the multiple diagnostics of the remarkably brutal shock that hit the real and the financial economies of this world in 2008. Second, the analysis is also influenced by the fact that the brutality of the shock has shaken the confidence of economists in their ability to differentiate between faith and facts in their diagnostics. The timing thus defines a context forcing humility and a focus on trying to separate facts from ideology to ensure that the growth and poverty-reduction prospects of the infrastructure finance strategies are not damaged by wishful thinking and hopes. The mistakes of the past have been costly and these costs should be recognized as much as the potential benefits and risks of the policies aimed at increasing private finance in the sector.

The study adopts the following logic to cover all the dimensions that need to be addressed to get a sense of the purpose, the instruments and the implementation challenges of infrastructure development finance. Section 2 provides a brief summary of the relevance of infrastructure for growth and poverty-related dimensions of development. Section 3 discusses the current investment levels in infrastructure, their efficiency as well as estimates of the needs according to development levels of developing countries. Section 4 summarizes the evidence across regions of the extent to which the private sector has taken over the traditional public-sector role of financing infrastructure. Section 5 briefly reviews the wide range of instruments which have been designed to increase opportunities for private-sector involvement in infrastructure as well as the evidence available on how much they managed to deliver. Section 6 offers a more strategic discussion of the financing challenges of development in which the

² See Martimort and Straub (2009) for an analytical assessment of the sources of popular unhappiness with the effort to rely on private financing of infrastructure.

infrastructure challenge fits. Section 7 discusses emerging challenges facing infrastructure financing in developing countries. Section 8 offers some concluding comments.

2. Infrastructure needs for growth and social goals

Unless governments were dramatically wrong in the design of the 2007-2009 stimulus plans, increasing infrastructure investment is widely perceived as an important way of restoring short to medium-term growth. According to Freedman *et al.* (2009), the expenditure measures adopted by G20 countries include an average annual additional allocation of fiscal resources of 0.40 percent of GDP to infrastructure, to be disbursed in 2009 and 2010, and longer in some countries. Khatiwada (2009) estimates that the share of the stimulus packages allocated to infrastructure was, on average, three times higher in developing and emerging economies than in developed economies, quite consistent with the idea that infrastructure needs are actually much stronger in the poorer countries. In these countries, even more so than in developed countries, the bet on infrastructure was also a bet on job creation, as suggested by the ILO (2009).

The poorer the country, the more infrastructure matters for health, education and economic growth.

But for developing countries, infrastructure investment is a much longer-term concern than a bet on recovery from a crisis. It is indeed common knowledge that developing countries lack access to electricity, water, telecommunication facilities as well as common transport infrastructures such as roads and ports. Better health and education outcomes are the usual policy goals when addressing infrastructure coverage gaps. But tackling these gaps is also associated with the potential role of infrastructure as an engine of long-term economic growth. Indeed, there is a lot of evidence on the opportunity cost of infrastructure investment gaps in terms of growth and productivity. A few surveys have recently summarized the very large literature on the importance of infrastructure for growth.³ The relevant point of that research is that the poorer the country, the more infrastructure matters!

Before discussing the specific estimates of infrastructure investment needs in developing countries, it may be useful to provide a more intuitive sense of the coverage gaps through a summary of the state of access to infrastructure around the world. The sheer number of people lacking access is more impressive than the cold dollar figures revealing the high costs of the coverage gaps.

2.1 Electricity coverage gaps

According to the International Energy Agency (IEA), about 1.5 billion people lived without electricity in 2008; almost all of them in developing countries. That's about 22 percent of the world population. The information on access rates per region is summarized in Table 1.

It shows that only 58.4 percent of the people living in rural developing areas have access to electricity. The most extreme situation is in Sub-Saharan Africa where about 88 percent of the rural population live without electricity but also 42.5 percent of the urban population. This means that roughly 3 out of 4 people in Sub-Saharan Africa do not have access to electricity. There is nothing romantic about not having access to electricity day after day. About 3 billion people, half of the world's population, have to rely on traditional and harmful biomass for cooking and heating. The smoke from the biomass is associated with pulmonary diseases causing, annually, the death of 1.5 million people, mostly women and children.

³ Straub (2008), for instance, provides a recent lengthy overview of the literature. More recently, Estache and Garsous (2010) conducted a meta-analysis synthesizing analytically the large literature on the elasticity of growth to infrastructure stocks, finding it to vary from 0.15 to 0.35 depending on the model specification.

Lack of access to modern electricity sources is also commonly stated as an impediment to investment in the 'Doing Business' reports of the World Bank.

Table 1. Electricity access rates in 2008

	Population without electricity (millions)	Electrification rate (percent)	Urban electrification rate (percent)	Rural electrification rate (percent)
East Asia	195	90.2	96.2	85.5
Latin America	34.1	92.7	98.7	70.2
Middle East	21	89.1	98.5	70.6
North Africa	2	98.9	99.6	98.2
South Asia	614	60.2	88.4	48.4
Sub-Saharan Africa	587	28.5	57.5	11.9
Developing countries	1,453	72.0	90.0	58.4
Transition economies and OECD	3	99.8	100.0	99.5
World	1,456	78.2	93.4	63.2

Source: IEA (2009)

2.2 Water and sanitation coverage gaps

Close to a billion people lack access to safe drinking water, and almost three times as many have no decent sanitation facilities.

The situation in the water sector is just as bad for the poorest. The figures reported in the World Bank Development Indicators (World Bank 2009a) suggest that in 2007, about 925 million people lacked access to safe drinking water. Almost three times as many lacked access to improved sanitation facilities. The World Health Organization argues that the investment gap in the sector contributes to explain the deaths of 1.4 million children every year from diarrhoea caused by unclean water and poor sanitation (Prüss Üstün *et al.* 2008). The Millennium Development Goals (MDGs) call for halving, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation. The effort needed is, however, distributed quite disproportionately in the developing world. Table 2 shows the geographical distribution of the investment needs. Sub-Saharan Africa is the region with the largest water gap. Moreover, unless investment allowing sound water delivery and management speeds up, the problem is likely to get worse as supplies of freshwater are dropping as a consequence of climate change and over-consumption.

Table 2. Water and sanitation access rates in 2007 (percent of population)

	Access to improved water source	Access to improved sanitation facilities
East Asia	87	66
Eastern Europe and Central Asia	95	89
Latin and Central America	91	78
Middle East and North Africa	89	77
South Asia	87	33
Sub-Saharan Africa	58	31
World	86	60

Source: World Bank (2009a)

2.3 Telecommunication coverage gaps

While energy and water needs are easily connected to health concerns, the investment needs in the telecommunication sector are more commonly linked to knowledge, education and business opportunities. The latest evidence suggests that telecommunications coverage gaps are still very wide as well. The 2010 International Telecommunications Union report on the measurement of the information society provides useful insights into the investment needs in the sector (ITU 2010). First, it shows that the digital divide is slowly closing. In developing countries, average mobile penetration has reached 57 percent in 2009 more than twice what it was in 2005. Two thirds of the world's cell phone subscriptions are in developing countries – just a little bit less than their share of the world's population – with the highest rate in Africa where 25 percent of the population now has a mobile. However, in contrast to progress in access to basic phone services, the evidence on the access to the main new information and communication technology (ICT) instruments needed to close the educational and knowledge gaps around the world is much less positive. Indeed, the number of Internet users per 100 inhabitants in developing countries was the same in 2008 as it was in Sweden, the world's top performer on ICT, at the end of the 1990s.

While mobile penetration is rising fast, access to the Internet and new information and communication technologies still lags behind.

2.4 Transport coverage gaps

On transport, it is common to read that one billion people have no easy access to all-weather roads but there is a lot more discussion of its repercussions for business. There is indeed quite robust evidence of the importance of transport for trade and growth. In a study of transport costs and trade, Limao and Venables (2000) find that poor transport networks account for 60 percent of transport costs for landlocked countries and only 40 percent for coastal countries since they can rely on the sea to move freight and people. This original research has since been validated by numerous other papers. For instance, Buys *et al.* (2006), find that an investment of USD 20 billion and an annual maintenance expense of USD 1 billion, to conduct a continental network upgrading in Sub-Saharan Africa, would expand overland trade by about USD 250 billion over 15 years.

While these studies show that transport investment matters for growth, they do not lend themselves to easy estimates of relatively precise macroeconomic assessments of investment needs as can be done for access gaps in energy, water or telecoms. The concept of access is more complex for transport. One possible approximation to give a more intuitive sense of this gap – and hence of the investment needs – is to compare the differences across regions in terms of freight mobility. Table 3 summarizes the information reported by the International Road Federation on the relative shares of freight of the various regions of the world.

Table 3. Share of regions in total freight transported in 2007 (percent of total), by transport mode

	Road	Rail	Waterways
East Asia	25	30	62
Europe (East and West)	38	34	11
Latin America	4	<1	<1
Middle East and North Africa	<1	<1	<1
North America	28	35	26
South Asia	2	<1	<1
Sub-Saharan Africa	4	<1	<1
Total	100	100	100

Source: International Road Federation (2009)

Note: Freight transported is measured in million of ton-kms for each mode.

These data show that the distribution of the shares of world freight is extremely skewed in favour of some regions, the most developed. This is the case for each mode. The data also show that the freight movement in South Asia and Sub-Saharan Africa, the poorest regions of the world, is abnormally low. Table 3 finally reveals, somewhat surprisingly, the very low mobility of freight in the Middle East and Latin America.

2.5 Regional dimensions of the coverage gaps

As network externalities extend across borders, many electricity, telecom and transport projects require international coordination.

The discussion of infrastructure gaps so far gives a good first-order approximation of what the priorities need to be in each region and potentially in each country, since the identification of gaps is actually done at the country level. However, the approach hides one of the major dimensions for the sub-sectors characterized by potentially significant network externalities. There are indeed many instances in which investment in electricity, telecoms and transport in one country need to be coordinated with similar investment in other countries.

This is why regional infrastructure projects are central to the regional economic integration of almost all developing regions in the world. In Central America, in all parts of Africa and in some parts of East Asia, major regional power pools are essential to be able to meet the country-specific needs at the lowest possible unit cost for each individual country. Similarly, many of the potential benefits of roads and rail projects can only materialize if the investments are made in projects that allow landlocked countries to become better integrated with other countries. Some of the main growth payoffs to investment in telecommunications will come from large scale multi-country investments in the backbones needed to close the digital divide in Africa. The cost of these telecommunication investment needs tends to dwarf the cost of the purely local investment needs.

This discussion of the needs explains why the African Development Bank, the Asian Development Bank and the Inter-American Development Bank, the three major regional development banks, have all recently introduced major programs to support supranational transport investment programs. These decisions were based on the conviction that there is an opportunity cost in terms of trade and growth associated with the insufficient coverage of transport networks in the poorest regions. The share of supranational projects in the portfolio of these institutions is very likely to increase significantly in the near future.

2.6 The information gaps on infrastructure

The discussion so far has been possible because in recent years, the international community has put in place useful and objective monitoring systems for the basic access rates in the key infrastructure sub-sectors – although it has not addressed the service quality issue yet. The coverage of the monitoring system is not exhaustive. In particular, it does not really have an equivalent standard objective indicator for transport access. But the international community has also developed interesting indicators on the subjective importance of various infrastructure sub-sectors in terms of their importance for the investment climate. These include the “Doing Business” indicators of the World Bank and the sectoral indicators of the World Economic Forum used in its competitiveness report.

The information challenge is overall still very important. The international community has probably not learned as much as it should have. Consider the most politically sensitive sector: water and sanitation. It has been in the limelight for over 20 years, with the Water Decade and its inclusion in the MDGs. Yet, the measures of access continue to be rough approximations based on imperfect household consumption and expenditure surveys. These surveys offer some coverage of energy and transport but it is not systematic. For energy, the global access figures are based on extrapolations – conducted by the International Energy Agency on behalf of the international community – for each region based on

evidence for a sample of countries in each region. The telecoms sector is probably the best informed, simply because the technology lends itself to cheaper monitoring. As mentioned earlier, the transport sector lags well behind on the monitoring and information front, even if efforts to address the issue are on the agenda of the international community.

3. Costing the regional and sectoral infrastructure investment needs

This section summarizes a relatively large literature generally not found in academic publications but widely quoted and used among development agencies interested in getting a sense of the resource allocation needs of the infrastructure sector. The discussion starts with an overview of estimations of current investment levels in the sector. It continues with a discussion of the efficiency of the expenditures and concludes with a summary of the estimates of the investment, and operation and maintenance expenditure needs of the sector.

3.1 Assessing the current levels of investment

Before discussing the main sources of financing and their relative importance, it may be useful to get a sense of the total level of investment currently observed in developing countries. As for most efforts to generate estimates in this sector, this turns out to be quite a challenge. Neither the national accounts nor the IMF Government Finance Statistics (GFS) report a disaggregation of total and public investment data detailed enough to allow identifying every infrastructure sub-sector. In national accounts, energy data cover both electricity and gas but also all primary-energy related products such as petroleum. Similarly, the data do not really distinguish between transport and communication. Water expenditures can be hidden in public works or even in health expenditures.

The most common approach is to derive a sense of the actual investments from estimates of physical stocks and, if possible, to correct for the quality of these stocks. There are too many internal notes in international development agencies reporting these somewhat heroic estimates to be able to summarize them here. But they all start with physical data and approximations of the monetary value of those data obtained from an estimate of unit costs or some approximation derived from a growth requirement function along the lines followed by Yepes (2008) or OECD (2006 and 2007).

To discuss the current levels of investment in developing countries in a consistent way across regions, we rely again on the rough estimates of current average expenditure levels in the sector generated by Yepes (2008). A problem with his paper relevant here is that it does not distinguish clearly between the investment and the operational and maintenance components. Yepes (2008) simply suggests that the investment component of these expenditures is roughly 40 percent. This means that based on his valuation of the current physical stocks of capital, the actual investment levels, as shares of GDP, are 5 percent, 3.3 percent and roughly 1 percent, respectively, in low-income, lower middle-income and upper middle-income countries. Back in 1994, the World Development Report, which focused on infrastructure, estimated an average investment level of around 4 percent of GDP for the developing world (World Bank 1994). These two global approximations are thus comparable. Based on these orders of magnitude, it seems reasonable to assume that the average investment in infrastructure in the developing world is somewhere between 3 and 4.5 percent of GDP.

Infrastructure investment in the developing world is between 3 and 4.5 percent of GDP.

These estimates are also quite consistent with the more detailed estimates generated within regions. In Latin America, for instance, public investment in infrastructure was estimated to be just under 1 percent of GDP until the early 1990s (Calderon and Servén 2004). With the liberalization, the private sector invested nearly 1.1 percent of GDP in infrastructure during the 1990s, but in many countries it

crowded out public investment, reducing public investment further (Fay and Morrison 2007). The match with the Asia-specific estimates is not as strong as Asia counts important outliers in terms of public infrastructure investment such as China and Vietnam. In that region, the fast-growing middle-income countries (China, Malaysia, Thailand), have somewhat surprising investment-to-GDP levels that are higher still than the expectedly high averages of the lowest-income countries of the world. In China, for instance, investment in infrastructure averaged 6.7 percent of GDP in the 1990s and 9 percent in the period 1998-2002 (Naughton 2004). This level has been sustained ever since. For Sub-Saharan Africa, Foster and Briceno (2009) estimate investment at 6.1 percent of GDP for low-income non-fragile states.

3.2 Improving efficiency to cut the needs

There is a wide margin for efficiency gains in infrastructure service delivery, varying across regions and sub-sectors.

An important debate in the infrastructure literature is to assess the extent to which infrastructure services are delivered efficiently. Many regulatory regimes now used in infrastructure ensure that there is an explicit incentive for operators to improve efficiency and for regulators to monitor this efficiency. Measuring efficiency of regulated industries has in fact become an important consulting business. The concern for efficiency in regulated infrastructure in both developed and developing countries has also led to a large volume of academic research because the topic raises many interesting methodological issues. Estache *et al.* (2006) provide an overview of academic research on the margin for efficiency gains in developing countries in the various infrastructure sub-sectors. They show that the average potential gains tend to be quite high whilst varying significantly across sub-sectors and across regions. Offering a single sector-specific figure does not really make sense. The efficiency gains are case specific and the homework needs to be done to get a reliable answer.

The real support for efforts to assess efficiency often comes from the fiscal side when the public sector is expected to pick up the financing of infrastructure. Foster and Briceno (2009) suggest that in Sub-Saharan Africa, costs to be recovered and subsidized could actually be cut, on average, by an extra 8 percent by improving efficiency and reducing corruption in the sector. This is equivalent to 1.2 percent of GDP. In other terms, subsidies to the financing of the sector could be cut significantly if the sector were better managed, less subject to corruption, and if its users were charged for the cost of getting the services they are getting.

The Sub-Saharan Africa figures are significant. More importantly, they provide a benchmark for gains that need to be achieved by improving the management of policy, regulation and operations of the sector, as discussed later.

3.3 Costing the needs

The discussion of the gaps in the various sectors hints at major expenses to cover the investment needed to close these gaps. The assessment of the costs of the associated investment needs has become a bit of an industry in the last 10 years. Almost every regional development agency has generated its own set of estimates based on country level estimates. These are often based on bottom-up approaches building on project cost estimates conducted by engineers. This is useful at the country level, but it often causes cross-country comparability concerns, which are difficult to address when conducting broad-brushed assessments of investment needs.

To obtain a relatively robust, if rough, cross-regional comparison of the expenditure requirements to cover both investment and associated annual operation and maintenance (O&M) costs, the easiest approach is to rely on a top-down approach. This is what Yepes (2008) has done, updating and expanding an older study (Fay and Yepes 2003). The general total expenditure need levels (investment plus O&M)

are driven by expected demand growth paths and global goals such as the MDGs for basic services. The resulting estimates are reported in Table 4.

Table 4. Annual infrastructure expenditure needs, 2008–15 (at 2005 prices)

	Transport	Telecoms	Electricity	Water & Sanitation	Total
	Percent of GDP				
Region					
East Asia and the Pacific	1.7	0.4	3.2	0.5	5.9
Eastern Europe and Central Asia	3.1	0.5	2.5	0.3	6.5
Latin and Central America	1.5	0.6	2.0	0.4	4.4
Middle East and North Africa	3.0	0.9	4.5	0.8	9.2
South Asia	4.0	1.3	4.3	1.7	11.3
Sub-Saharan Africa	3.0	1.1	2.8	2.0	8.9
Expenditure type					
Operation and Maintenance	1.8	0.4	1.5	0.3	4.1
Investment	0.5	0.4	1.5	0.3	2.7
Total	2.3	0.6	3.0	0.7	6.6
	Annual amount (USD billion)				
Region					
EAP	121.5	29.0	226.1	33.3	409.9
EECA	88.7	15.3	72.0	7.3	183.3
LCA	50.6	20.5	66.9	11.9	149.9
MENA	25.2	8.1	38.4	6.9	78.5
SA	73.4	23.5	79.3	31.2	207.4
SSA	28.9	10.1	26.4	19.1	84.5
Expenditure type					
Operation and Maintenance	309.6	57.9	248.9	55.8	672.2
Investment	78.8	48.6	260.2	53.9	441.5
Total	388.3	106.5	509.1	109.7	1,113.6
Share of Total (percent)	34.9	9.6	45.7	9.8	100

Source: Yepes (2008)

Yepes finds that the developing world will require total annual expenditures of about USD 1.1 trillion (6.6 percent of the developing world GDP) through 2015 to satisfy consumer and producer demand for infrastructure services, assuming current GDP growth and demographic trends. As mentioned above, about 40 percent of this amount is assumed to be required for capital expansion of infrastructure (*i.e.* investment) and 60 percent for maintenance of both current and future infrastructure. These estimates include improvements in the level of some current services, particularly in transport. As expected, Table 4 shows an important diversity of needs across regions.

The highest needs as a share of GDP are in low-income countries with 12.5 percent of GDP. For lower middle-income and upper middle-income countries, these needs are respectively 8.2 percent and

The developing world will need total annual infrastructure expenditure of 6.6 percent of GDP through 2015.

2.3 percent of GDP. Electricity and transport represent the highest burden with a share of the total needs of 46 percent for electricity and 35 percent for transport. The average share for water and sanitation is about 10 percent, but it is close to 18 percent for the low-income countries – about 2.2 percent of their average GDP.

These figures may appear to be very high. Yet they probably still underestimate the real needs. The recent diagnostic conducted for Sub-Saharan Africa on behalf of all major donor agencies from a bottom-up approach suggests that the comparable total annual expenditure needs are USD 90 billion, about 7 percent more than what Yepes finds.⁴

What do the figures mean in terms of affordability for the poor population in each region, the main focus of development assistance? This concerns the population earning less than USD 1.25 per day for those in extreme poverty and less than USD 2 per day for those in poverty. In absolute figures, most of the people concerned live in Sub-Saharan Africa and South Asia.

Full cost recovery would require the average citizen of South Asia and Sub-Saharan Africa to spend an impossible 25-35 percent of income on infrastructure services.

To get a sense of the affordability, a very rough approximation consists of dividing the estimated expenditure needs for each region by the corresponding population. The result is summarized in Table 5, which gives the average *per-capita* daily cost recovery effort associated with the expenditure needs estimated by Yepes. Clearly, the cost recovery efforts are the harshest in the poorest regions in which the infrastructure access gaps are also the largest. More specifically, this rough approximation suggests that in Sub-Saharan Africa and South Asia, any attempt at obtaining full cost recovery would demand the average citizen of these regions to spend 25 to 35 percent of their income to pay their share of total infrastructure costs. This is unlikely to happen. It is not only politically unrealistic, it would also raise ethical issues, which are commonly mentioned to justify subsidies to help the poorest cover their share of the infrastructure costs. A common rule of thumb among practitioners is that the poor should not have to spend more than 15 percent of their income on infrastructure. The rest needs to be subsidized.

Table 5. Amounts needed to recover the new infrastructure expenditure needs (in USD per day and per person)

	Transport	Telecoms	Electricity	W&S and WW	Total
East Asia and the Pacific	0.17	0.04	0.32	0.05	0.59
Eastern Europe and Central Asia	0.54	0.09	0.44	0.04	1.13
Latin and Central America	0.25	0.10	0.33	0.06	0.73
Middle East and North Africa	0.23	0.07	0.34	0.06	0.69
South Asia	0.13	0.04	0.14	0.06	0.37
Sub-Saharan Africa	0.10	0.03	0.09	0.07	0.29

Source: Author's calculations based on Yepes (2008) and the population figures reported in World Bank (2009a)
 Note: W&S: Water and sanitation; WW: Waste water.

It is important to recognize that Table 5 is only illustrating the problem. For most sectors, the actual tariffs are more complex and often more costly than the above average suggests. Consider, for instance, the case of telecoms. Despite a significant drop in costs in recent years, ICT services, especially fixed

⁴ Based on the estimates reported in Foster and Briceno (2009) but adjusted to exclude sectors not covered by Yepes such as irrigation and supranational projects.

broadband access, remain out of reach for most people in developing countries. In 2009, the ITU standardized ICT price basket represented on average of 17.5 percent of average income *per capita* in developing countries. It averaged only 1.5 percent in developed countries. The technology access gap is even more obvious in internet access pricing. An entry-level broadband connection costs, on average, as much as 167 percent of income *per capita* in developing countries, compared to only 2 percent in developed countries. A high-speed Internet connection represents 500 percent of average monthly *per-capita* income in Africa, 71 percent in the Arab world and 46 percent in Asia and the Pacific Region. It represents 10 percent of income in the US and 2 percent in Europe.

In sum, this discussion has summarized two of the main lessons learned by the international community in recent years. The first is the financial importance of the sector. We now have a much better collective sense of how costly infrastructure investment needs really are in the poorest countries. It is however essential to keep in mind that since the investment needs estimates are based on a derived demand analysis, growth targets are unlikely to be met if the investments are not made. This also means that poverty reduction targets will not be met either since these targets are based on the same growth estimates. The second is the recognition that the optimal financing approach cannot be made independently of a sound analysis of the majority of the population's ability to pay. When cost recovery represents too high a share of a consumer's income, the odds of non-payment for a service increase a lot. The commercial risk associated with an investment decision thus also increases very significantly. When this risk becomes too high, the odds of convincing a private operator to take the lead are low, unless explicit commitments are made to subsidize the investment and sometimes consumption as well, and/or to provide guarantees that cut the risk levels. The menu of realistic financing options for Mali cannot be the same as the menu for England or Australia. This is what explains the relatively low levels of private-sector participation in Africa's and South Asia's infrastructure as will be further discussed in the next section.

The optimal financing approach cannot be made independently of an analysis of the population's ability to pay.

4. Public versus private-sector financing

While the approximations discussed in the previous section may be rough, they are robust to illustrate the large gap between current investment levels and needs across regions. The main purpose of this section is to summarize what we know about the past sources of financing the sector and the lessons that can be drawn for the future distribution of the financing between the various sources.

The simplest classification of these sources would distinguish between public financing and private financing. It is, however, interesting to try isolating the importance of Official Development Aid (ODA) for the sector since infrastructure has been, and continues to be, a major business for development agencies.

The approach followed here is to identify the relative share of the various key players, starting from the information available on commitment figures both for ODA and for private participation in infrastructure (PPI). The public-sector share is then the residual. Actual disbursement flows are not measured by any international organization. For ODA, the commitment data reported on the OECD web site (<http://stats.oecd.org/Index.aspx?DatasetCode=CRSNEW>) tend to underestimate multilateral committed flows as well as actual flows because not all multilateral sources are collected. For PPI, the information reported on the web site of the unit of the World Bank collecting the data (<http://ppi.worldbank.org/>) tends to overestimate commitments since it is not uncommon for projects to be cancelled. The World Bank website itself suggests that, on average, about 8 percent of the projects were cancelled between 1990 and 2008.

Private-sector commitments represented between 19 and 25 percent of the total in 2006 and 2007, Official Development Aid between 3 and 4.5 percent.

Looking at 2006 and 2007, which were the top years in terms of PPI since the 1997 East Asia crisis, the private-sector commitments represented roughly between 25 and 19 percent of the total, depending on whether total investment was closer to 3 percent or to 4.5 percent. Following a similar back-of-the-envelope calculation, ODA would have represented between 4.5 and 3 percent of the total infrastructure investment estimated for that period. This adds up to at most 30 percent and at least 22 percent, implying that the financing share of the public sector ranged from 70 to 78 percent of the total. These estimates imply that the private sector has financed the equivalent of, at most, 1 percent of GDP in infrastructure investment. Similarly, it means that ODA has financed at most 0.2 percent of GDP.

These figures are similar to those estimated for the 1990s by the 2005 Global Monitoring Report (World Bank 2005), except for the fact that the share of ODA estimated then was about the double of the estimates reported here, with the difference absorbed by public financing. They were also recently repeated in the 2009 Global Monitoring Report (World Bank 2009b). The latter argued that in the 2000-05 period, public funding of infrastructure was at around 70 percent, while private investment was around 22 percent and ODA at 8 percent. It adds that in International Development Association (IDA)-eligible countries, only 10 percent of infrastructure was funded from the private sector in 2007, and the number is likely to fall in the immediate future in light of the financial crisis. The recent study on Africa edited by Foster and Briceno (2009) shows that Sub-Saharan Africa fits roughly that mould. However, the share of the private sector in financing infrastructure drops from 22 to 10 percent once ICT is ignored, suggesting the limited commercial interest of the "life-and-death" businesses such as water and electricity distribution or secondary, yet essential, road networks in developing countries.

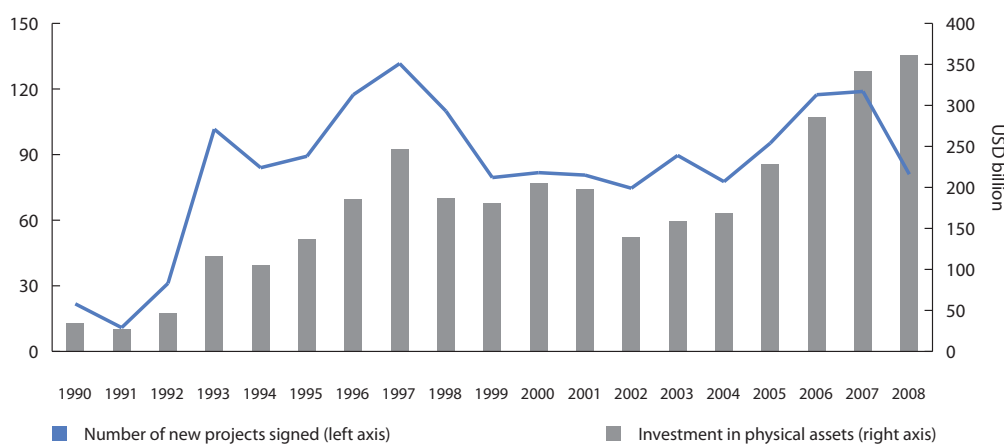
There is not much detail in the ODA data. The most interesting one may be that roughly two thirds of the support given to infrastructure investment in developing countries corresponds to multilateral aid and one third to bilateral aid. The distribution across sectors was also relatively stable. The transport sector tends to get just over a third, the electricity sector just below a third, water and sanitation just above a quarter and telecoms around 2 percent of the total.

It may be important to point out that new players are becoming increasingly important in some regions. These are not strictly speaking official development agencies but it is often financial support organized by foreign governments just like ODA. There is a lot of talk about the growing role of China, India and the Arab funds in Africa for instance. These sources of funding are becoming quite important. As for so many other dimensions of this sector, precise measures do not exist. The order of magnitude of the importance of these non-traditional sources of funding turns around 10 percent of total ODA but they are growing fast. Many projects which were in the pipeline of international agencies are now funded from these sources. Their main advantages seem to result from their much simpler procurement processes and finance packaging.

The growing presence of these alternative sources of financing is also likely to change the nature of, and the opportunities for, private-sector involvement. It may thus also be useful to get a sense of the current characteristics of the private investment in infrastructure. The information on PPI commitments collected by the World Bank provides the best approximation available although actual disbursements by all private operators are not monitored. It focuses on large contracts involving private counterparts. The dataset generated by the World Bank has become a standard reference in the field even if we do not really know by how much commitments are overshooting actuals. Despite the limitations, the data can be used to assess the evolution of the number of contracts with private operators and their amounts since 1990 across regions, sectors and contract types.

Since the hope is that private financing continues to make it to the top of the political agenda of many countries, the discussion starts with the evolution of the size of large-scale private investment in infrastructure. Figure 1 shows that the case for such hope is not as strong as some argue. Prospects were indeed good from the early 1990s to the 1997 East Asia crisis, when the volume of private commitments to physical infrastructure assets followed a clear upward trend, with acceleration as of 1995. However, the East Asia crisis resulted in a fast drop. As PPI was recovering over a three-year period, the Argentina crisis hit in 2001-2002 and this resulted in a new drop. It took again about three years to notice a recovery and it is only in 2006 that PPI reached levels comparable to those of the earlier 1997 peak. After 2007, the crisis explains the drop in new project commitments and the stagnation informally observed since. The full impact of the crisis will only be seen in 2011, since the infrastructure project cycle is such that it can take up to two years for a project to reach a preparation stage that lands it in these statistics.

Figure 1. Investment commitments to infrastructure projects with private participation in developing countries, 1990–2008



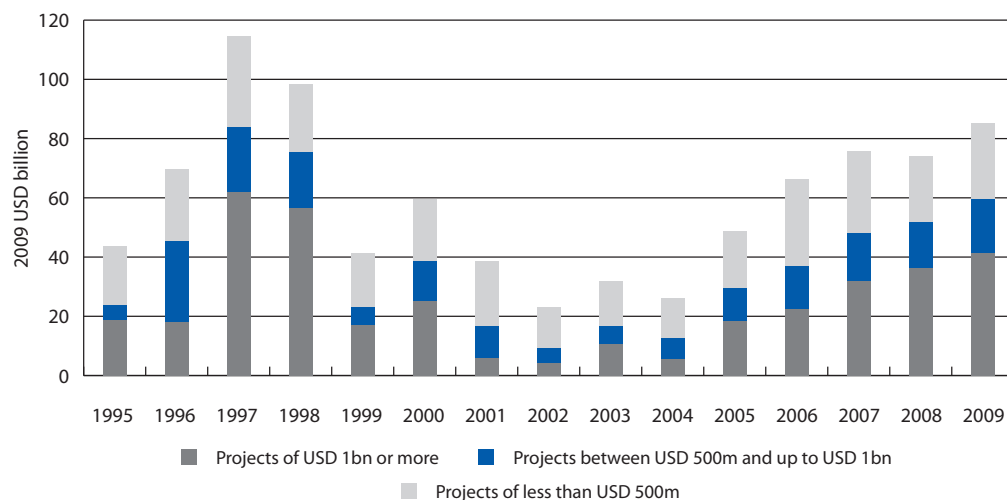
Source: World Bank and PPIAF, PPI Project and impact of the crisis on PPI databases

Figure 2 shows two interesting characteristics of PPI in developing countries. First, investment commitments tend to fluctuate quite a lot and tend to be pro-cyclical. This is bad news for governments in times of crisis since it means that their share has to increase when their own ability to pay is lower due to slowing tax revenue. Second, it shows that the volume of large projects varies more than the volume of small projects. This suggests that most of the adjustment in commitments is done through delays in medium-sized and large projects. This is somewhat surprising and may be the consequence of a bias in the World Bank data set which does not pick up many of the small local projects without foreign investment. One would indeed expect that the lower costs associated with the preparation of small projects would make the latter easier to postpone.

Private investment commitments are pro-cyclical, and the volume of large projects varies more than the volume of small projects.

Figure 3 tracks the recent evolution of the types of contracts under which PPI is taking place. For the last 10 years, the dominating form of PPI has been Greenfield projects. Concession contracts, once very popular, in particular in Latin America and Sub-Saharan Africa, have become a much smaller component of the business. The prevalence of large-scale contracts has, however, increased in the two types of PPI. Infrastructure divestitures have only been a major PPI arrangement in telecoms, energy generation and ports. They have clearly been an important instrument in Eastern Europe during the various privatization waves, including the last one for accession countries between 2003 and 2008.

Figure 2. Investment commitments to PPI projects reaching closure in developing countries by project size, 1995–2009



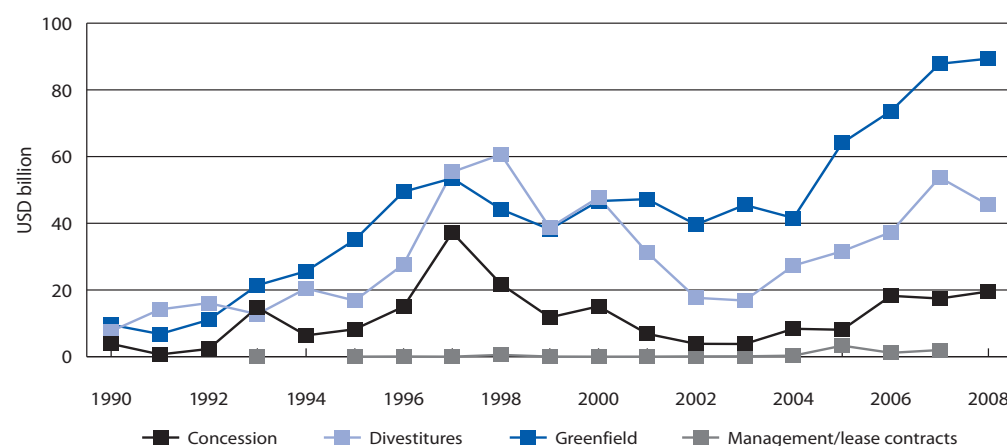
Source: World Bank and PPIAF, PPI Project and impact of the crisis on PPI databases

Note: 2009 USD are obtained by adjusting pre-2009 projects with the US Consumer Price Index.

Private commitments increasingly target the large economies within recipient regions.

Historically, Latin America and East Asia were by far the major beneficiaries of PPI. For quite a while they benefited from 70 to 80 percent of the commitments. Two changes in the directions of PPI flows have been observed in the last 5 years. First, Eastern Europe is becoming an important beneficiary with 23 percent of the total since 2000. South Asia, dominated by India, has attracted about 17 percent in the same period. But the most important change may be the huge increase in the selectivity of investment. Brazil, China, India, Russia and Turkey are now the main beneficiaries of a large share of these investments.

Figure 3. Investment commitments to PPI projects in developing countries by type of contracts, 1990-2008

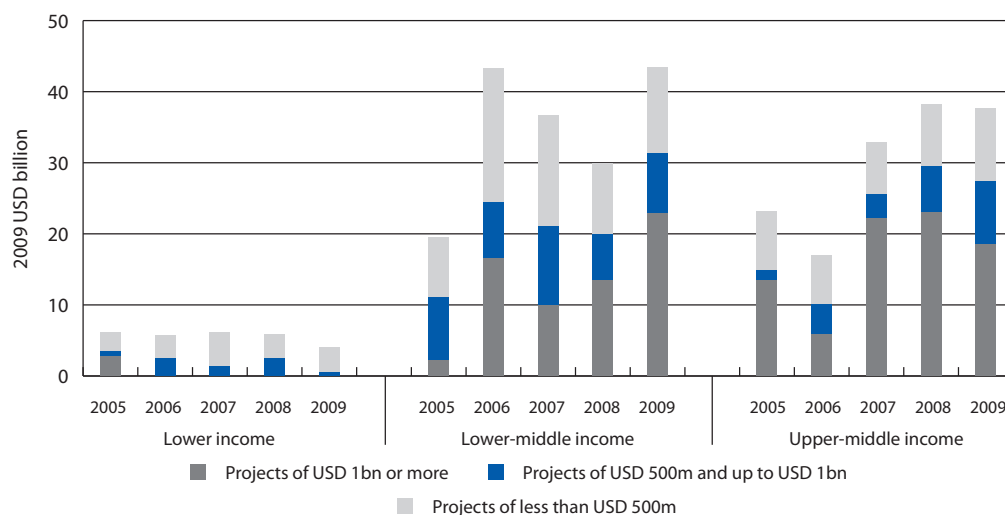


Source: World Bank and PPIAF, PPI Project and impact of the crisis on PPI databases

Figure 4 provides a complementary look at the data on the beneficiaries of PPI by differentiating the evolution of PPI commitments according to the *per-capita* income of beneficiary countries. If the BRICs – the country group comprising Brazil, Russia, India and China – have become the major beneficiaries of the flows of private investments to infrastructure, Figure 4 shows the extent to which

the poorest countries are the main losers. They get few projects and low volumes of investment. In Africa, for instance, over 75 percent of the flows go to South Africa. The rest is concentrated in less than 25 percent of the countries of the region.

Figure 4. Investment commitments to PPI projects reaching closure in developing countries, by country income group and project size, 2005–2009

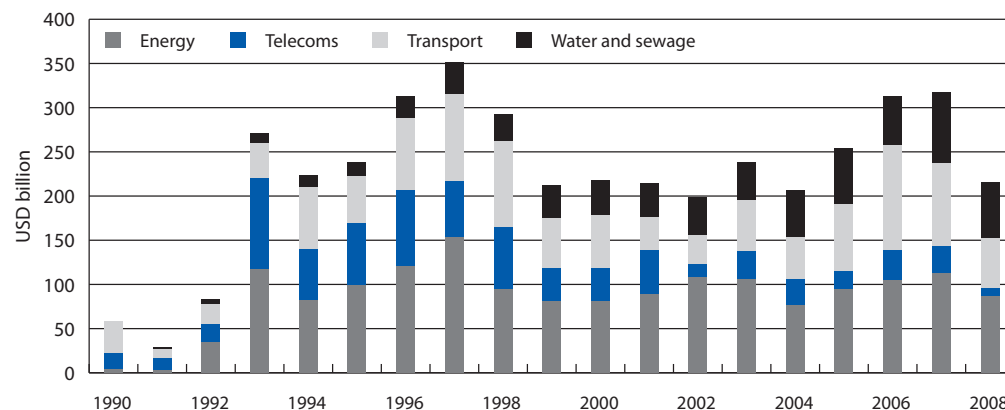


Source: World Bank and PPIAF, PPI Project and impact of the crisis on PPI databases
 Note: 2009 USD are obtained by adjusting pre-2009 projects with the US Consumer Price Index.

Figure 5 provides a snapshot of the sectoral distribution of PPI. In a nutshell, the energy sector has enjoyed the strongest volume of commitments in developing countries. Until the late 1990s, telecoms tended to be another important beneficiary of PPI. Yet, most of the big profitable transactions are now a thing of the past. Big business in backbones often requires multi-country regulatory commitments and hence, represents harder-to-deal-with risk levels. The transport sector has replaced telecoms as the second-most important beneficiary of private infrastructure investment. The water sector has not been as successful as expected at attracting private-sector investment in recent years because of a series of difficult contracts that cooled the enthusiasm. This may be because water is the most politically sensitive sector and trying to recover costs in that context tends to be hard. Management contracts are likely to dominate in this sector, simply because they reduce the exposure of investors. The main drawback is that the investment in the sector will have to be financed with public money.

The energy sector has attracted the largest share of private commitments whereas the transport sector has replaced telecoms as the second-largest recipient.

Figure 5. PPI commitments per sector, 1990–2008



Source: World Bank and PPIAF, PPI Project and impact of the crisis on PPI databases

Overall, this section concludes with a mixed bag. There has been an obvious effort of the international community to monitor the financing sources of the sector. The best evidence is for the monitoring of private financing of infrastructure, which, as mentioned earlier, only covers commitments, not actual expenditures. As a rule, the more basic the need, the more public financing is likely to be needed.

5. Instruments to finance infrastructure

There are three main dimensions relevant to the discussion of instruments to finance infrastructure. The instruments to recover costs *per se* define the first dimension. The second dimension is defined by the financial instruments available to operators to operate and make the necessary investments. The third dimension is made of the institutions from which these financial instruments are available.

5.1 Financing through cost recovery

In any country, costs are recovered from two main sources: user charges and subsidies. The richer the country, the more likely it is to be able to recover costs from users. The poorer the country, the more likely a large number of users will have to benefit from subsidies. Table 6 gives a snapshot, around 2004, of the distribution of countries around the world in terms of the ability of utility operators to recover their costs through user charges. It is useful to distinguish between cost recovery of operational and maintenance costs/expenditures (OPEX) on the one hand and that of capital costs/expenditures (CAPEX) on the other. The table also shows that costs vary across regions.

The fact that costs are higher in higher-income countries as compared with lower-income countries is not a surprise. What may be more surprising is that the intra-regional variance of these average costs (not shown in the table) is quite high, in particular in Sub-Saharan Africa. The information reported in Foster and Briceno (2009) for this region suggests that these differences can be attributed to differences in technology. In energy, for instance, the relative importance of hydro sources is likely to be a major determinant of differences across regions. For the water sector, differences in the scale of operation and associated technologies and in labour cost are likely to play a role in explaining cross-regional differences. But some of the differences can also be attributed to inefficiency or high implicit profit margins which are passed on to tariffs without much transparency.

In the water and electricity sectors, cost recovery is a problem at all levels of development and in all regions.

The main interest of Table 6 in the context of this study is to show that the cost recovery problem is common for the two main utility types (water & sanitation and electricity) at all levels of development and in all regions. In electricity, roughly a third of the developing countries in the two lowest *per-capita* income groups do not attempt any cost recovery at all. These countries are spread over all regions of the world. For the water sector, the situation is even more extreme. No country in the South Asia and Sub-Saharan Africa samples attempts any cost recovery of its capital expenditures. Around the world, just over 10 percent of the poorest countries show an effort to recover at least some of the costs.

This raises two questions. The first is about the cost to the alternative source of financing, *i.e.* taxpayers. The second is about the motivation for the low levels of cost recovery in these sectors. This is dealt with in the next sub-section.

The available data (Foster and Yepes 2006) do not allow an estimate of the degree of cost recovery in each region. Foster and Briceno (2009) suggest that in Sub-Saharan Africa, on average, the electricity sector only recovers 75 percent of its costs and the water and sanitation sector recovers about 64 percent of its costs. In that region, utilities subsidies are equivalent to 0.7 percent of GDP. According to these authors, increasing cost recovery in electricity and water to 100 percent would “buy” about 5 percent of the financing needs across all infrastructure expenditures. This implies an average subsidy component per country of at least 0.7 percent of GDP across sub-sectors.

Table 6. Distribution of country groups according to cost recovery efforts for water and electricity

Country group	Water				Electricity				
	Median tariff	No cost recovery	Partial cost recovery for OPEX	Partial cost recovery for CAPEX	Median tariff	No cost recovery	Partial Cost recovery for OPEX	Partial cost recovery for CAPEX	
By income	USD/m3	Percent of countries				USD/kWh	Percent of countries		
High income	0.96	8	42	50	0.11	0	17	83	
Upper-middle income	0.35	39	22	39	0.06	0	71	29	
Lower-middle income	0.22	37	41	22	0.05	27	50	23	
Lower-income	0.09	88	9	3	0.05	31	44	25	
Global	0.35	40	30	30	0.07	15	44	41	
By region									
Latin America	0.41	13	39	48	0.09	0	47	53	
Eastern Europe	0.37	58	25	17	0.06	31	38	31	
East Asia	0.25	53	32	16	0.05	29	65	6	
South Asia	0.13	100	0	0	0.05	29	71	0	
Sub-Saharan Africa	0.09	100	0	0	0.04	33	67	0	

Source: Foster and Yepes (2006)

Notes: For water, the average tariffs are based on residential consumption of 15 cubic meters for utilities in 132 major cities worldwide between 1999 and 2004, with most of the data are for 2004, among which: South Asia (24), Latin and Central America (23), East Asia and the Pacific (19), Middle East and North Africa (12), and Eastern Europe and Central Asia (6); for electricity, data are drawn mostly for 2004 from 84 countries worldwide, among which: LCA (19), EECA (18), SSA(13), EAP (8), and SA (3).

Cutting these subsidies significantly is politically unrealistic. Obviously, they could be cut somewhat through production and service cost savings from efficiency improvements. But in the world's lowest-income countries such as India and most of Sub-Saharan Africa, assuming that access was available to all, around 70 percent of households could be expected to face difficulties in paying full cost recovery tariffs. In these regions, tariffs would likely have to increase by a factor of 10 to reach cost recovery levels, and this could be expected to have a significant impact on poverty. Latin America is not exempted from this problem. In Bolivia, Honduras, Nicaragua or Paraguay, where *per-capita* income levels are quite low, reaching cost recovery tariffs would represent a significant affordability problem for around half of the population.

This does not mean that subsidies cannot be improved. The real challenge is their targeting. Any effort to improve cost recovery should be matched by an effort to improve the targeting of subsidies because of a long history of failure to make them progressive in practice. The core of the problem stems from the fact that even when tariff structures are well designed (often they are not), subsidies benefit the users who are connected. Yet, most of the poor are not. So, in the poorest countries of the world, even if tariffs have tended to undershoot costs because they were initially designed to minimize the risks of exclusion of the low-income classes – which can represent 50 percent of the population of many of the countries – they have often failed to reach those they were intended to help. The built-in subsidies are thus clearly the response to a political concern with the limited affordability of these services if charged at full cost.

There are two main lessons from this brief overview of the distribution of cost recovery between users and the government. The first is that very few countries are actually betting on a full cost recovery from users. The second is that the poorer the country, the higher the likelihood that the government will have to contribute to the financing of infrastructure services – a major challenge, since the poorer the country, the lower its tax base.

5.2 Dealing with the limited ability to pay of many users

The future generation of taxpayers will have to fund a large share of today's high infrastructure subsidies.

In view of the limited income of a large share of the population in the poorest countries of the world, it is thus useful to try to track down the subsidies that need to complement user fees to allow the recovery of infrastructure costs. In view of the narrow tax base of the poorest countries, governments essentially rely on loans, grants, and on bonds for those with relatively developed financial markets. This means that a large share of the high levels of explicit and implicit subsidies going to this sector is likely to be covered from taxes to be paid by the next generation of tax payers.

In terms of the relative size of these various options, loans from domestic or international private banks or development agencies dominate. In some of the countries with enough credibility with private infrastructure players, it may also be possible to get private operators to pre-finance some of the financing needs, but often this will require guarantees. As discussed later, guarantees and equivalent insurances have become an important complement to the more traditional sources of financing but they are also associated with fiscal costs.

Unfortunately, much of the discussion on the importance of these various financing options has to be qualitative. Indeed, how operators manage to get financing for the share of costs not recovered directly from users is poorly documented. The list of specific possible financing sources is not short. Loans can be from domestic banks, international banks or from international agencies. They can be complemented by equity provided by the operators. Some of these loans can be at costs lower than they would otherwise be, given the country and the sector, thanks to guarantees provided by bilateral or multilateral donors. This is where most of the creativity has taken place in the last 10 years or so in particular.

The number of risk mitigation instruments has indeed exploded. They include partial or full (wrap) credit guarantees, export credit guarantees (e.g. when energy is traded internationally) and insurances and more recently regulatory or political-risk guarantees and insurances.⁵ Finally, for some of the poorest countries, operators may sometimes count on direct grants or indirect grants such as debt swaps or debt repurchases.

5.3 How can financing institutions help?

The large number of institutions interested in financing infrastructure in developing countries shows the competitive character of the development business. Moreover, the number of instruments these institutions rely on is often underestimated. The British development agency, DFID, for instance supports 14 programmes and initiatives aimed at increasing Public-Private Partnerships (PPPs) in infrastructure.

The main financing role, however, can probably be credited to development banks and agencies, and to guarantee agencies. Their place in the financing of the sector is indeed hard to overestimate. Their contribution corresponds to 15 to 20 percent of the financing of total infrastructure investments in developing countries, although the specific shares depend on the region and on the sector and this role is stronger in Sub-Saharan Africa, for instance.

It is hard to overestimate the role of development agencies in the financing of infrastructure.

Both development and guarantee institutions can be anchored locally, regionally, nationally and internationally. In principle, they offer support to projects that may not have access to commercial banks and insurers. Most of the time, they fix a market failure explained by high country or regulatory risks (for instance in post-crisis or post-conflict countries), economic returns unmatched by financial returns or simply because the local financial sector is not developed enough to be able to take on the role domestic financial institutions play in OECD countries.

The development banks and agencies generally focus on partial funding of projects through loans. The guarantee agencies or the guarantee units of development banks focus on providing insurances.⁶ The fact that related institutions offer both types of instruments makes it easier to tailor the combination of instruments to specific infrastructure projects. Indeed, the two types of services are often bundled together. Loans are much more common than guarantees.

Typically, development agencies are initially solicited for loans which function as commercial loans except that they usually have the benefit of below-market interest rates, longer terms and repayment schedules that can be adjusted when needed. They are also often paired with technical assistance to ensure successful implementation of the projects as well as their longer-term sustainability. Guarantees are sometimes matched with a loan or even an equity investment when the development agencies work with private counterparts. The guarantee then acts as insurance for the equity investments and loans in countries or activities rejected by commercial insurers because of the associated risk levels. Guarantees offered in the context of development also often have the benefit of better contractual terms than private insurers tend to offer in developed countries. For instance, coverage tends to be longer term and rates can be tailored to the main risks typically associated with infrastructure projects. Political and regulatory risks are among the hardest to insure in private markets.

⁵ For a more detailed overview see Matsukawa and Habeck (2007).

⁶ Narrowly defined, guarantees refer to financial guarantees granted to ensure the timely payments of debt service. Insurances usually require claims that need to be investigated and thus have more complex trigger rules.

China and other emerging economies are entering the market for infrastructure finance in developing countries with very attractive terms.

Multiple development banks and guarantee agencies often pool their limited resources in coordinated efforts to support specific infrastructure projects. For instance, most of the large supranational power pools tend to be sponsored by multiple donors, both domestic and international in some cases. In most such projects, one of the institutions takes the lead. This can be an important catalyser to get other players to support governments and share the risks of investing in a sector in which assets are long-lived and hence slow to be amortized. It can also be an effective way to support the development of domestic credit markets where donor resources are used to leverage local commercial banking involvement in the sector.

While the multilateral and bilateral development agencies are clearly the main players and commercial banks have a notable place in the business as well, there are other players with an actually or potentially important role to play in developing countries.⁷ The first is China. Its role is symptomatic of the growing role of middle-income or emerging economies as sources of funding for developing countries. The growing presence of China, but also India and Brazil, in Africa is creating a sense of competition in the infrastructure business. These countries have valuable experience in infrastructure and are less demanding in terms of procurement, resettlements or environmental concerns. Moreover, they enter the market with very attractive financial terms. Corkin *et al.* (2008), for instance, explain that infrastructure projects undertaken by Chinese companies are often financed by soft loans from the Chinese government, on the condition that they are carried out by Chinese companies.

A second player with a strong presence in some regions and with a potential for continued growth are pension funds. Pension funds offer long-term financing. When they are local, as is often the case in Latin America, for instance, they have the additional advantage of offering domestic financing, an important element when local capital markets are not yet very developed since it can reduce the exchange rate risk in project finance. A recent study financed by a major Spanish bank present in Latin America enthusiastically supports the need to develop the involvement of pension funds in infrastructure as a way to accelerate growth (Alonso *et al.* 2010). So far, however, pension funds have been relatively reluctant to get involved because of uncertainty on the size, risk, return and correlations of this diverse asset class (Inderst 2009). Moreover, infrastructure assets also involve new types of investment vehicles and risk for pension fund managers such as fluctuating leverage and ownership issues as well as regulatory, political and environmental risks they have not been used to assess.

The final player is actually an instrument with some potential in the sector. Indeed, there is a push towards relying more on local government bonds to help sub-national governments find financial resources. Hyun *et al.* (2008), for instance, offer an interesting description of how adaptations of US or Japanese revenue bonds could help in financing infrastructure in Asia. Platz (2009) gives a more general and detailed assessment of the potential for this instrument. He suggests creating specialized “project development facilities”, local or national depending on the size of the country. He mentions the Municipal Infrastructure Investment Unit in South Africa and the state-level Urban Infrastructure Development Funds in India. In addition to providing financial, technical, and managerial support to municipalities and public utilities, these facilities could be used to help structure and market the sub-sovereign bond to meet domestic investor community needs. Another motivation in focusing on domestic investors is to reduce exchange rate risks. Major international development agencies are devoting significant resources to exploring and mainstreaming local government bonds.

⁷ In addition to the players covered here, a growing number of countries are talking about setting up infrastructure banks.

5.4 How well are the lessons from experience internalized?

The discussion so far has shown that there has been enough experimentation with various types of instruments to have a good academic sense of which ones work and which ones do not and under which circumstances. However, it is not clear whether policy circles are internalizing the lessons fast. For instance, the recognition by policy makers that full cost recovery of water and sanitation in the poorest countries was an unrealistic option was slow to come. Less than 10 years ago, it was still a goal for the main development donors. It is only recently that it has been adjusted to focus on the recovery of operational expenditure for the lowest-income classes. Similarly, guarantees have long been on the agenda of most development agencies without obvious success because they represented a high-cost high-risk option for many projects. The expectations on their potential have now been adjusted to reflect the fiscal risks.

But not all lessons are lost and the scope for self-financing of some sectors is increasing. For instance, increasingly infrastructure sub-sectors are used as tax handles to contribute to their own financing. In some instances, funds thus collected are used to feed dedicated or special-purpose funds such as road funds or universal-service funds in the telecoms and sometimes in the energy sector. In most cases, governments rely on traditional instruments such as sector-specific taxes. Local and sub-national governments have been typically keen on following this approach in developing countries. But there are also new forms of tax instruments. For instance, environmental charges or levies are an increasingly common way of complementing the financing of sanitation projects when tariff structures cannot be designed to recover all costs.

Infrastructure sub-sectors are increasingly used as tax handles for their own financing when full cost recovery from bills is not feasible.

6. Infrastructure, finance and development

This section offers a very brief summary of the evidence on the importance of the sector from three perspectives relevant to its financing. The first is the importance of the sector for the development agencies. While it is now established that development agencies are an important source of financing with around 10 percent of the total needs of the sector, it is easy to underestimate how much infrastructure is a core sector for these development agencies but also to overestimate how much more these agencies can do. The second is a discussion of some of the drivers of the limits to private-sector financing. The finance world tends to ignore the relevance of some of the social and fiscal implications of the continued efforts to rely on the private sector to finance infrastructure. The third is on the scope for improvement in the ways the public sector procures its huge responsibilities in the sector.

6.1 The importance of infrastructure for development agencies

ODA is an important source of financing to some extent because infrastructure is the dominating development business at the sector level. A glance at the annual reports of the major international (World Bank) and regional development agencies (ADB, IDB and AfDB) shows that infrastructure loans add up to at least a third of the portfolio and even to close to a half in recent years for some of them (e.g. the World Bank in 2009). But loans are not their only business. Technical assistance and other forms of non-reimbursable support are a strong business line as well. Although they do not finance CAPEX for developing countries, they make CAPEX more sustainable and in many instances, technical assistance is a substitute for local OPEX. For the IDB, for instance, technical assistance to infrastructure represented about 45 percent of the total budget allocated to infrastructure in 2008. For the ADB, non-reimbursable support to infrastructure was about 60 percent of its grant budget in the most recent years.

**Conventional
infrastructure financing
from development
agencies has probably
reached a cap.**

The main point to retain here is that financing from this source has probably reached a cap. Since the share of infrastructure is unlikely to rise further, the volume infrastructure financing will not increase unless the overall budget of these agencies grows. Financing to the sector might increase in some regions simply because of a reallocation of resources within the sector but the major natural reallocation, which is from a reduction in ICT, has already taken place. Infrastructure may continue to benefit indirectly from international efforts to support climate change mitigation and adaptation. These resources are often on top of the regular infrastructure budget.

In the future, the main improvements are likely to come from more cost-effective support to the sector, especially from *ex-post* evaluations conducted by these agencies. What they do essentially is to recalculate the cost-benefit analysis reported in the appraisal report, replacing forecast values of the key parameters with observed values. Briceno *et al.* (2004) report the evidence from World Bank infrastructure projects for which 95 percent or more of the loan commitments had been disbursed between 1960 and 2000. Except for the water sector where the returns were relatively low at 9.2 percent on average, the assessment of the 40 years of experience revealed lower-bound estimates of *ex-post* economic returns ranging from 19.2 percent in transport to 25.4 percent in ICT. The average rates are particularly high considering that project officers often tend to assess financial rates of return rather than true economic rates of return. This is because many externalities are not taken into account and market prices rather than shadow prices are generally used.

The really interesting information in terms of improving the efficiency of support comes from a more detailed assessment of the types of loans that were disbursed. This information was recently documented for Africa (Foster and Briceno 2009, Table 2.5). It shows that among all transport projects, economic rates of return were highest for road maintenance in Africa, averaging 139 percent for the continent, well above returns for rehabilitation (17 percent) and new construction (24 percent). This raises questions about the decision to favour volume over quality in the region. An assessment of the relative importance of these conclusions at the national level shows that the highest returns to maintenance are found for networks that are already well developed, particularly in middle-income countries and non-fragile low-income countries. Economic returns to railway investments are the lowest at around 5 percent. It is also interesting to note that in spite of the very strong support for railway in the debate on climate change, railway rehabilitation interventions seem to be justified only for a few traffic systems.

6.2 What limits the scope for private-sector financing?

It is worth trying to understand more objectively why the large multinationals specializing in infrastructure activities are not a lot more involved in infrastructure in developing countries. On the one hand, the assessment of risks made by these large firms may be a lot more subjective and complex than the one reported by international organizations comparing *ex-ante* and *ex-post* performances of their own operations in the sector. But ultimately, they drive the decision to invest or to stick to an investment in environments in which culture and governance require specific skills and commitments. On the other hand, the assessment of governments of the net benefits they achieve from collaboration with these players is also much more subtle than reported in publications advocating PPPs. It is not only about finance and economics; it is also about geo-politics. This is probably why the failure of efforts to develop PPPs in developing countries is discussed so controversially. There is enough research documenting the success and the failures of privatizations and PPPs to fuel the speeches of dogmatic partisans in favour of or against an increased role for the private sector.

There are, however, a number of interesting objective facts to keep in mind when assessing the limits of the scope for infrastructure PPPs in developing countries. The first is that the common wisdom

suggests that private operators are more efficient providers of infrastructure services than public providers. A recent study by Gassner *et al.* (2009) assesses the performance of 1,200 utilities in 71 developing and transition economies. The results could be used to cater to both extremes of the spectrum on the differences between public and private operators. On the one hand, the study shows that private operators score a lot better than public operators on some dimensions. They reduce losses, improve bill collections, reduce employment faster and sell more than public operators. Thus, ownership matters when it comes to looking for profit. This is an important result if it means that public-sector operators rely on excessive subsidies simply because they do not make the same efforts to cut costs and increase revenues. This matters in view of the large financing gaps of the sector. But on the other hand, Gassner *et al.* (2009) confirm less positive results identified by earlier studies. These include that all the improvements are achieved without significant differences in investment and with very little price changes. Moreover, there is no difference in efficiency between public and private operators of water and electricity utilities. What this boils down to is that the involvement of the private sector has transformed an unmanaged rent available from the poor performance of the sector into an explicit profit for the private sector. This conclusion is factual based on Gassner *et al.* (2009) and the many previous studies they survey in their book. But it has a political dimension. Indeed, these profits are at the core of many of the criticisms of efforts to scale up PPPs. Why did anything have to change since final prices and investment did not really improve?

While the critics have good reasons to complain, they are unfortunately barking at the wrong tree. Investment, prices and overall efficiency are about regulation and competition, not ownership. This point has been made many times for OECD countries as well as in regulation textbooks written for OECD countries. It is even easier to make for developing countries where higher risks are associated with higher expected private returns. An assessment of the first large-scale regional effort to transform the power sector of a developing region, *i.e.* Latin America, makes this clear. The assessment of the 1990s reforms of the Latin American electricity sector shows that privatized firms operating under rate-of-return regulation have, at most, similar labour productivity to public firms. It thus turns out that regulation drives productivity. In incentive-based regimes, both public and private firms show higher labour productivity levels than firms under rate-of-return regulation (Estache and Rossi 2004). Similar results have been found in Asia or Africa for instance.

Investment, prices and efficiency are about regulation and competition, not ownership.

The upshot is that PPP is a rational way of trying to leverage public resources, but it is not just a financial transaction. What is required from the key players involved in designing these transactions is a serious effort to get the institutional dimensions right that are needed to ensure the sustainability of private-sector participation and of the efforts to improve service delivery to all, including the poor. This is in addition to greater honesty and realism about the scope for private financing in countries in which commercial and political risks are high.

6.3 Scope for improving public procurement

The final dimension that has not yet been touched upon and which is essential is the extent to which the public sector could deliver better. In view of the fact that in many of the poorest countries, the public sector plays this role in close collaboration with international development agencies, it is useful to consider the ways in which the cost effectiveness of procurement could be improved. Keep in mind that the 10 percent or so of ODA infrastructure financing adds up to about USD 70–100 billion. Recent research shows that these financial resources are not allocated the most efficiently.

One particularly important source of inefficiency is current infrastructure procurement prices. This raises again a concern with competition in the sector since improved competition could curb public-procurement costs. Based on data from the World Bank and the Japanese Development Agency,

Competition-enhancing reforms of procurement rules (e.g. auction design) would allow for significant cost savings.

Estache and Iimi (2010) analyze procurement data from three infrastructure sectors: roads, electricity, and water and sanitation. They find that the competition effect is underutilized. That said, the problem is not equally important in all sectors. For instance, they estimate that to take full advantage of competition, at least seven bidders would be needed in the road and water sectors, while three may be enough in the power sector. Many of the competition issues identified come from auction design, especially lot division. According to this research, the developing world might be able to save up to 8.2 percent of total infrastructure development costs by reforming procurement rules to promote competition more effectively.

The scope for procurement reform has not really been looked at seriously by international organizations in a long time. If this is a wrong decision as suggested by the recent research, its cost is very high, in particular in view of the fact that many of the poorest countries are being asked to adopt the procurement rules of international organizations as their own.

6.4 Lessons learnt

The efforts to push PPPs in developing countries have not been matched in practice by efforts to reinforce the institutions needed to support the fair distribution of the gains that can be achieved from improved competition allowed by the increased participation of private players. The large technical-assistance budgets have not been sufficient to make a difference yet. The most remarkable fact, however, is that improving regulation and competition to improve the distribution of rents features prominently in the political rhetoric. Training, conferences, toolkits and similar products enjoy sound support. But the day-to-day support is too often insufficient. Politics can be very effective at slowing the much-needed institutional support. Moreover, problems with the type and sometimes the level of human capital of the players managing the PPP transactions help explain why institutions are not improving.

In practice, this means that it is important to internalize in the strategic vision and hence, in the staffing of development agencies that regulation and competition require specific skills – just as engineering, assessing the economic costs and benefits of projects or their health, environmental or social consequences do. A simple look at the distribution of staffing across these specialities in donor agencies provides a good sense of the limited concern for the regulation and competition dimensions of PPPs. Paying lip service to the institutional needs is no longer sustainable if public and private costs are to be minimized in infrastructure, if the gains are to be shared fairly between users, operators and taxpayers and if competition is to attract an increasing number of private players eager to function in a predictable environment.

7. Key challenges ahead

The failures, or limited success, of various infrastructure finance-related policy options to systematically and lastingly improve service delivery have many sources. One major source is the inability of reforms to address the complex institutional and political characteristics of the sector. The choices between policy options are made particularly difficult by the multiple goals of politics in a sector that represents a high share of public expenditures. In developing countries, primary expenditures represent roughly 25 percent of GDP on average. Infrastructure expenditures represent between 20 and 40 percent of this amount, depending on the country. That implies a lot of political power to pass on. So the key challenges are related to the size of the sector. Another major source is the lack of information.

As shown in the discussion so far, a lot of what is happening in infrastructure is hardly supported by precise data. The amounts involved, the lack of data and the political leverage that the sector generates are probably quite strongly correlated. Development agencies are addressing these problems one by one.

The first area of focus is corruption. Words like favouritism, fraud, cronyism, patronage, embezzlement, state capture, and cash bribes are often associated with the delivery of infrastructure services – and not just in developing countries. The Transparency International Global Corruption Index suggests that the share of the population with a direct experience with corruption in utilities is around one third. It has been less than 10 years since the analytical research has started to approximate the impact of all forms of corruption on the performance of the sector. In his recent survey of these impacts, Kenny (2009) also argues that it has been less than 5 years since research has managed to generate specific-enough information to try to figure out solutions that are politically viable.

Progress is being made in uncovering the mechanisms of corruption, collecting essential data and evaluating them – but more is needed.

The second challenge is the need to scale up and improve information collection efforts in the sector. The MDGs and related commitments are forcing a closer monitoring of quantitative targets. But as discussed earlier, a lot has been left behind that should be part of the agenda going forward. This includes quality and cost data. Much of this effort should start within donor agencies. For instance, most donors are unable to report unit cost at the project level. Regulators have their own agenda. The benefits of regulatory accounting or more transparent procurement rules as ways of reducing corruption are well known. Unfortunately, very few developing countries have internalized the lessons so far.

The final area is the need to systematically improve the evaluation of the information that can be collected. Addressing this problem is one of the reasons why the serious evaluation of the impact of policies in the sector is starting to pick up. Since the mid-2000s, the interest in analytically robust evaluations of the impact of infrastructure projects, programmes or policies has exploded among development academics and field workers. There is a particularly keen interest in evaluations based on randomized field experiments and quasi-experiments. These approaches are now viewed by many as the most effective technique yet to measure the effectiveness of efforts to target the poor or efforts to stimulate various types of businesses in major development projects. But it is not only about efficiency. Better evaluation also enables policy makers to ensure that the poor get their fair share of the economic and social benefits achieved through the projects. In-depth experimental or quasi-experimental impact evaluations are now mainstreamed in many health and education activities in which international development agencies are involved.

Why is this change in the way of monitoring impact happening now? First, many important donors have put significant political pressure to trigger a more systematic use of these techniques by key development agencies. This includes the British, Spanish or Norwegian bilateral agencies. They are increasingly conditioning their decisions to allocate their development resources to the commitment of doing what is needed to generate robust evidence. Most actually work on evaluations themselves.

Second, from an academic viewpoint, the explosion of interest stems from the increase in data availability and from our improved collective capacity to process the data. The academic evaluation field has been able to grow fast in recent years thanks to significant improvements in the availability, the scope and the quality of household income and consumption surveys conducted in developing countries. It has also benefited from major improvements in microeconomic and general-equilibrium modelling techniques in the last 15 years or so.

8. Conclusions and policy implications

We now know more about financing gaps, the scope for private finance and the need to promote competition, fairness, and donor-financier coordination.

This overview of the main dimensions of infrastructure finance in developing countries has shown that we have learned quite a bit since the mid 1990s:

- In view of our better sense of the size of financing needs and financing gaps across sectors and regions, the international community should be aware of the need to continue a sustained effort to this sector;
- The international community should stop being unrealistic on the scope for financing from private sectors across the board;
- It should also be less sanguine about the differences in the effectiveness of provision between public and private infrastructure services; the real differences stem from the management of competition and regulation, not that of ownership – although the interpretation of this evidence is still far from unanimous;
- In its support to the reform of regulation, the international community should internalize the lessons learned on the many sources of unfairness in the way services are provided, priced and subsidized across income groups and user types; these sources of inequity can and should be dealt with;
- It should ensure more effective coordination between the many donors and financiers, which, in spite of political commitments, continue to limit their effective joint support to large-scale infrastructure that requires multiple sources of financing;
- This improved coordination should also be reflected in the collective efforts to deal with some of the major challenges that should be on the agenda of all players in the sector, including the greening of the sector, corruption, improvements in monitoring the performance of the use of resources, and governance of the sector. That means a lot of new information to collect.

But there are also a number of dimensions which this study has not covered because they are not often discussed even though they might be important to understand. The first is related to basic data issues. This study has already mentioned how poor the fiscal monitoring of the sector is. It could also have mentioned how poor the performance monitoring is. The performance data presented here focus on quantity indicators, simply because the quality indicators that would allow a fairer assessment of the infrastructure needs are not collected systematically. A second knowledge gap is more subtle but probably even more important in a development context. Our collective knowledge of how big and costly the gaps can be has grown, but we know very little about what drives the basic efficiency-equity trade-off in this sector. The extent to which governments have traded off between social and growth concerns in their choices of policy goals and instruments may be the biggest unknown. While everyone knows that infrastructure gaps have both growth and social costs, researchers have understood that the two costs should be looked at together. Poverty researchers do their thing and macroeconomists do their own. Yet, the growth and social costs go hand in hand.

It will be challenging to get the data and the models to assess the direction that the international community and national governments in developing countries need to follow to identify win-win situations in the sector. But it is a reasonable way of making sure that the scarce international and national financial resources allocated to the sector deliver cost-effective infrastructure at a speed that is consistent with political promises and the likely pace of population and GDP growth. And this means a lot faster than in the past.

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