



IMF Working Paper

Financing Infrastructure in India: Macroeconomic Lessons and Emerging Market Case Studies

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Asia and Pacific Department

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Abstract

Driving infrastructure development, notably mobilizing financial resources for infrastructure projects, has been challenging in many countries. This study includes two parts: an empirical analysis of macroeconomic risks associated with infrastructure booms, and a case study of four emerging economies about their practice of funding infrastructure development. The study shows that (i) there is no empirical evidence that rapid infrastructure growth would undermine contemporary macroeconomic performance, implying that room is created to accommodate infrastructure booms without compromising fiscal and external sustainability; (ii) banks may play an important role in financing infrastructure, but caution is needed to avoid directed lending and regulatory forbearance that the authorities may use to promote financing; (iii) capital market development is important to accommodate the usually high financing needs, and encouraging private investors to move into infrastructure would require regulatory and institutional improvements; and (iv) public support, including credit guarantees, may help bolster investors' confidence, but the authorities should carefully monitor and manage fiscal risks.

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I. INTRODUCTION

The US\$1 trillion that India plans to spend in infrastructure over the next five years raises questions about how such a massive wave of financing can be accommodated. Most analysts estimate India's medium-term trend rate of growth at or above 8 percent a year, and a continuation of or further increase to India's already high savings rates.¹ This should provide a sufficiently large envelope for strong growth in infrastructure, as foreseen under the 12th Plan, as well as in other areas². However, it is not clear how a larger pool of savings can be intermediated into infrastructure finance. Under India's 11th Plan, while targets for infrastructure finance have broadly been reached, this is partly to do with the profitability of telecommunications, where investment has been particularly strong. In other areas, such as energy, roads, and railroads, either funding has lagged behind targets or physical output is unlikely to reach Plan targets.

This paper examines how other countries have managed rapid growth and the need to build supporting infrastructure and attempts to draw some lessons for India. This paper looks first at how infrastructure booms fit within macroeconomic frameworks. Section II looks at a broad sample of advanced and emerging economies and assesses whether rapid investment in two areas of crucial importance for infrastructure, roads and energy, have coincided, led or followed significant changes in national savings, fiscal and current account deficits, and financial depth indicators. In general, however, the results show that country experiences are quite heterogeneous. For that reason, the following sections look more in depth at how four other emerging markets have financed infrastructure improvements in those two areas. The four countries chosen have pursued quite different paths to mobilizing capital for infrastructure finance. Along with India, Brazil, China and Korea are among the largest emerging markets, while Chile has been unusually successful at catalyzing private sector involvement in infrastructure finance. Section III looks at Brazil, Section IV looks at Chile, Section V at China and Section VI at Korea. Section VII presents some broad lessons for India and concludes.

II. INFRASTRUCTURE INVESTMENT AND THE MACROECONOMY

This section analyzes through a cross country empirical study how countries have mobilized resources to finance large improvements in infrastructure. While different countries have pursued these goals in different ways, this section looks heuristically at whether periods of rapid infrastructure investment are significantly different from periods of slower investment. In particular, four questions are explored: are infrastructure booms associated with more rapid GDP growth, are they associated with increases in savings and if so, are those savings

¹ Guimaraes-Filho, Roberto and Ju Pyun, manuscript.

² India's development strategy is laid out in five-year Plans. The current Eleventh Plan covers the period 2007-2012; the Twelfth Plan will be published in 2012.

foreign or domestic, are they associated with fiscal deterioration, and are they associated with deepening financial markets.

The impact of infrastructure development on economic growth, productivity and trade has been extensively studied, and most studies conclude that improvements in a broad range of infrastructure categories lead to faster growth. Roller and Waverman (2001), using data for 21 OECD countries for over 20 years, find evidence of a significant positive causal link between telecommunication infrastructure and economic growth. Calderón and Servén (2003) find positive and significant output contributions of telecommunications, transport and power in a sample of Latin American countries. Donaldson (2010) using Indian historical data during 1870-1930 finds that railroad development reduced trade cost, bolstered trade, and increased real income, while Mohommad (2010) finds that physical infrastructure improvements lead to faster TFP growth in manufacturing. Finally, Canning and Pedroni (2008) use cross-country data in 1950–1992 to show that infrastructure positively contributes to long run economic growth despite substantial variations across countries.

Beyond growth, however, there is little analysis of how these improvements in infrastructure are financed, and to what extent macroeconomic frameworks should be adjusted to accommodate infrastructure booms. A crucial question is whether countries are generally able to meet financing needs domestically, either through higher domestic savings or through crowding out other investment needs, or whether foreign savings are generally accessed via higher current account deficits. Additionally, if large scale improvements in infrastructure are not generally financed through private or foreign savings, then public savings must be increased to ensure adequate resources for development. And finally, if financial markets tend to deepen during periods of rapid investment, this implies that the domestic financial sector intermediates the savings: we are also interested in seeing which part of the financial sector and which instruments are used in infrastructure financing. The analysis below provides a first stab at each of these questions, as well as the issue of growth and infrastructure.

A. Data and methodology

There are important econometric considerations about how to tackle the relationship of the macroeconomic environment and infrastructure investment. Current account balances and fiscal deficits are likely to be jointly determined with any large investment boom, raising endogeneity concerns. Tax revenues, growth and infrastructure are all obviously linked. The purpose of this analysis is not to assess causality but rather to make a first pass over the data and see whether there is any relationship at all between infrastructure booms and macroeconomic shifts. Therefore rather than building a general equilibrium model, this section isolates boom periods in infrastructure investment and tries to assess whether there are changes in macroeconomic and financial performance during those periods.

Given the variations of financing vehicles across different areas of infrastructure, we look into two types of infrastructures only: electricity production (measured in KWH) and road construction (measured in miles). Data used in this paper are annual data for macroeconomic performance and infrastructure construction with observations from 1980 through 2009 for 105 advanced and emerging economies. Booms are defined as the periods during which the growth rates of infrastructure capacities are at least $\frac{1}{2}$ - 1 standard deviation higher than their three year moving averages. Among the macro variables, fiscal deficit, current account deficit, bank credit, bond market size, central government spending and government revenue are scaled by nominal GDP. Most macro data are from the CEIC database, and the bond market size data is from the BIS.

The analysis focuses on mileage of paved roads and KWH of installed electrical capacity rather than funds invested in infrastructure for a number of reasons. First and prohibitively, data on infrastructure investment are not available on a comparable cross country basis, leaving installed capacity as the best available measure of infrastructure investment. Second, the goal of infrastructure investment is not money spent but capacity increased, and as such focusing on outputs, i.e., roads and generation capacity, is a better measure of the success of the investment than focusing on inputs. Finally, given differences in economic composition between advanced and developing economies, the analysis below also differentiates between these two groups, according to the IMF's classification.

B. Growth

Intuitively, periods of fast growth should lead to infrastructure constraints that make improvements necessary while also increasing the pool of resources to make them more affordable. That is, regardless of the direction of causality, it would be reasonable to expect infrastructure investment to be contemporaneous with faster growth. This is observed for energy investment across the sample, as well as for road investment in developing countries, though not for road investment in developed economies. These findings broadly coincide with the results found in the literature, with the finding that roads investment is not associated with faster growth in developed economies an exception.

C. Savings

Since the current account is equal to the difference between domestic savings and investment, looking at these variables allows us to determine whether domestic or foreign savings generally increase during periods of infrastructure booms. If countries are able to rely on additional domestic savings to finance infrastructure without diverting resources away from other areas, then domestic savings should rise while the current account remains the same. Alternately, if foreign savings are required, then the current account deficit should increase while domestic savings remain the same. Of course, other explanations and partial adjustments are possible, so these correlations should be taken with caution.

During boom periods for electricity investment, savings rates tend to rise without any significant increase in the current account deficit, implying that investment during electricity booms tends not to rise by more than domestic savings. On the other hand, no such effect is seen for highway construction, implying that these booms are financed by foreign sources or through a reallocation of domestic investment.

D. Fiscal

At first glance it seems reasonable that the higher growth associated with infrastructure investment would lead to higher revenue, while infrastructure investment would lead to higher spending, possibly leaving fiscal deficits broadly unchanged. However, across the sample and for both electricity and road investment, no significant changes are found in central government current or capital spending. At the same time, government revenue, as expected, does appear to outperform during boom periods than during pre-boom periods, except for advanced economies during booms in electricity production. These results would seem to imply that governments do not increase spending overall during periods of infrastructure booms, instead reallocating funds without a significant deterioration of fiscal balances.

However, some caveats are in order. The booms may be financed entirely or partially by local governments, for which spending data are not available. Alternately, infrastructure spending might not be large enough to change the overall spending envelope significantly. The fact that in advanced economies undergoing electricity booms neither revenue nor spending appears to change implies that these countries may be better able to allocate such investment within existing envelopes.

E. Financial

In India, the effort to develop the financial sector in a way to catalyze more long-term financing into infrastructure has led in part to measures to develop the corporate bond market and facilitate bank lending into infrastructure. More broadly, infrastructure booms, either privately or publicly financed, are likely to necessitate additional debt financing either to finance private projects or close fiscal gaps stemming from additional public investment. Unless this spending crowds out other investment, it should be manifest in a deeper bond market or in unusual growth in bank credit.

In general, bond markets tend to grow relative to GDP during periods of infrastructure booms. This may be due to rapid growth more than to infrastructure investment, but is at least favorable to using the bond market to develop infrastructure. Similarly, bank credit also tends to rise relative to GDP during infrastructure booms, the only exception being road booms in developing countries. Given the importance of bank finance in developing economies and the significance of this variable in advanced economies, this is surprising. It may reflect a relatively weak capacity of the banking sector to mobilize resources to finance road construction, or the constraints of prudential standards on bank lending in this area.

F. Main Findings of the Macroeconomic Analysis

The results discussed above agree with the results of previous analyses that rapid economic growth tends to go hand in hand with increases in infrastructure investment. Beyond that, it would seem that booms in energy capacity tend to be financed domestically, while investment in roads is less likely to be undertaken without the involvement of foreign capital. Governments tend to be able to finance infrastructure booms within their current spending envelope, and whatever additional spending is undertaken tends to be exceeded by higher revenues concurrent with the infrastructure boom and its accompanying growth spurt. Finally, there is evidence that private capital markets tend to deepen during periods of infrastructure investment. While this may not be due to infrastructure investment itself, it means that conditions for private finance of infrastructure do tend to improve along with the need for additional financing. These results, broken down by emerging versus advanced economies and by infrastructure sector, are summarized in Table 1.

Table 1: Output Summary—Contemporary Periods—In Comparison with Pre-boom Periods

	Electricity Production			Road Construction		
	Total	Developing Countries	Advanced Economies	Total	Developing Countries	Advanced Economies
Saving Rate	+	+	+			
Current Account Deficit						
Fiscal Deficit						
Real GDP Growth	+	+	+		+	
Bank Credit	+	+	+	+		+
Bond Market Size	+	+	+	+	+	+
Government Revenue	+	+		+	+	+
Current Spending						
Capital Spending						

+ refers to the case where the mean of the variable's deviation from its unconditional mean is significantly different from zero.

Overall, however, this analysis can only go so far in telling us that fiscal and financial conditions, and to a lesser extent savings, tend to improve during periods where infrastructure investment is growing. Countries' experiences differ, and it would be informative to look in detail at how individual countries have secured infrastructure finance. The analysis below looks at four emerging markets. Rather than focus on boom periods, the analysis is focused on how private and public capital have been mobilized to finance infrastructure in recent years. With more and more experience in how to gain private sector support for infrastructure finance, focusing on the current period, with its relatively well developed markets, makes more sense than focusing on earlier years where private mechanisms were less well developed.

III. BRAZIL

Brazil's financial sector is relatively sophisticated, with a large banking sector including some banks with extensive foreign operations. Derivatives markets, particularly for foreign currency, are also well developed. The stock market, with total capitalization around $\frac{3}{4}$ of

GDP, has grown dramatically in recent years. This growth has been particularly significant in the *Novo Mercado*, which has relatively rigorous listing requirements, including a minimum float of 25 percent and a requirement that all shares be common rather than preferred stock. Pension funds, however, are relatively small, with assets of around 15 percent of GDP, and largely within the corporate sector. Other institutional investors, such as insurance companies, are growing but the sector is not yet well developed.

Interest rates are generally quite high, a phenomenon which has been variously attributed to Brazil's vulnerability to external shocks, the historic legacy of high inflation, and crowding out by a large public sector. While short term rates have gradually fallen over the last 10 years, longer rates remain quite high, with high reserve requirements and priority sector lending playing a role. Corporate spreads also tend to be higher than in comparator countries. Partially for this reason, most bank funded private sector lending is concentrated in the short term. Long-term lending tends to come from the *Banco Nacional de Desenvolvimento Econômico e Social* (BNDES), a publicly-owned development bank, discussed in greater detail below.

Commercial banks, including foreign ones, are active in long-term lending to households, but their role in lending to enterprises is generally limited to an advisory role for projects in which BNDES is involved, or else trade finance or syndicated loans. However, in cases where BNDES or foreign lenders are able to provide longer-term financing, domestic commercial banks can and also have been brought on board to assume commercial risks.

Recognizing private sector constraints on infrastructure investment, particularly given the run-up to Brazil's hosting of the World Cup in 2014 (and now of the Olympics two years later), the Brazilian government in 2007 created the Growth Acceleration Program (PAC for its initials in Portuguese). The program, aimed at increasing growth and reducing poverty, calls for US\$251 billion in additional infrastructure and other investment over four years, to be financed by the government (US\$34 billion) as well as public enterprises and the private sector.³ Among other measures, it exempts from some federal taxation certain capital and primary goods related to infrastructure investment and construction, and will eventually create a tax-exempt national Investment Fund to finance infrastructure projects.

A. BNDES

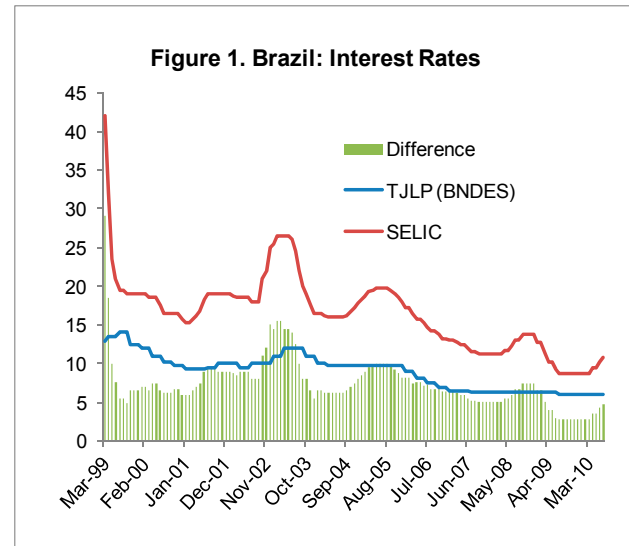
Long-term private sector corporate finance in Brazil is dominated by BNDES, and the 2007 PAC strengthened the bank's position at the center of Brazilian infrastructure finance. The bank reduced spreads for infrastructure projects dramatically and also extended the terms of

³ In this sense it is similar to India's Five Year Plans, though in Brazil most public sector investment will be undertaken by public enterprises rather than directly by national and local governments..

some of its loans. From only US\$3.4 billion in 2003, BNDES lending for infrastructure projects rose to US\$17.5 billion 2008 and US\$25 billion in 2009.

BNDES provides loans directly to companies investing in infrastructure, but also provides guarantees and securities underwriting, and itself buys bonds placed by some corporations. BNDES secures financing from retained earnings and some foreign funding (including from bilateral and multilateral lenders), but also from various tax and workers' funds and, in recent years, debt issued under the auspices of the Brazilian government.

The interest rate on BNDES loans is composed of a base rate (the *taxa de juros de longo prazo* (TJLP), or long term interest rate) that moves with inflation but is set by the government, plus spreads related to sectoral and project-specific risks (Figure 1). These sectoral spreads were also lowered as part of the PAC. While they remain positive, they are now generally below 2 percent and in many cases below 1 percent. Even with project specific spreads added in, BNDES's long-term lending rates are generally well below the central bank's overnight lending rate, the SELIC (Figure 1).



BNDES' dominance in Brazilian long-term finance, its support from taxpayers and workers, and its low lending rates have raised questions about to what extent it distorts the Brazilian financial system.⁴ Supporters point to the stability of the Brazilian financial system during the recent financial crisis, as BNDES was able to expand credit in a period when private sector credit was falling rapidly. Other studies have tried to assess whether BNDES crowds out longer-term lending by private sector banks, and whether its low lending rates result in poor custodianship of the pension and taxpayer resources it manages.

B. Electricity

Brazil's electricity industry is relatively fragmented. In 2004, there were 59 companies involved in generation, and 64 in distribution.⁵ Electricity generation is concentrated in hydroelectric plants, responsible for 80 percent of the country's generation capacity, with the balance coming from thermal plants and two nuclear plants. Most hydroelectric investment is

⁴ Formal-sector workers in Brazil contribute to a Workers' Assistance Fund (FAT), which in turn invests much of its capital in BNDES. The FAT receives a return on its investments based on the TFLP.

⁵ OECD, 2005.

public, with the national power company Eléctrobras dominating the sector along with various state companies, but some privately funded schemes exist.

Eléctrobras

Eléctrobras is the largest power company in Latin America, and one of the largest in the world. It operates most of Brazil's hydroelectric plants, and dominates generation, transmission, and distribution of electricity through a large number of subsidiaries. Since 2008, the company has also implemented an active foreign expansion plan, announcing in 2010 that it hoped to secure small stakes in numerous North American electricity generation companies.

The company is state-run, but listed. The national government holds 52 percent of ordinary shares, with minority shareholders (both resident and nonresident) holding 22 percent. The company also issues preferred shares domestically, with minority shareholders' participation at 85 percent. (The remainder of both ordinary and preferred shares are held by Brazilian public funds, including pension funds.) Eléctrobras also issues ADRs in New York, and is listed in the Latibex exchange in Madrid.

Eléctrobras actively issues debt in international markets, in 2009 issuing a US\$1 billion bond for the first time since 2005, when US\$300 million was issued. S&P rated the 2009 notes at BBB-, the same rating as the Brazilian government, given the firm's state ownership and likely state backing in case of financing difficulties. The company also receives financing from multilateral and bilateral lenders with a state guarantee.

The company has been involved in many large hydroelectric projects, including most recently the 11.2 GW Belo Monte hydroelectric project in the southern Amazon basin. The project generated strong opposition from indigenous groups and environmentalists. To encourage private investors to participate in the project, Eléctrobras and the government have provided subsidized credit, tax incentives, and publicly-guaranteed insurance. Without substantial involvement by the government, Eléctrobras would likely not have been able to keep private investors on board with the project.

Other Financing

Despite the chronic lack of long-term private financing at reasonable rates, Brazil has experienced substantial private sector investment in the energy industry during the last 10-15 years. BNDES is the most common source of long-term financing, with commercial banks often stepping in to provide trade credit.

Private financing in electricity has not always been profitable: the electricity crisis in 2001, as well as strong conservation efforts in Brazil, have reduced the average level of

profitability of electricity generation well below the levels in the United States or Chile.⁶ The combination of this with the relatively high cost of capital in Brazil has made it difficult for companies to justify investing in energy compared to other areas. However, as the Brazilian economy accelerates, and the cost of capital has declined in recent years, the window of profitability may now be wider than in the past.

The PAC also lowered BNDES spreads associated with energy loans to 1 percent for large hydroelectric projects above the bank's base lending rate, and to 1.5 and 2 percent for transmission and distribution loans, respectively. Loans for large hydroelectric projects also now have repayment periods of 20 years, while small hydro plants and thermoelectric projects can be repaid over 12–14 years. Finally, participation by BNDES in projects has risen, with the bank now being able to finance up to 85 percent of hydroelectric projects and 80 percent of gas projects.

C. Highways

Concessions and Public-Private Partnerships

During the 1990s, Brazil embarked on a relatively successful program of concessions in the road sector that concluded with around 8 percent of all paved federally maintained roads moving into the hands of around 45 private concessionaires. These concessions have traditionally involved no public financing, leading the relatively large program to be concentrated in the richer south and southeast of the country.

In 2004 the Brazilian government passed a law allowing joint public financing of projects with primarily private financing. The law required the national government and states engaging in PPPs to establish guarantee funds to ensure private concessionaires would be funded in the event of project difficulties, but limited the size of these funds relative to the state or central government's total annual revenues. Despite these changes, further expansion of the program has been slow given legal and bureaucratic roadblocks.

The emergence of PPPs has led to some division within the industry. Since concessions allow the private company more control over toll rates and have a greater prospective upside, these have become more concentrated in the type of larger, inter-city highway projects implemented by the federal government. With PPPs, the public sector retains more control over the profitability of the private firm in exchange for additional guarantees, leading these to be employed more widely at the state level, as well as for railroads.

⁶ World Bank (2007).

Equity

The main concessionaires in Brazil have only minority shareholdings listed domestically, but do actively issue equity in the Brazilian market. The largest concessionaire, the Companhia de Concessões Rodoviárias (CCR), listed shares on the São Paulo Novo Mercado in 2002. By 2010, 38 percent of voting shares were traded. The second largest concessionaire, OHL Brasil, has a free float of less than 18 percent of ordinary shares, while the third, Ecorodovias, has around 26 percent.

FDI has also been a factor in the industry. Until June 2010, a large Portuguese infrastructure company, Brisa, was an important shareholder in CCR. OHL is a 60 percent subsidiary of the Spanish company OHL, and Crédit Suisse Hedging holds around 20 percent of the company. Ecorodovias, on the other hand, is majority held by two large Brazilian construction companies.

Debt

The relatively long term of highway concessions and PPPs have led to strong demand for long-term financing. Some of this has been met through private financing: concessionaires tend to issue debt in the local market at maturities of between 3 and 10 years, though interest rates, particularly at the long end of this range, have even in recent years been well above 12 percent. Bonds also come in various forms: shorter ones tend to be fixed-rate or tied to interbank rates, but longer ones are often indexed to inflation, or at floating rates. The market is sufficiently deep, however, that issuances are quite large, in the range of hundreds of millions of dollars.

The preponderance of medium-term lending and high rates at longer tenors, however, creates space for BNDES and multilaterals. BNDES, in particular, was incentivized under the PAC to increase its exposure to highway loans. The bank will now finance up to 70 percent of the cost of a highway project at a spread of 1 percent (plus project specific risk) above the TJLP. This has led to a rapid expansion in road projects: in the first half of 2010 alone, BNDES disbursed US\$8.6 billion in road loans, more than twice what it disbursed in the first half of 2009. It is also involved in designing concessions for road projects.

Multilateral involvement is very important in Brazil. The Interamerican Development Bank has in some cases provided financing to concessionaires in road development: in 2009, a 13-year credit for US\$900 million was approved for a highway operator building a beltway near São Paulo. The World Bank is also often involved in financing of roads; their financing for any project is limited to 50 percent of capital, while the IFC is part owner of AGConcessões, an important shareholder of CCR.

IV. CHILE

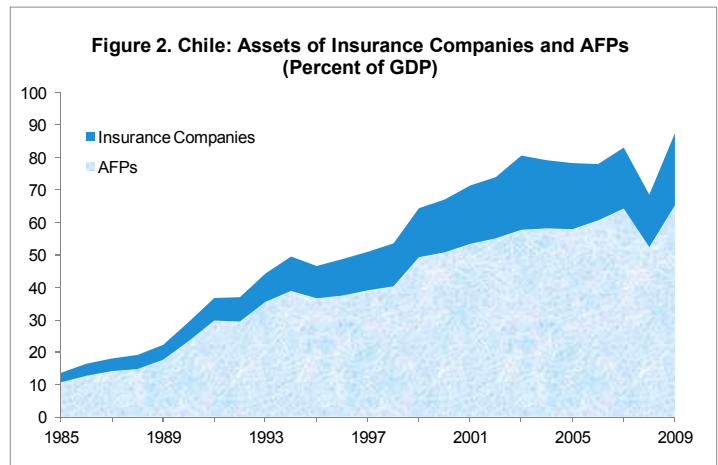
Chile represents one of the best environments in the world for private investment in infrastructure. A 2010 World Economic Forum report on private infrastructure financing in Latin America gave it the top ranking, far above any other country in the region, due to its macroeconomic and political stability, but also due to its “extremely well-developed e-government services, clear information on policy changes, transparency and openness of statistics publications, and dialogue and decision-making process”.⁷

Chile ranked 49th in the world in the World Bank’s 2010 Doing Business Report, and rates about average for starting a foreign business in the Investing Across Borders Report. The financial sector is relatively well developed, with a stock market capitalization of around 144 percent of GDP, a reasonably well developed corporate bond market, and a liquid market in interest rate derivatives.

The financial sector has developed in tandem with Chile’s privatized pension system. Following privatization of the public system in 1981, workers were given ‘recognition bonds’ proportional to their contributions to the public system, and opened accounts in the new investment firms, called AFPs, into which a proportion of their salaries was deposited each month.

Contributions to pension funds are made automatically. AFPs charge management fees in exchange for investing clients’ funds and provide regular reports on performance. Upon retirement, regulations do not allow workers to take lump-sum payouts: a substantial portion (though not all) of the account must be turned into an annuity indexed to inflation. This annuity requirement, in turn, has led to substantial growth in Chile’s insurance industry, which until the 2007 pension reform was effectively the administrator of the country’s retirement program.

The large flow of funds into AFPs that began in 1981 led to a sustained increase in the assets under management of the pension fund and insurance industries, reaching 83 percent of GDP at end-2007. Assets fell in 2008, but rebounded in 2009, and by the end of that year had reached 87 percent of GDP (Figure 2).



⁷ WEF (2010).

The sustained flow into AFPs and insurance companies led to a rising demand for financial assets in Chile, in particular fixed income securities that AFPs and insurance companies could match to their long-term liabilities.⁸ Privatization of the pension system was thus an important impetus to the development of the fixed income market. At the same time, Chile's stock market has also grown rapidly, with end -2009 market capitalization at 144 percent of GDP.

A. Electricity

Beginning in 1982, Chile's electricity generation and transmission sector was completely privatized. The government's national development corporation, CORFO, has since started up other energy firms, but these have also been spun off over time. The large majority of generation capacity is accounted for by four large enterprises: Endesa, Gener, Colbún, and Suez Energy. Among the major actors in distribution and transmission are Enersis and Transelec.

Equity

Endesa, Gener and Colbún are all listed in the Chilean stock market. All actively issue equity in the market for investment purposes. While pension funds were important in the 1990s as a source of equity financing for the privatized energy companies, the entry of foreign investors in the late 1990s and 2000s has reduced their control over firms and importance as a source of marginal capital (Table 2).

Table 2. Chilean Electrical Companies: Ownership

	ENDESA		ENERSIS		AES-Gener	Chilquinta
	AFP	Endesa	AFP	Endesa	AFP	AFP
1990	11.3	n.a.	26.8	n.a.	28.9	16.9
1995	29.5	n.a.	30.7	n.a.	47.2	16.8
2000	13.4	59.98	13.48	65	28.57	0
2005	20.55	59.98	17.13	60.62	<1	0
2009	18.23	59.98	15.9	60.62	15	0

Energy, along with mining, has been one of Chile's most important destinations for foreign direct investment. Endesa and Enersis are both majority owned by ENEL of Italy, AES Gener by the AES Corporation of the United States, and Suez Energy by the Belgian-French Suez company Suez. Transelec is controlled by the Canadian firm Brookfield Asset Management. (Colbún is controlled by the Matte Group, a diversified Chilean holding

⁸ In particular, given Chile's high historic inflation and the requirement that pension annuities be indexed, there was a large demand for inflation-indexed financial instruments. Most domestic Chilean debt, and almost all debt of maturity greater than five years, is denominated in *unidades de fomento* (UF), an inflation-indexed unit of account.

company.) Chilean companies are also active foreign investors themselves, with most of the larger companies having affiliates in numerous other South American markets.

Debt

All the large Chilean energy companies issue bonds in both the domestic and foreign markets, though the composition of financing varies. Gener issues almost entirely in pesos and the inflation indexed units of account called UFs, while Colbún and Enersis have recently issued large Yankee bonds.

Domestic bonds are issued at investment grade without insurance. The main local market purchasers are the AFPs and insurance companies, with bond funds and other investors remaining a small share of the buyers' market. Maturities are long, often in the 10–20 year range, with some companies issuing at 24- and 30-year tenors.

Chilean energy companies are also active in the Yankee Bond market, with issuances in the US\$300–US\$500 million range. Maturities here are also range up to 20 years, with individual issuances rated by Moodys and S&P in the A-AA range.⁹ Another source of debt financing is lines of credit from international banks. These tend to be relatively short term, but various Chilean energy companies have accessed credit from U.S., Canadian, Spanish, and Japanese banks in recent years.

B. Highways

The Chilean government began to privatize construction of major roads beginning in the early 1990s. The roads program focused on upgrading the main highway connecting, via Santiago, the north and south of the country (Route 5), adding “transverse roads” connecting Route 5 other major cities (e.g., ports such as Valparaíso and San Antonio), and urban toll roads around Santiago.

The upgrade to Route 5 created a divided-highway toll road 1500km long from La Serena in the north to Puerto Montt in the south. The highway was divided into eight segments, each auctioned off to concessionaires between 1995 and 1998, and all were finished by 2002. The program is ongoing, with PPPs now being used to finance the construction of suburban freeways and a partial beltway around Santiago, as well as to upgrade connectivity to and between Chile's major ports.¹⁰

⁹ Chile's sovereign rating is A+ (S&P) for foreign currency debt.

¹⁰ An important consideration of the PPP program was to improve infrastructure specifically for exports. Access roads to ports, which given Chile's geography tend to be short, constitute around half the concessions that were not for Santiago freeways or Route 5.

Features of the PPP program

Infrastructure projects in Chile are contracted out on a Build-Operate-Transfer (BOT) basis. When fixed periods for operation are given, these are generally in the range of 20-30 years. However, payments for some concessions have been set at – or in some cases changed during the course of the concession – to a present-value payment. For example, the Talca-Chillán leg of Route 5 in 2004 was modified from an expiration in 2007 (itself already extended from 2004 due to a request by the Ministry of Public Works that further work be done to improve the highway) to a net present value of UF 12 million, which assumed annual traffic increases of 5 percent per year. When this total is reached, the concession will expire. This flexibility has allowed the government to retake control of a road section if traffic expands more quickly than originally forecast, allowing further improvements to the highway to be bid out to new concessionaires without having to buy out the remainder of the previous concessionaire's term.

Bidders for highway sections are allowed to set base-year tolls within strict limits established by the Ministry of Public Works. Tolls can then be adjusted for inflation, and some other factors such as time of concession and safety.¹¹ The Chilean government in some cases asks for additional works on highways; in these cases the terms of the concession can be extended.

The Chilean authorities determined that minimum income guarantees (MIGs) would be necessary to encourage private participation in highway construction. By 2000, traffic exceeded original forecasts on almost all routes, though some MIGs have been called. Beginning in 2005, the Chilean government for some programs began to insure concessionaires against exchange rate risk if financing had been secured in foreign currency.¹² As some of the MIGs were called in the late 1990s, observers recognized that this had become a fiscal risk. The Chilean government in the past decade thus began to include in each budget a report on the contingent liabilities of the PPP program.

The methodology for estimating these contingent liabilities has evolved over time. Under the current methodology, the authorities employ a stochastic model to estimate the revenues from each project and the likelihood of the MIG being called. The model generates a risk-weighted series of annual net flows from each project, which the government presents along with the NPV of the expected net flow. The authorities also estimate a maximum exposure

¹¹ The Chilean government also allows a small increase in tolls if highway operators are able to reduce the number of car accidents resulting in to injuries and fatalities during the course of the concession.

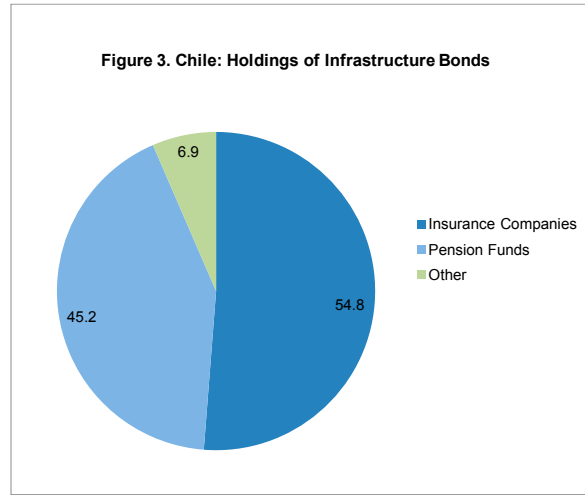
¹² This program shifted financing currency risk from the concessionaire to the government by requiring the government to reimburse the concessionaire if the peso weakened below an agreed level, but in turn requiring the concessionaire to reimburse the government if the peso strengthened. Three PPPs took advantage of this program at its inception, but as the peso strengthened in 2005, all the companies ended their involvement with it.

assuming zero revenue flow from each of the PPPs to demonstrate the upper bound of public sector exposure to the PPP program.

Equity

Chile's PPP program has attracted substantial FDI. The Route 5 construction in the 1990s attracted around US\$250 million in foreign equity investment, with participating firms from Mexico and Spain.¹³ Two of the segments of Route 5 were originally won by Tribasa SA, a Mexican infrastructure company which later went bankrupt. Its shares were transferred originally to a Mexican bank, but then sold again to other investors.

Most concessions, however, have been won by domestic Chilean investors or consortia. Transfer of concessions has been quite common with the original concessionaire selling the project on to other investors as the revenue stream comes on line. Albertis, SA, a Spanish infrastructure firm, now operates several segments of Route 5 despite not having been involved in the original construction.



Debt

By contrast with the electrical sector, where share issuances and foreign equity infusions have been important, Chilean private road projects have been largely debt-financed. With pre-construction financing relatively risky, concessionaires have employed monoliners, generally XL Insurance from Bermuda or MBIA, to secure AAA domestic Chilean ratings for their issues, and allowing the securities to be purchased by the country's large insurance and pension fund companies.

The tenor of bonds tends to be quite long. Of the 51 issues trading in 2008, the average original maturity of the bonds was 21 years. Given their high ratings and the strong demand for long-term fixed-income securities in Chile, the yields on infrastructure bonds tend to have relatively low spreads over prevailing government borrowing rates. With little secondary market trading and relatively low yields, however, refinancing options are limited. Some projects have been refinanced, generally as further improvements are made to projects, or due to declining long-term borrowing rates internationally as well as domestically (Chile's fiscal position improved consistently between 1999 and 2008 as rising copper prices and

¹³ A PPP to rebuild Santiago's international airport also included participation by a Canadian airport operator.

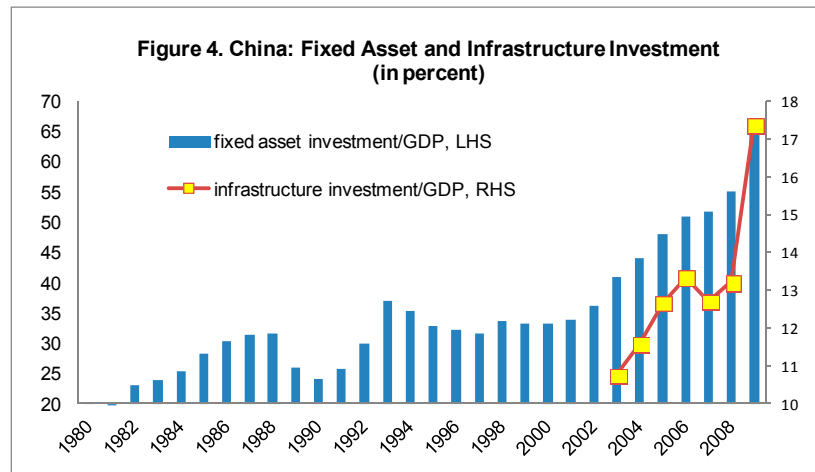
strong economic growth moved the country from net debtor to net creditor status), but much of the original stock of bonds used to finance Route 5 remains outstanding.

These bonds have been an important tool for deepening the corporate bond market in Chile. At end-September 2008, the corporate bond market totaled US\$19.4 billion, or 11.4 percent of GDP. Infrastructure bonds for PPP projects constituted 20 percent of this total, or 2¼ percent of GDP. Pension funds and insurance companies hold more than 90 percent of the stock of infrastructure bonds in Chile (Figure 3).

Beyond roads, PPPs have also been used in Chile to upgrade public transit and improve airports. The country centralized a vast informal network of public, private and semi-informal bus services in Santiago into a large public scheme called Transantiago in early 2007. PPPs were used to build the infrastructure of boarding and transfer stations and to improve bus connectivity in the city. Chile also rebuilt ten airports, including the country's largest airport in Santiago, during the 1990s and 2000s. Four airports are currently being renovated under PPPs, including the expansion of two airports rebuilt in the 1990s, while the government is soliciting bids for improvements to be made to a fifth.

V. CHINA

China's infrastructure construction picked up in late 1980s, and accelerated dramatically after 2000 as the authorities aimed to increase domestic demand and reduce bottlenecks to the booming economy. In the past decade, fixed asset investment as a share of GDP has almost doubled, about one quarter of which is related to infrastructure development.¹⁴



¹⁴ There is no definition of infrastructure in China's national account statistics. It is broadly accepted that the "narrow" definition of infrastructure would include electricity, gas, water production and supply; transport, storage, and postal service; and water conservancy and environment management. Other infrastructure may involve investment in agriculture (including irrigation systems), information transmission, computer and software, resident services, education, healthcare, culture, sports and entertainment, public administration and social organization, etc. In this paper, we use the "narrow" definition.

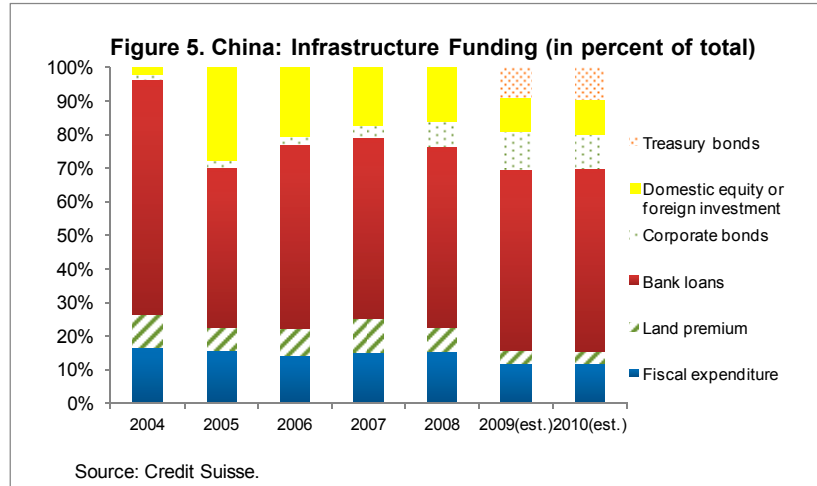
Local governments have been the one of the major drivers behind China's infrastructure boom since obtaining economic autonomy in the reform process begun more than thirty years ago. Following a 1994 tax reform that allocated a greater share of taxes to the central government, they have become eager to promote

economic growth to generate additional revenues. Local authorities have thus poured resources into infrastructure in an effort to accelerate economic activity and productivity.

To achieve these objectives, local governments are actively involved in mobilizing financing for infrastructure projects. For example, they provide guarantees—implicit and explicit—for bank loans to infrastructure projects, and in some cases provide subsidies directly for infrastructure SPVs to boost these entities' profits and credit ratings. These factors may partially explain the rising share of infrastructure loans in the total loan portfolios of the state-owned commercial banks.

The pattern of financing for infrastructure projects has evolved in the past few years:

- Banking loans have been the major source of funding for infrastructure projects. State-owned commercial banks and policy banks hold around 80 percent of total infrastructure loan portfolios, and bank financing accounts for more than half of total infrastructure financing.¹⁵ Among the most important lenders is the China Development Bank, a policy bank set up in 1994 to provide long-term financing for key projects supported by the state.
- Direct fiscal support is declining. Traditionally, government financing more often took the form of direct fiscal support and what is referred to in China as “land premium”.¹⁶ In



¹⁵ Bank financing may have given rise to maturity mismatches. However, given the high saving rate and relatively sound performance of most infrastructure projects, the mismatch has so far not had a significant impact on bank performance. Also, some working capital loans may actually be used for infrastructure investment, to be renewed later when the loans mature.

¹⁶ The land premium refers to the proceeds the authorities receive from real estate developers for the use of lands previously acquired by the authorities minus the associated cost of land acquisition.

recent years, central and local governments have tended to assign a larger role to debt instruments.¹⁷

- Corporate bonds have become more important, but remain a small share in total financing as the bond market remains underdeveloped. So far, these bonds have largely been guaranteed by public banks or other associated companies, which have enhanced credit ratings to levels that allow commercial banks and insurance companies to invest.
- Uniquely, many infrastructure SPVs are listed in the stock market. These SPVs have actively channeled funds from the capital market to infrastructure projects.

Table 3: Outstanding Infrastructure Loans of China's Banking System

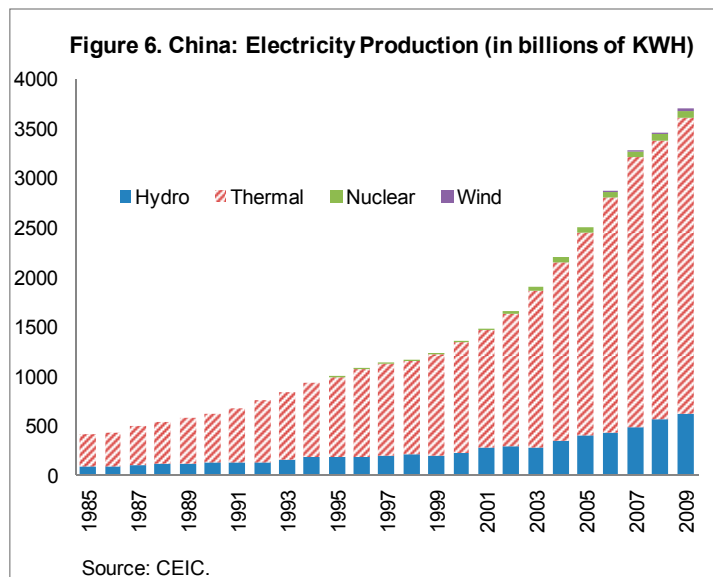
	2003	2004	2005	2006	2007	2007
Outstanding infrastructure loans	(in billions of US Dollar)					(percent of GDP)
China Development Bank	114.3	137.7	164.0	187.1	224.1	6.4
Industrial and Commercial Bank of China	80.8	104.6	98.2	130.7	162.6	4.7
China Construction Bank	45.3	63.1	75.7	92.4	112.4	3.2
Bank of China	48.1	52.3	57.1	66.3	79.1	2.3
China Merchants Bank	9.2	12.0	13.5	14.4	16.2	0.5
Bank of Communication	7.0	9.7	14.0	19.6	27.1	0.8
Agricultural Bank of China	82.3	93.9	103.6	118.5	137.2	3.9
Other banks	89.2	95.6	114.7	142.2	181.9	5.2
All financial institutions	476.1	568.8	640.9	771.3	940.5	26.9
Outstanding infrastructure loans	(in percent of total loans)					
China Development Bank	82.8	80.7	77.5	73.8	74.8	
Industrial and Commercial Bank of China	19.7	24.0	25.3	29.6	31.6	
China Construction Bank	23.8	23.8	25.6	26.3	27.0	
Bank of China	22.7	25.0	26.0	26.6	26.0	
China Merchants Bank	25.6	27.3	24.2	20.4	18.3	
Bank of Communication	10.5	12.4	15.0	16.9	18.6	
Agricultural Bank of China	40.0	40.0	40.0	40.0	40.0	
Other banks	15.0	15.0	15.0	15.0	15.0	
All financial institutions	24.8	26.4	27.0	27.3	27.3	

Sources: Credit Suisse, annual reports of commercial banks, and IMF staff estimates.

¹⁷ Local governments are not allowed to issue debt. However, there are no regulations prohibiting SPVs from issuing debt. As a consequence, local governments have established infrastructure SPVs as a platform to secure financing for infrastructure projects.

A. Electricity

China's electricity production has increased by more than tenfold in the past two decades, reaching 3.7 trillion KWH in 2009. Thermal generation accounts for 80 percent of total production. Hydroelectric production has increased dramatically since 2000, now accounting for 18 percent of the total. Nuclear electricity production emerged in the early 1990s but has remained small as a share of total production. Wind generation has grown rapidly in the past few years, but remains less than one percent of the total.



The industry is dominated by five large state-owned groups, which account for about half of total electricity production. Private participation has been broad: there are more than 50 power generation companies listed in the stock market,¹⁸ and private capital reportedly has been more active in hydropower and wind power plants. Though there are scant statistics, it appears that private capital accounts for the majority of investment in small hydro power projects in some provinces.

However, the financial performance in this industry has been generally unsatisfactory, and uneven across regions and technologies. The financial performance of these listed companies is far from being satisfactory.¹⁹ The median ROE was about 5.8 percent in 2009, and the median net margin stood at 3.9 percent, which were significantly below the average of all listed companies. In general, most thermal power plants are at the brink of making losses or are already loss-makers, while some hydro and wind power plants are quite profitable, as are many firms serving the more developed coastal provinces. However, the boom in hydro and wind projects has been fueled by government subsidies, including those under the Clean Development Mechanism.

The lackluster performance of the electricity production industry as a whole, SOE dominance, and uncertainty in state policies have deterred private investment. In addition, retail electricity prices are subject to state regulation, while the prices of inputs such as coal

¹⁸ The five SOE groups are China Huaneng Group, China Datang Corporation, China Guodian Corporation, China Huadian Corporation and China Power Investment Corporation.

¹⁹ Grid companies are mainly state monopolies and their performance is beyond the scope of this note.

have been increasingly liberalized, squeezing the profitability of thermal power plants. Recognizing these problems, the authorities announced in May 2010 a plan to encourage private investment in a few industries previously dominated by SOEs, *inter alia* electricity production, though it remains unclear how the policy will be implemented.

B. Highways

China's road construction—mainly driven by local governments—has expanded dramatically in the past ten years as the length of highway has more than doubled to 3½ million km in 2009.

Government expenditure and bank loans remain the major financing vehicles for road projects, accounting for about 3/4 of the total financing in 2009. However, other sources of funding are playing an

increasing role. Private capital is reported to have been very active, some of which took the form of BOT and TOT (Transfer-Operate-Transfer). The corporate bond market is being explored, so are asset-backed securities and foreign loans (including from multilateral institutions), while quite a few highway SPVs have issued equity in the stock market.

A glance at listed SPVs—whose financial disclosure is better than other firms—provides some insight about financial performance in this industry. In China's stock market, around 20 highway SPVs are listed. These SPVs can be involved in both management and development of highways. Some also acquire existing highways to bring a highway network under their control, aiming to benefit from scale economies. In 2009, the listed

highway SPVs had assets totaling more than US\$24 billion. The median level of ROE stood at around 9 percent, which is close to the average level of the stock market as a whole. Meanwhile, the median net margin was about 36 percent, a reasonably high level compared to other industries.

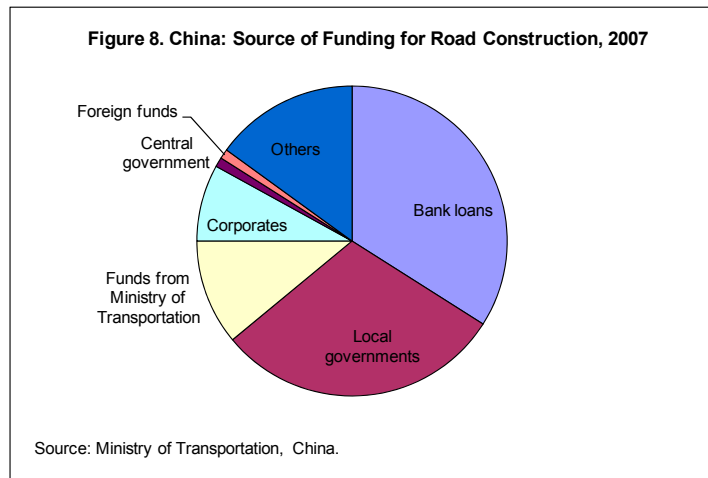
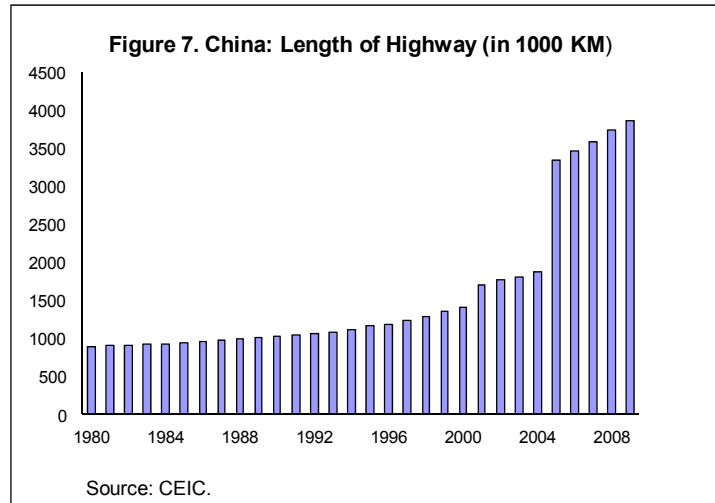


Table 4. Financial Indicators of Selected Highway SPVs Listed in China's Stock Exchange--2009

		Net margin (%)	ROE (%)	Total assets (billions of US\$)
1	Ninghu Hwy 1/	35.03	12.00	3.73
2	Shen Hwy	37.47	6.61	3.25
3	Zhongyuan Hwy	21.42	7.67	3.21
4	Ganyue Hwy	37.78	14.04	2.15
5	Shandong Hwy	28.68	11.23	2.03
6	Fujian Hwy	32.92	10.06	1.76
7	Wantong Hwy 1/	38.01	12.72	1.40
8	Yue Hwy-A	35.44	9.23	1.31
9	Modern Investment	35.80	17.03	0.82
10	Chongqing Road	28.27	6.36	0.71
11	Dongguan Holding	62.55	10.29	0.69
12	Huabei Hwy	35.48	7.43	0.62
13	Wuzhou Transport	59.33	6.60	0.59
14	Chutian Hwy	38.77	11.22	0.55
15	Hainan Hwy	25.18	2.31	0.40
16	Jilin Hwy	25.98	8.60	0.34
17	Longjiang Transport	42.33	4.80	0.46
18	Hunan Investment	46.45	7.67	0.31

1/ These corporations are also listed in the Hong Kong Stock Exchange.

Source: Annual Reports of listed companies.

VI. KOREA

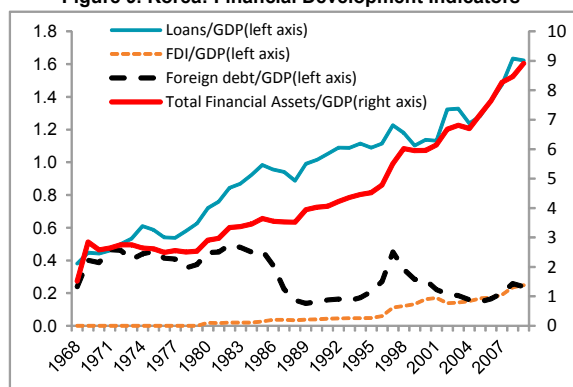
Infrastructure investment has been a crucial component of Korea's longstanding export-driven growth strategy. During the 1960s, infrastructure investment accounted for around one third of gross fixed capital formation. At the time, Korea's financial system was relatively poorly developed, so infrastructure finance was heavily dependent on public and foreign sources.²⁰ (Figure 9). Korea has relatively detailed statistics on infrastructure investment. Table 5 shows the rapid growth in infrastructure investment in the 1960s and 1970s. Though infrastructure investment declined as a share of total investment since then, during the 2000s infrastructure still accounted for 11 percent of gross investment.

²⁰ Even FDI was negligible until a 1998 foreign investment promotion law came into force. With domestically financed investment a relatively small share overall, it is likely that infrastructure, too, was heavily reliant on foreign sources.

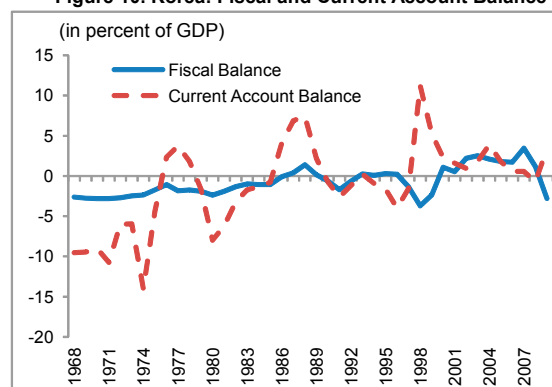
Table 5. Korea: Infrastructure Investment

	1960s	1970s	1980s	1990s	2000s	2005	2006	2007	2008
(yoy percent change)									
Gross Fixed Capital Formation	41.0	36.3	16.7	13.1	7.5	3.4	4.4	6.7	8.1
Infrastructure Investment	36.3	48.0	12.7	16.0	5.5	0.6	11.5	12.6	12.0
of which:									
Electricity, gas and water supply	67.3	46.2	9.9	18.7	3.1	7.9	5.7	12.7	2.6
Transport and storage	49.9	57.6	15.8	14.7	7.6	-4.2	15.8	12.5	18.3
Manufacturing	43.1	49.9	19.0	10.0	11.0	9.0	5.4	8.0	11.3
Information and Communication	n.a.	53.8	23.2	21.9	5.6	-4.3	18.6	4.2	3.4
(in share of Gross Fixed Capital Formation)									
Infrastructure Investment	32.5	13.6	16.3	11.0	10.8	9.7	10.4	11.0	11.3
of which:									
Electricity, gas and water supply	8.4	6.7	7.0	4.8	4.5	4.1	4.2	4.4	4.2
Transport and storage	24.1	6.9	9.3	6.2	6.3	5.6	6.2	6.5	7.1
Manufacturing	23.7	23.0	26.6	23.6	25.1	26.1	26.4	26.7	27.5
Information and Communication	0.0	2.1	4.0	5.0	7.1	6.0	6.8	6.6	6.3

Source: The Bank of Korea, National Accounts.

Figure 9. Korea: Financial Development Indicators

Source: The Bank of Korea, Flow of Funds

Figure 10. Korea: Fiscal and Current Account Balance

Source: IMF World Economic Outlook, October 2009

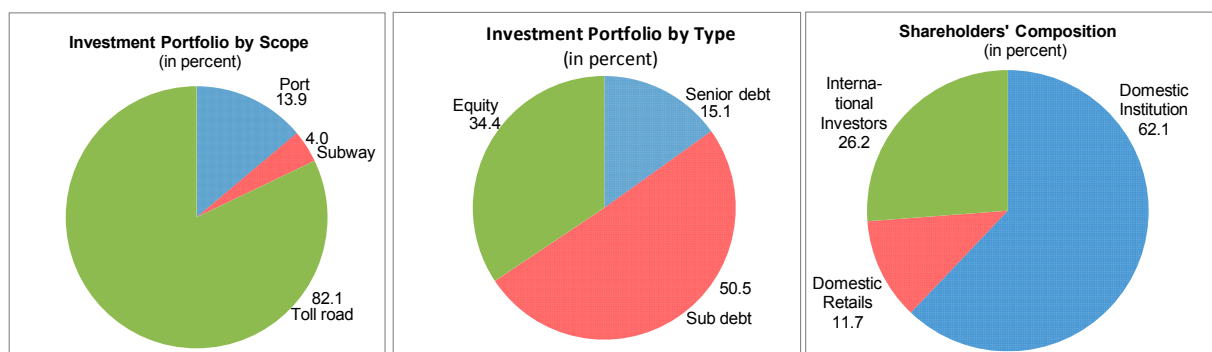
In the 1990s, as financial sophistication increased, the Korean government moved to increase private participation in infrastructure, though this was initially limited in size and sectoral coverage. Some measures included partial VAT rebates when facilities were completed, capped public guarantees, early completion bonuses and permission for excess profit resulting from lower than expected construction costs, and compensation for certain losses such as those due to exchange rate movements. This program was successful and the ratio of private to public investment in infrastructure increased to 18.4 percent in 2008.²¹

The government later also allowed the creation of private equity infrastructure funds. These funds were intended to support further private investment in infrastructure, but also to

²¹ The ratio of private investment to public investment decreased to 15.4 percent in 2009 as the government raised infrastructure investment spending to respond to the global financial crisis.

improve the pool of management and operation skills by encouraging more active project management. These funds allow investors to provide equity to green field infrastructure projects as well as through recycling equity currently tied up in near-complete or operating infrastructure projects. One of the largest currently in operation, the Macquarie Korea Infrastructure Fund (KIF), has around US\$ 1.7 billion under management, and is listed in Seoul and London. Institutional investors comprise 62 percent of shareholders, with domestic (12 percent) and foreign retail (26 percent) investors holding the remaining shares (Figure 11). The fund invests primarily in toll road construction, with some involvement in port facilities and other areas as well.

Figure 11. Macquarie Korea Infrastructure Fund 1/



Source: Macquarie Korea Infrastructure Fund 2009 Annual Report.

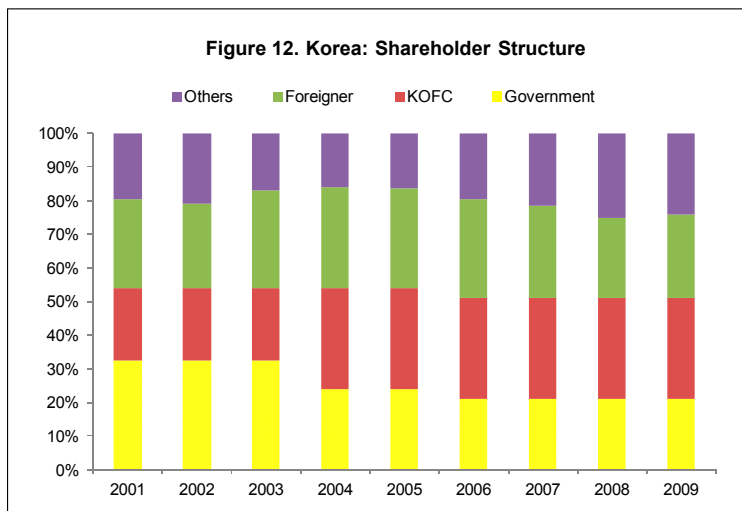
1/ MKIF is one of major infrastructure fund in Korea established on 12 December 2002 and managed by a Korea-based joint venture between Macquarie Capital Funds Limited and Korea's Shinhan Capital Co. Ltd.

Establishing the legal and regulatory framework for these private equity funds was not straightforward and the Korean authorities faced difficulties in a variety of areas, *inter alia*, the funds' legal structure (e.g., permission to make unlisted investments, dividend tax regulations, issues related to minority equity stakes), concern about investors' knowledge of infrastructure investment, fee structures, and valuation issues. However, since these concerns have been addressed, infrastructure funds have become more active. By end-2009, a total of US\$76 billion in privately executed projects was underway in Korea.

A. Electricity

Korea's electricity sector is state dominated. The Korean Electric Power Corporation (KEPCO) was completely state owned between 1981 and 1989, when the government floated 21 percent of common shares. KEPCO is now an integrated electric utility company engaged in the transmission and distribution of almost all electricity in Korea with a large number of subsidiaries operating in specialized energy fields. KEPCO and its six generation subsidiaries account for approximately 87 percent of the electricity generating capacity in Korea as of end-2009. The sector is reliant on coal, which at end-2009 constituted 44.1 percent of overall electrical supply, with nuclear energy account for another third.

KEPCO directly issues stock, but there are limitations on shareholdings by foreigners, and a legal requirement that the government directly or indirectly hold at least 51 percent of the capital stock. As shown in Figure 12 the government and the Korea Finance Corporation (KOFC) now hold 51.1 percent of common stock, while foreigners hold 24.9 percent and domestic investors 24.1 percent.



Capital equity has been increased over time through issue of common stock at par value, capitalization of capital surplus, DR issuance, conversion of convertible bonds, government investment, and stock dividends by transferring revaluation surplus.

KEPCO actively issues bonds domestically and in foreign markets. By end-2009 these accounted for around two thirds of total KEPCO liabilities. Foreign debt issuance tends to be at longer maturities than domestically issued debt, taking advantage of a broader global market in long-term fixed income securities, while the company pays an interest premium for domestic shorter-term issuance.

Table 6. Korea: Outstanding Electric Power Bonds as of end-2009

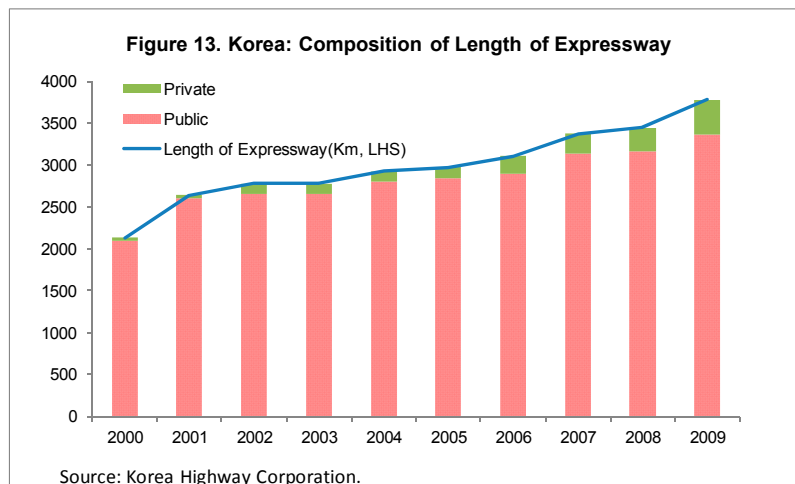
Type	share (%)	Average of Maturity(years)	Max of Maturity (years)	Average of Interest rates(%)	Max of Interest rates(%)
Domestic	86.0	4.8	10	5.7	7.2
Foreign	14.0	24.5	100	5.6	8.3
Total	100.0	6.7	100	5.7	8.3

Source: Korea Electric Power Corporation.

B. Highways

During the earlier phases of Korea's development, highway construction was largely financed publicly, though multilateral lenders covered around one quarter of construction costs during the 1960s. The government also established the Korea Highway Corporation (KHC) to issue highway construction bonds and contract foreign loans. With the market for long-term securities relatively small at that time, most public debt was held by the central bank until the early 1970s, at which point banks, nonfinancial corporations and individual investors became more important.

Between 2000 and 2009, around one-quarter of highway construction was privately financed, though the stock remains small relative to the publicly financed share (Figure 13). Under a 1994 scheme to increase private investment in infrastructure, BOT and BLT (Build-Lease-Transfer) mechanisms were allowed for private investors.



The government also

provided incentives including minimum revenue guarantees, a guarantee of buyout rights, and various tax reductions and exemptions. The government also established an infrastructure fund to carry out equity and loan investment in private infrastructure projects on a commercial basis.

Financing

Over the last ten years KHC continued to receive financial support from the government, though declining as financial markets in Korea have developed and more options for external funding have appeared. During this period, 79 percent of funding has come from domestic bond issuance, with an additional 14.5 percent from foreign bonds.

KHC issues debt at long tenors, with a maximum maturity of 30 years in the domestic market and a maximum coupon rate of 8.6 percent. KHC has also issued bonds abroad since 2003. Issuances in 2009 carried spreads of 350-450 basis points above Libor. Nevertheless, the average remaining maturity of domestically issued bonds is longer than that of internationally issued ones, while their average interest rate tends to be higher.

Table 7. Korea: Outstanding Korea Highway Bonds as of end-2009

Type	share(%)	Average of Maturity(years)	Average of Remaining Maturity(years) 1/	Max of Maturity (years)	Average of Interest rates(%)	Max of Interest rates(%)
Domestic 2/	95.9	9.4	5.1	30	6.0	8.6
Foreign	4.1	8.1	4.6	10	4.8	5
Total	100.0	9.3	5.1	30	6.0	8.6

Source: Korea Highway Corporation.

1/ as of December 31, 2009.

2/ Domestic Bonds includes currency swap and private placement.

VII. CONCLUSION

The goal of this paper was to look at how countries have financed infrastructure improvements and what financing options are available to emerging market countries that are planning to increase infrastructure investment substantially, such as India. Country

experiences in general are quite heterogeneous, but some themes apply across the countries in this sample.

The broad-brush analysis of linkages between infrastructure investment and the macro economy showed that improvements in infrastructure can be financed in a variety of ways. As in previous research, the results above imply that high growth tends to accompany infrastructure investments, which could be taken as evidence that rapid growth makes such investments more affordable, or that there is a strong payoff to infrastructure growth. The evidence on whether such increases are financed domestically or externally is less clear: it appears that domestic savings tends to rise during periods of strong investment in the electricity sector, but that foreign sources, or at least a reallocation of domestic savings, tends to occur during periods of rapid investment in roads.

On the modalities of how these increases are financed, public finances do not appear to deteriorate during periods of rapid investment in the two areas assessed here. The higher growth associated with infrastructure booms unsurprisingly leads to higher central government revenues, but spending totals do not appear significantly higher. It is possible that this is due to reallocation of existing spending envelopes, but without further research it is impossible to exclude the possibilities that local governments in fact finance such improvements, that such improvements are too small to show up at the macroeconomic level, or that country experiences are just too heterogeneous.

Financial deepening tends to occur during periods of infrastructure development, both in terms of bank credit and in terms of bond finance. Again, causality is not clear in these cases - financial deepening also tends to accompany rapid growth – but it does suggest that infrastructure finance can be accommodated within a growing financial system rather than crowding out other sources of finance during a period of significant investment.

These results were supplemented by four case studies. The country experiences discussed above also present some broad lessons for how infrastructure can be financed using private sector resources. In India, a number of overlapping challenges have hampered private sector financing of infrastructure finance. The case studies above show how three of these have been addressed.

First, securing sufficient long-term financing for infrastructure investments is of paramount importance in all four countries. Chile and Korea have been relatively successful in developing local bond markets to support relatively long-term issuances by infrastructure companies. In Chile's case the development of the country's pension system was crucial: the growing pension system of the 1990s created a market for local currency-denominated long-term securities, minimizing the need for bank finance. In Korea, foreign and individual investors are now relatively important, but in earlier stages banks also purchased infrastructure debt. Finally, in China and Brazil, bank loans have been instrumental. In China

public banks have provided long-term financing, while in Brazil, BNDES, the main public development bank, has proved to be a major source of finance.

Second, motivating institutional investors to buy into long-term debt markets is difficult without some form of credit enhancement. Only Chile has been successful at encouraging institutional investors to buy bonds issued by fully private companies. Chilean pension funds are only able to invest in investment-grade securities, but private (and largely foreign) insurance companies have insured infrastructure bonds, allowing the pension funds to buy into these markets. In Korea, private infrastructure funds operate with extensive background public guarantees. In Brazil and China, public sector banks finance a great deal of infrastructure projects: through BNDES in Brazil, and through a range of options in China, including implicit local government guarantees and bond insurance provided by publicly owned banks.

Finally, mobilizing foreign savings for infrastructure has been undertaken in a variety of ways across countries. Multilateral lenders have been important in quite a few countries, but encouraging private finance has been more challenging, though prospects have improved over time. In Korea and Brazil, large public sector electricity companies are able to issue debt in international credit markets. The ratings of those companies, however, depend on the rating of the sovereign that investors assume would stand behind the company. Both countries have also been reasonably successful at encouraging foreign companies to invest in publicly guaranteed infrastructure funds (Korea) and in public-private partnerships (Brazil). China and Chile represent opposite extremes: in China, foreign participation in infrastructure is minimal, while in Chile, a competitive electricity sector is operated to a large extent by foreign owned multinationals and foreign companies bid for and buy road construction and operation PPPs along with domestically owned companies.

These results have some important implications for India. Banks have dominated infrastructure finance in India in recent years, as they have in some countries looked at above. But the RBI has rightly been concerned about asset liability mismatches and concentration risks, and has not allowed the same levels of concentration in infrastructure assets that Chinese banks have taken on. The Indian government has not been willing to take on the contingent fiscal liability that a development bank like BNDES might present. The obvious alternative is to look at domestic institutional investors, which should be a fruitful area for India, given that their investments are so far concentrated in government securities. The development of the New Pension Scheme (NPS) also holds the promise of significant growth of assets under management of pension funds.

However, encouraging institutional investors to move into infrastructure would require regulatory changes. Large insurance companies and pension and provident funds would have to be allowed to diversify into bonds issued by private insurance companies. Here an important concern would be exposure to the credit risk of infrastructure bonds. In Chile, private insurance companies have taken on these risks, but Chile's market is relatively small

and in any case, many monoline insurers are in difficult financial straits at present. Risk-seeking domestic investors might be a source of capital for bond insurance, especially if bankruptcy proceedings could be improved to allow better recovery from infrastructure projects. Beyond this, India would have to look to foreign investors.

Of course, credit guarantees could be issued by the public sector, either directly through loan guarantees or indirectly through regulatory forbearance at public sector banks. However, this process raises fiscal risks which should be taken into account and transparently managed. Chile has developed a sophisticated method for estimating contingent fiscal liabilities stemming from infrastructure investment, including both a probability-based average estimated cost from failed PPPs as well as a maximum exposure. Preparing a similar report in India would present better information about contingent fiscal liabilities and clarify these long-term risks.

India has tapped multilateral lenders, as other countries have, but with India reaching the peak of exposure to World Bank lending while infrastructure needs remain large, this pool is unlikely to grow quickly in the medium term. Securing private financing, on the other hand, would likely require institutional improvements. Korea's framework for foreign infrastructure funds had to be repeatedly adjusted in the 1990s, but has now resulted in a relatively large pool for foreign investors, albeit one with public guarantees. Chile and to a lesser extent Brazil have been open to foreign companies bidding on road projects, but in both cases a pro-business environment and transparency in policy administration have been crucial.

Finally, in Brazil, Chile and Korea energy companies have issued shares and bonds in international markets, but those companies have had investment-grade ratings and have benefited implicitly from sovereign guarantees. This might be practical for some larger Indian corporates or public utilities, but the fiscal risks will have to be carefully monitored and managed.

References

- Aschauer D. A. (1989c), "Does Public Capital Crowd Out Private Capital?" *Journal of Monetary Economics*, Vol. 24, pp 171-88.
- Barro R. J. (1990), "Government Spending in a Simple Model of Endogenous Growth," *Journal of Political Economy*, Vol. 98, pp 103-125.
- Canning, D. and P. Pedroni (2008), "Infrastructure, Long Run Economic Growth and Causality Tests for Cointegrated Panels" *The Manchester School*, 76, 504-527, 2008.
- Calderón, C. and L. Servén(2004), "The Effects of Infrastructure Development on Growth and Income Distribution," working paper, Central Bank of Chile.
- Credit Suisse Report(2009), "China Market Strategy"
- Donaldson, D. (2010), " Railroads of the RAJ: Estimating the Impact of Transportation Infrastructure," NBER working paper 16487.
- Engle R. F. and Granger C. W. J. (1987), "Co-integration and Error Correction: Representation, Estimation, and Testing," *Econometrica*, Vol. 55, pp 251-276.
- Ghali K. H. (1998), "Public Investment and Private Capital Formation in a Vector Errorcorrection Model of Growth," *Applied Economics*, Vol. 30, pp 837-844.
- Gramlich E. M. (1994), "Infrastructure Investment: A Review Essay," *Journal of Economic Literature*, Vol. XXXII, pp 1176-1196.
- Holtz-Eakin D. and Schwartz A.E. (1995), "Infrastructure in a Structural Model of Economic Growth," *Regional Science and Urban Economics*, Vol. 25, pp 131-151.
- Mohammad, A. (2010). "Manufacturing Sector Productivity in India: All-India Trends, Regional Patterns, and Network Externalities from Infrastructure on Regional Growth," Dissertation, University of Maryland.
- Pedroni, P. (1998a), "On the Role of Human Capital in Growth Models; Evidence from a Nonstationary Panel of Developing Countries," working paper, Indiana University.
- Röller, L.H. and L. Waverman (2001), "Telecommunications Infrastructure and Economic Development: A Simultaneous Approach," *American Economic Review*, 91, (4).