

Inderst, Georg

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ADB Working Paper Series

**Infrastructure Investment, Private Finance, and Institutional Investors:
Asia from a Global Perspective**

Georg Inderst

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Georg Inderst is an independent adviser at Inderst Advisory in London, United Kingdom.

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Please contact the author for information about this paper.

Email: georg@georginderst.com

Asian Development Bank Institute
Kasumigaseki Building 8F
3-2-5 Kasumigaseki, Chiyoda-ku
Tokyo 100-6008, Japan

Tel: +81-3-3593-5500

Fax: +81-3-3593-5571

URL: www.adbi.org

E-mail: info@adbi.org

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Abstract

This study evaluates infrastructure investment and finance in Asia from a global perspective. It provides an overview on infrastructure needs and the various sources of private finance, globally and within Asia, and creates a “bigger picture” for the demand and supply of capital for infrastructure by using a simple framework, i.e., percentages of gross domestic product.

The picture is expectedly not uniform across Asia, but some interesting features emerge from global comparisons. Overall, the private sector still plays a relatively subdued role. Bank loans dominate private infrastructure finance, and there is much scope for the further development of capital markets. The volumes of listed and unlisted investment instruments, of project finance and of public–private partnerships, are still small in relation to investment needs and well below the global average. However, there are some notable exceptions.

Institutional investors are widely seen as a new financing source for infrastructure. There are some distinctive features in Asia, such as the prominence of large pension reserve funds and sovereign wealth funds, and comparatively weak private long-term savings institutions. The current asset allocation to infrastructure by domestic investors is overall very low, and the attractiveness for foreign investors still sub-par. Expectations on the future involvement of investors in this field should be realistic, and there are barriers and risks that need to be worked on. Asian governments can take steps to attract more private capital.

JEL Classification: G23, G28, G31, H54, O16, O18

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1. INTRODUCTION

Good infrastructure is key to economic growth as well as social and ecological development. Infrastructure investment requirements are huge worldwide, and particularly so in developing economies. Many countries are held back by chronic underinvestment in infrastructure and poor maintenance of existing infrastructure. However, there can also be “overinvestment” of taxpayers’ money in infrastructure. With public sector budgets often stretched, the private sector is asked to play a bigger role in the financing of infrastructure.

This study evaluates infrastructure investment and finance in Asia from a global perspective. It provides an overview on infrastructure needs and the various sources of private finance, globally and within Asia. Institutional investors are widely seen as a promising new financing source, but it is less clear what their potential contribution is. An increasing number of pension funds, insurance companies, sovereign wealth funds (SWF), and other investors are seeking investment opportunities in this field. However, they are not a homogenous group as they all have their own different objectives and experience is still short.

Given the importance of these subjects, surprisingly little seems to be known to date. Information is typically piecemeal, with definitions of “infrastructure” varying rather widely. Nonetheless, it is important to look at the “bigger picture” of the supply and demand of capital for infrastructure. This paper puts the information available into a simple framework, i.e., percentages of gross domestic product (GDP), in order to get a better understanding of the “orders of magnitude” in this field. Further studies may provide more detail in particular areas.

The report is structured as follows. Section 2 gives an overview on historical infrastructure spending and projections of future infrastructure investment needs, globally and in Asia. Section 3 evaluates the supply of capital and the various sources of infrastructure finance. It discusses the role of corporate and project finance, and presents the main investment vehicles, such as listed infrastructure companies, infrastructure funds, direct investments, and project bonds. Furthermore, it looks at public–private partnerships (PPPs) as an alternative financing arrangement, and private participation in infrastructure in emerging markets more generally.

The role of institutional investors as financiers of infrastructure is discussed in Section 4, in particular their asset base and investment activities. Section 5 presents barriers and risks in this process, and considers their potential future contribution. The paper concludes in Section 6 with experiences and lessons learned thus far by investors, plus recommendations for policy makers.

2. INFRASTRUCTURE FINANCING NEEDS

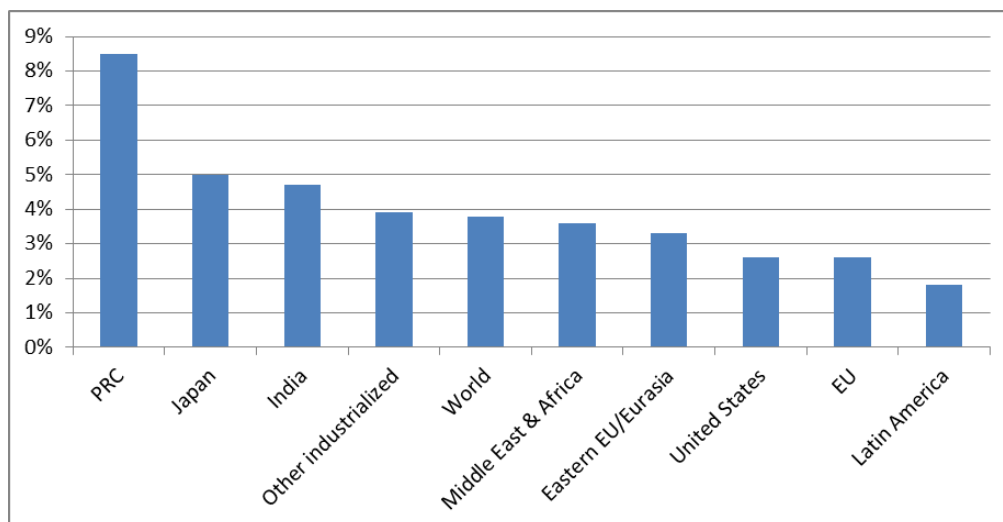
2.1 Historical Perspective

We take historical infrastructure spending as a starting point. About 3.8% of world GDP has been spent on *economic* infrastructure over the last 20 years, i.e., an annual amount of around \$2,400 billion (applied to 2010 GDP). Infrastructure investment in both the United States (US) and the European Union (EU) amounted to 2.6% of GDP, but was much higher in East Asia, with 5% in Japan and 8.5% in the People’s Republic

of China (PRC)¹ (Figure 1) (McKinsey 2013).² Infrastructure spending trended down in the developed world from 3.6% of GDP in 1980 to 2.8% in 2008, but grew in emerging economies from 3.5% to 5.7% of GDP. This rise was primarily driven by East Asia while Latin America in particular lagged behind.

Figure 1: Infrastructure Spending, 1992–2011

(% of GDP)



EU = European Union, GDP = gross domestic product, PRC = People's Republic of China.

Source: McKinsey (2013).

World Bank research (Fay et al. 2011) estimated annual infrastructure spending in developing countries in 2008 at \$800 billion–\$900 billion, of which \$600 billion–\$650 billion was by the public sector, \$50 billion–\$100 billion by official development assistance (ODA), and \$138 billion with private participation in infrastructure (PPI). Relative to GDP, this was 4.2% globally, 6.8% in East Asia Pacific, 4.2% in South Asia, 7.1% in Sub-Saharan Africa, 6.9% in the Middle East and North Africa, and 1.2% in Latin America and Europe and Central Asia.³

Infrastructure investment patterns differ considerably, not only across regions but also within regions and countries. For example, spending on infrastructure investment is much lower in Association of Southeast Asian Nation (ASEAN) countries than in the PRC, at roughly 1.5% of GDP in Indonesia, 2% in Thailand and the Philippines, and 3.5% in Malaysia (Goldman Sachs 2013). The Republic of Korea appears midfield with a figure of 4.3%. For the South Asia region, Andrés et al. (2014) report an increase in investment from 4.7% of GDP in 1973 to 6.9% in 2009, driven mainly by electricity generation.

¹ The country names in this report are according to ADB convention.

² The report covers seven sectors of economic infrastructure (roads, rail, ports, airports, power, water, and telecom), merging data from different sources: International Transport Forum (ITF) for transport, HIS Global Insight (IHS) for energy (including generation) and telecom, and Global Water Intelligence (GWI) for water.

³ Country groups of developing countries as defined by the World Bank (2015a). For simple reference: World GDP in 2012 was about \$72 trillion, the GDP of Asia \$21 trillion (share of 30%), East Asia Pacific \$18.5 trillion (26%), South Asia \$2.5 trillion (4%), emerging Asia \$13 trillion (18%). Asia has close to 60% of the world population.

Unfortunately, data are not available for global or Asian investment in social infrastructure. For Europe, Wagenvoort et al. (2010) calculated an additional 1% of GDP in the health (0.6%) and education (0.4%) sectors.

Overall, longer-term economic infrastructure spending has been measured at about 2.6% for Western, developed countries and 3.8% of GDP globally. There is a wide dispersion across emerging markets and developing economies (EMDEs). East Asia compares well both among developed and developing countries. However, infrastructure investment levels have been much lower in many other Asian countries.

2.2 Estimates of Future Demand

Infrastructure bottlenecks are evident in many places. More investment is required not only to build new projects but also to maintain existing infrastructure. This paper's focus is on the financial, not the physical aspect. Future investment needs are not easily quantifiable—financing gaps (i.e., the difference between the capital needed and the capital available) even less so. We now look at some main estimates in this respect.

2.2.1 Global Estimates

Some groundwork was produced about a decade ago by the Organization for Economic Co-operation and Development (OECD 2006, 2007, 2012) in a sectoral analysis. Infrastructure needs in key economic infrastructure sectors add up to a total of over \$80 trillion until 2030, i.e., about \$3 trillion per annum, or more than 4% of world GDP (Table 1). Top-down estimates produce similar results.⁴ Based on such figures, the World Economic Forum (WEF 2012) calculated a global infrastructure financing gap of about \$1 trillion per annum (1.25% of GDP).

Table 1: Global Infrastructure Investment Needs to 2030
(% of world GDP)

Water		1.3
Telecom		0.5
Transport		0.8
Road	0.3	
Rail	0.3	
Airports	0.2	
Ports	0.1	
Energy		1.5
Electricity transmission and distribution	0.2	
Electricity generation	0.7	
Other energy	0.4	
Oil and gas, transmission and distribution	0.2	
Total		4.1

GDP = gross domestic product.

Sources: OECD (2006, 2007, 2012), WEF (2012), Inderst (2013).

⁴ There are two basic approaches: top-down and bottom-up estimates. The first is based on the development of macro-statistics, such as GDP, capital stock, and investment. The second is based on microeconomic information, such as regional and sectoral case studies, planning documents from local entities, and experts' assessments.

Most estimates concentrate on the infrastructure needs to keep pace with “normal” economic and demographic growth, rather than any “social optimum.”⁵ Investment for climate change mitigation and adaptation, or to meet low-carbon targets, requires additional resources. The same is true when other targets for social and human development are introduced. For example, by adding “green infrastructure” needs, estimates could rise to \$3.5 trillion–\$5 trillion per year, or roughly 5%–7% of GDP, globally (WEF 2013).

2.2.2 Infrastructure Capital Stock and Productivity

It appears that capital investment could, to a certain extent, be substituted by good infrastructure policy and management. Better use of existing infrastructure and better selection of new projects could reduce the financing gap (Andrés et al. 2014). For example, McKinsey (2013) estimates a potential 60% improvement in infrastructure productivity that could save an annual \$1 trillion in spending worldwide. Furthermore, some countries might show a high overall infrastructure capital stock from past investments, but it may be of poor quality, with overcapacity in some sectors, or include some infrastructure “white elephants” (i.e., are expensive to maintain or difficult to dispose of).

McKinsey (2013) estimated an infrastructure stock of about 70% of GDP for most major countries, and also as a global average. Japan is the big outlier on the upside, with a ratio of 179%, driven especially by road infrastructure. The PRC and India are at 76% and 58%, while Southeast Asian countries are in the range of 30%–50% of GDP (IMF 2014). In the Asian context it is worth noting that “overinvestment” in the past may allow lower spending in future, at least in some places.

2.2.3 Emerging Markets and Asia

Infrastructure investment needs are expectedly higher in EMDEs than in developed markets. World Bank experts, using a top-down, multi-sectoral model, produced estimates of 6.6% of GDP on average in developing countries. New investment would take 2.6% of GDP and operations and maintenance 4.0% of GDP. However, there is a very wide dispersion between low-income (12.5%), lower-middle income (8.2%), and upper-middle income countries (2.3%). For comparison, the actual investment levels were estimated at 5%, 3.3%, and 1% respectively in 2008 (Fay et al. 2011; Estache 2010).

According to Bhattacharya et al. (2012), to keep pace with the demands of rapid urbanization and economic growth (at 4%), developing economies will need to increase spending from the current \$800 billion–\$900 billion to about \$1.8 trillion–\$2.3 trillion per year by 2020, or from about 3% to 6%–8% of GDP.⁶ In other words, a spending gap of approximately \$1 trillion per annum is projected for developing economies only. The East Asia Pacific region would require the highest share of this (35%–50%), followed

⁵ PWC (2014) expects global capital project and infrastructure spending to grow from about \$4 billion to \$9 billion per year over the next decade. The Asia-Pacific region is set to grow above average by 7%–8% a year, reaching an annual volume of about \$5 billion by 2025 and representing nearly 60% of the world total. The definition of infrastructure is wide-ranging in this PWC/Oxford Research Economics’ report, also including primary activities (e.g. extraction of oil, gas coal, metals and other resources), key manufacturing activities (that enable transportation and utilities sectors to develop and operate), and social infrastructure.

⁶ This includes investments for climate change mitigation and adaptation of \$200 billion–\$300 billion per year.

by South Asia (20%–25%). In terms of sectors, electricity takes the lion's share with 45%–60%.⁷

A number of regional studies have also produced estimates of future infrastructure investment requirements and gaps. In his work for the Asian Development Bank (ADB), Bhattacharyay (2012) found that 32 developing economies in Asia would need infrastructure investment of \$8.2 trillion (in 2008 prices) over the course of 2011–2020.⁸ In terms of sectors, about half of investments should go into energy, about one-third into transport (mostly on roads), and the rest into telecommunications, water, and sanitation. Two-thirds is needed for new capacity and one-third for maintenance and the replacement of existing assets.

The PRC requires more than half, and India more than a quarter of the estimated amounts, followed by Indonesia (5%). Relative to GDP, however, infrastructure needs are very high in South Asia (especially for roads), with a value of 11% against the regional average of 6.5% of GDP (Table 2). A number of other Asian countries have values over 8%, too (Lao People's Democratic Republic, Mongolia, Cambodia, Viet Nam, Uzbekistan, Tajikistan, the Kyrgyz Republic, and Afghanistan).

Table 2: Infrastructure Investment Needs, 2010–2020

	(% of GDP)				
	Energy	Transport	Telecom	Water and Sanitation	All Sectors
East and Southeast Asia	3.2	1.6	0.5	0.2	5.5
South Asia	3.0	5.6	2.0	0.4	11.0
Central Asia	3.0	1.9	1.4	0.4	6.6
Pacific	0.0	2.6	0.7	0.3	3.6
All Developing Asia	3.2	2.3	0.8	0.2	6.5

GDP = gross domestic product.

Source: Bhattacharyay (2012).

Andrés et al. (2014) took a closer look at South Asia and found annual investment requirements of between \$140 billion and \$210 billion (in 2010 prices), or between 6.6% and 9.9% of GDP. In an analysis of four ASEAN countries, Goldman Sachs (2013) produced a figure of \$550 billion to 2020, substantially higher than past spending and government estimates (\$427 billion).⁹

To sum up, future investment needs in economic infrastructure are somewhat higher (over 4% of GDP) than past spending on a global basis. Projections are much higher for developing countries at an average of 6%–8%. Within Asia, there is a very wide dispersion around the core estimate of 6.5%. Some countries would need to increase

⁷ In an alternative study by RBS (2011), infrastructure demand in emerging markets for the 20 years to 2030 is expected to rise to \$19.2 trillion, with Asia accounting for the lion's share of \$15.8 trillion. Over the previous 20 years, the estimated infrastructure spending was \$7.4 trillion, of which \$5.1 trillion was in Asia (PRC, \$2.9 trillion; India, \$1.3 trillion; and the Republic of Korea, \$0.3 trillion).

⁸ This breaks down to an annual \$776 billion of national investments (estimated in a top-down approach) and an annual \$29 billion for regional infrastructure (bottom-up approach).

⁹ The figure is a sum of \$240 billion for Indonesia (Economic Master Plan 2011–2025), \$45 billion for Malaysia (public spending on infrastructure in the 10th Plan 2011–2015), \$70 billion for the Philippines (2011–2016), and \$72 billion for Thailand (2012–2020).

infrastructure investment substantially over a longer period, while others already have a high capital stock.

Investment in social infrastructure and for achieving green targets or development goals (e.g. the UN Millennium Development Goals) would require additional resources, but little is known about the size. On the other hand, there appears to be potential for substantial efficiency improvements in the use and construction of infrastructure. This is an area that would deserve much more attention in both research and policy in future.

3. SUPPLY OF CAPITAL

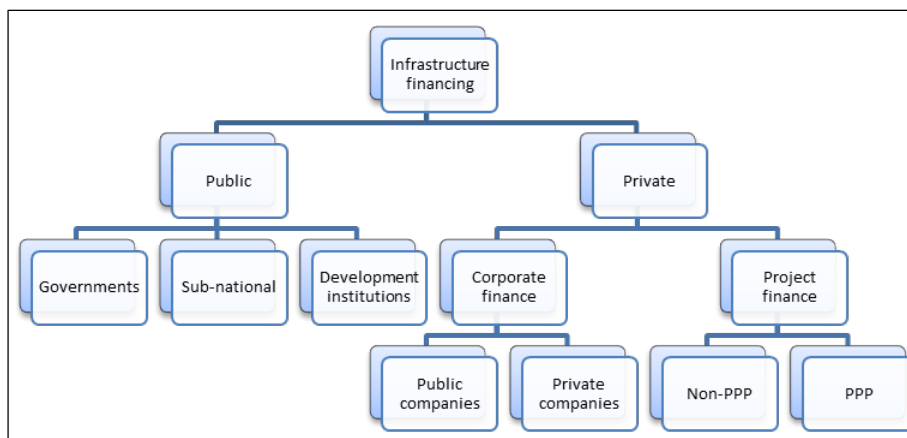
Now we turn to the composition of infrastructure finance, the supply of private capital, and investment vehicles. Figure 2 shows the main categories:

1. First, there are public or private sources of finance. Public capital comes from central, regional, local, and other government institutions, plus national development banks (NDBs) and multilateral development banks (MDBs), such as the World Bank, ADB, or the Islamic Development Bank.
2. Second, private capital is provided in two main forms: corporate finance (on balance sheet, from the own resources of infrastructure companies) and project finance, a contractual financing arrangement much used for infrastructure.¹⁰
3. Third, within corporate finance, one can distinguish between listed (publicly traded) and unlisted (private) companies. Within project finance, one can separate PPP and non-PPP arrangements.¹¹
4. Fourth, infrastructure companies can operate in regulated or unregulated sectors.
5. Fifth, there is typically a mix of equity and debt finance. Infrastructure and PPP projects in particular are often highly leveraged.

¹⁰ Project finance is the financing of long-term infrastructure, industrial, extractive, environmental, and other projects (including social, sports, and entertainment PPPs) based upon a limited recourse financial structure where project debt and equity used to finance the project are paid back from the cash flow generated by the project, typically a special purpose vehicle (SPV).

¹¹ A public-private partnership (PPP) is an arrangement between the public sector and the private sector for the purpose of delivering a project or a service traditionally provided by the public sector. Typically, a private sector consortium forms an SPV to develop, build, maintain, and operate the asset for the contracted period. The risk sharing depends on the specific contract.

Figure 2: Sources of Infrastructure Finance



PPP = public-private partnership.

Source: Author.

3.1 Sources of Infrastructure Finance

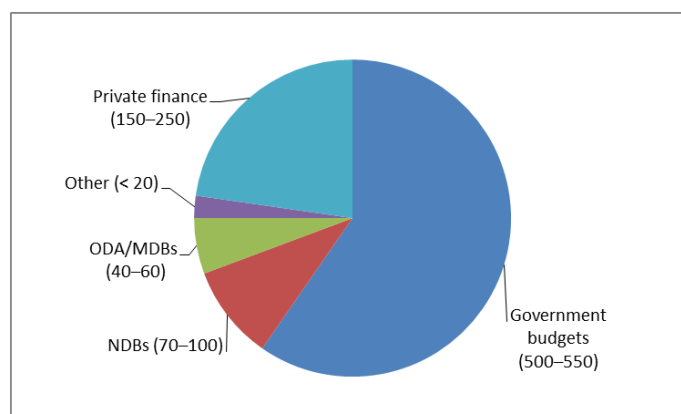
3.1.1 Public and Private Finance

The public sector has traditionally been central to the ownership, financing, and delivery of infrastructure services post-World War II. Private participation rose in several countries from the 1980s as a result of privatizations and, from the 1990s, with PPP schemes. Today, most developed countries, with the notable exception of Japan, have a higher share of private financing in infrastructure than developing countries. For example, in the EU, the ratio of public to private financing is about 1:2 in the old member states and 1:1 in the new member states (Wagenvoort et al. 2010). About 70% of the United Kingdom's economic infrastructure is funded by private sources (HM Treasury 2014).

In EMDEs, public funding of infrastructure accounts for about 70% of total infrastructure expenditure, according to World Bank estimates. Approximately 20% is financed by private sources, and the rest by development banks and agencies (Delmon and Delmon 2011). Similar figures are used by Bhattacharya et al. (2012) (Figure 3).

Figure 3: Sources of Infrastructure Finance in EMDEs

(\$ billion)



MDB = multilateral development bank, NDB = national development bank, ODA = official development assistance.

Source: Bhattacharya et al. (2012).

Public finance generally dominates in emerging Asia, especially in the PRC. Among the ASEAN countries, Goldman Sachs (2013) estimates a government share in infrastructure of 90% in the Philippines, 80% in Thailand, 65% in Indonesia, and 50% in Malaysia. There are efforts to shift the balance. For example, India is planning to move from about 2:1 to 1:1 between the 11th Five Year Plan 2007–2012 and the 12th Five Year Plan (2012–2017) (Sengupta et al. 2015).

ODA flows to the Asian infrastructure sector grew to a level of about \$12 billion in 2013 (Llanto et al. 2015). National development banks and MDBs have historically played an important role in Asia by providing loans, guarantees, and advice for infrastructure development, and also as a catalyst for private sector finance. The new Asian Infrastructure Investment Bank (AIIB) and the New Development Bank BRICS are designed to provide further finance.

3.1.2 Loan Financing and Capital Markets

Private capital investment, including infrastructure and project finance, is traditionally very dependent on bank loans in most countries outside North America. Since the financial crisis, the impacts of the recapitalization of banks and stricter regulations (e.g., Basel III) have been widely felt, especially by European banks. However, there has been a recovery of late, not the least boosted by very expansive monetary policies. Also, some non-European, e.g., Japanese and other Asian banks, have been more willing to lend over longer tenors. In Asia, bank loans still dominate infrastructure project finance, and public sector banks play a major role, especially in the PRC.

Asia has historically high savings rates, but one of the problems is a massive maturity mismatch between short-term bank deposits and long-term project financing (Yoshino 2012). Bank lending may be substituted, to a certain extent, in two ways. First, non-bank financial institutions, such as pension funds, insurers, or investment funds, may provide long-term loans directly. However, the point has been made that low credit standards and the low cost of funds by liquid Asian banks tend to push out non-traditional and foreign lenders (Greer 2015).

Second, there could be a stronger use of securitization and capital markets in infrastructure finance. A number of Asian countries made efforts to develop domestic capital markets already several decades ago. Countries such as the Republic of Korea, Malaysia, and Thailand were early in the use of infrastructure bonds, corporate bonds, and listed equities (Park 1998, Kumar et al. 1997; Walsh et al. 2011). However, there are considerable differences in the depth and structure of capital markets, e.g., in the use of state guarantees.

In international comparison, there is scope for further development of bond markets in particular (Ehlers 2014, ADB 2015, Burger et al. 2015). Also, some markets are more open to foreign investors than others.¹²

3.1.3 Conceptual and Data Issues

Infrastructure investment is finally receiving a high degree of public attention everywhere. However, it is still much under-researched, which is surprising given the importance of infrastructure investment for the economy and society.

¹² For example, Ray (2015) produced a table with FDI restrictions in five Asian countries. IOSCO (2012) compares the value of FDI to stock market capitalization. The ratio is around 30% in economies like the Republic of Korea, Malaysia, and Taipei, China, but only 1% in the PRC.

There are major conceptual issues in the discussion of the demand and supply of capital for infrastructure. Some of them are hinted at in the course of this paper, e.g., in relation to estimating infrastructure investment needs and financing gaps.

A crucial issue is the *definition* of infrastructure. Very different concepts are being used in the political, business, and financial worlds, including definitions along the lines of

- physical characteristics (roads, bridges, pipelines, cables, etc.);
- sectors (including economic infrastructure sectors such as transport, energy, water and waste, and sometimes also social infrastructure such as education and health);
- public and private infrastructure; new projects versus maintenance;
- economic characteristics (e.g., monopolies, networks, scale, barriers to entry);
- regulatory regimes (e.g., for utilities, airports);
- contractual approaches (e.g., project finance, PPP, and concessions); and
- investment characteristics (e.g., long-term, stable cash flows, inflation protection, low correlation to other asset classes, and relatively low default rates).

In practice, the implicit and explicit definitions of infrastructure vary widely, and there are a lot of grey and controversial areas (see, e.g., Beferman and Wain [2012], Inderst [2013]).

There are also major issues in relation to *data*, which are typically scattered around many places, incomplete, and not necessarily fully representative. To mention a few problems:

- Statistical sources have very different scopes and methodologies (national accounts, financial transactions, fund tables, asset allocation data, investor surveys, etc.).
- The underlying definitions of “infrastructure,” “investment,” “sectors,” “projects,” “institutional investor,” “public and private,” etc. can be unclear.
- Figures used in the discussions are typically just partial representations. There are sampling issues, with many gaps and overlaps.
- Data is often proprietary and of low transparency. Commercial data can be expensive or inaccessible to researchers.
- Data points are often incongruent, with figures out of date.
- Geographic definitions vary, especially for Asia, Asia-Pacific, emerging Asia, etc.
- There appears to be a “development bias” in data. Smaller and poorer countries tend to be underrepresented in statistics and research.

In a nutshell, infrastructure statistics need to be interpreted very carefully. National and international organizations could do a lot of “public good” by helping to improve the statistical information. We now look at the main building blocks of data available, keeping the earlier categorizations and caveats in mind.

3.2 Investment Vehicles

This report focuses mainly on private finance. From an investor’s perspective, this results in a multidimensional investment universe:

- equity and debt (bonds and loans) investments;
- listed and unlisted investment vehicles;
- direct and indirect (via investment funds) investment routes; and
- commercial funds, or funds sponsored by governments or national/international development institutions.¹³

As an example, investors can contribute to infrastructure debt finance by providing a loan to a particular project, by buying a project bond, or investing in a pooled vehicle. Table 3 gives an overview of the main investment instruments. The range of vehicles tends to be larger in developed markets although there are many practical examples of the use of different instruments in EMDEs (Inderst and Stewart 2014).

Table 3: Infrastructure Investment Vehicles

		Direct	Indirect
Equity	Listed	<ul style="list-style-type: none"> • Shares of transport, energy, water, utility companies, etc. • MLPs, YieldCos 	<ul style="list-style-type: none"> • Listed infrastructure fund • Investment trust • Indices, ETFs, derivatives
	Unlisted	<ul style="list-style-type: none"> • Direct investment in private companies/projects • Co-investment • Investor platforms, alliances 	<ul style="list-style-type: none"> • Unlisted infrastructure fund, closed-end, open-end • PPP fund • Fund-of-fund
Debt	Bonds	<ul style="list-style-type: none"> • Corporate bond • Project bond, PPP bond • Government infra bond, Sukuk • Sub-sovereign, municipal bond 	<ul style="list-style-type: none"> • Infrastructure bond fund • Trust structure • Bond indices
	Loans	<ul style="list-style-type: none"> • Private infrastructure debt • Project loan, PPP loan • Syndicated loan 	<ul style="list-style-type: none"> • Infrastructure debt fund • Hybrid/mezzanine fund

Source: Author.

3.2.1 Listed Infrastructure Companies

Corporate finance is a key element of private infrastructure finance. Companies listed on public exchanges are sizeable owners of infrastructure assets, and their capital expenditure is a substantial contributor to infrastructure investment in many countries. This includes companies that act as developers and operators of projects and infrastructure service providers, as well as more diversified conglomerates.

¹³ There are many examples of the former, especially in the Republic of Korea and India. Examples of the latter include the Asian Infrastructure Fund, the ASEAN Infrastructure Fund, InfraCo Asia, the Philippine Investment Alliance for Infrastructure Fund, the IDFC Indian Infrastructure Fund, and the PRC’s Silk Road Fund.

Infrastructure has become an important element of stock markets due to the privatization of electricity, gas, water, telecom, and other utility companies. Some countries also privatized transport assets, such as airports, ports, toll roads, bridges, and tunnels. Asian privatizations accounted for 22% of the global volume over the period 2013–2014 (FEEM 2014).¹⁴ RREEF (2011) found an “infrastructure equity universe” of 535 companies with a market capitalization of \$3.25 trillion worldwide. This was roughly 6% of the estimated global stock market capitalization, a percentage similar to the one worked out by S&P (2007).

With the emergence of the infrastructure investment theme in the mid-2000s, the major index providers all started to offer specialist infrastructure equity indices. There are major differences between indices in terms of the countries and sectors covered, the number and size of stocks included, and the particular index methodology.¹⁵ Regional and country weightings vary a lot, with Asia, including Japan, normally ranging between 10% and 20%.¹⁶ Some examples of indices give a feel for the relevance and structure of these markets.

Global emerging market infrastructure indices are usually dominated by Asian companies, ahead of Latin America. For example, Asia has a combined weighting of about 71% in the Dow Jones Brookfield Emerging Markets Index (of which the PRC is 27%; Hong Kong, China 14%; and India 10%), and about 62% in the Standard and Poor’s (S&P) Emerging Markets Infrastructure Index (of which the PRC is 40%; Malaysia 8%; and the Republic of Korea 7%).

There are also dedicated regional Asian infrastructure indices, and they show a high degree of variation. Here are some examples:

- The MSCI AC Asia ex Japan Infrastructure Index has 64 constituents with a total market capitalization of \$365 billion. The economy weightings are shown in Figure 4. In terms of sectors, it is very heavy in telecom companies (61%), notably China Mobile with a weighting of 23%. Electrical and gas utilities make up 17% and 10% of the index.
- The S&P Asia Infrastructure Index comprises 30 of the largest listed infrastructure companies in the region with a combined market capitalization of about \$250 billion. It does include Japan but does not have telecom stocks.¹⁷

¹⁴ There are estimates of revenues from asset privatizations of roughly \$3 trillion worldwide in the years 1988–2014. Of the \$357 billion raised by governments in 2013–2014, nearly \$80 billion was in Asia: \$41 billion in the PRC, \$11 billion in India, \$8 billion in Japan, \$5 billion in Singapore, \$4 billion in Malaysia, \$3 billion in the Republic of Korea, \$2 billion in Indonesia, and \$1 billion in the Philippines (FEEM 2014).

¹⁵ One of the main issues concerns the sectors and subsectors included or excluded in such indices, especially telecoms, industrials, oil and gas, construction, services, or diversified companies, etc. There are extreme examples of indices containing over 80% utility stocks.

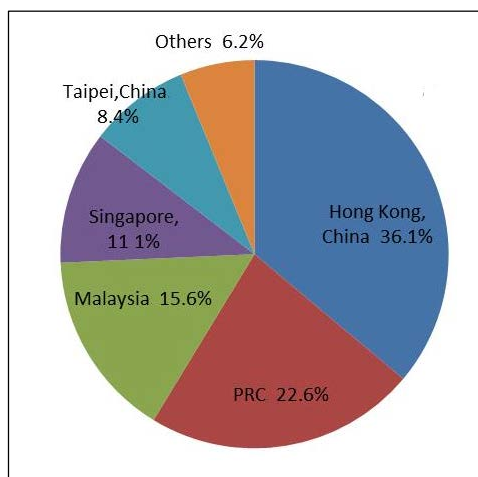
¹⁶ To give some examples, the FTSE Global Infrastructure Index has 839 constituents with a market cap of \$2.1 trillion. 291 companies are based in Asia, of which 111 are in Japan, 59 in the PRC, and 34 in Taipei, China. Asia has a market cap weighting of about 17% (of which Japan 11%, PRC 2%, and Hong Kong, China 2%). A more widely defined “Infrastructure Opportunities” Index has a market cap of \$4.2 trillion. Asia has a weighting of about 20%. The S&P Global Infrastructure Index tracks 75 companies with a market cap of about \$1.2 trillion. Asia has a weighting of about 12% (of which the PRC 5%, Japan 4%, Singapore 3%, and Hong Kong, China 0.4%) (figures as of March 2015).

¹⁷ In terms of sectors, it breaks down to 47% industrials, 43% utilities, and 11% energy stocks. In terms of economies, the weightings are Japan 29%; PRC 23%; Hong Kong, China 17%; Singapore 9%; Malaysia 8%; Thailand 5%; Republic of Korea 4%; Indonesia 3%; and Philippines 3%.

- The Dow Jones Brookfield Asia/Pacific Infrastructure Index has 23 constituents (of which about 35% is from Australasia) with a combined market capitalization of about \$100 billion. Oil and gas stocks account for over half of this index.¹⁸

Figure 4: Example of an Asian Infrastructure Index

(economy weightings, %)



Source: MSCI AC Asia ex Japan Infrastructure Index (March 2015).

Finally, there are several individual country infrastructure indices. The MSCI Japan Infrastructure Index has 18 stocks with a market cap of about \$220 billion. Examples for India are the S&P BSE India Infrastructure Index (with 30 stocks and a market cap of about \$140 billion), or the FTSE IDFC India Infrastructure Index (with 69 stocks and a market cap of \$60 billion). The Indxx China Infrastructure Index with 30 constituents (listed in Hong Kong, China; the US; and the EU) has a market cap of \$470 billion, and the new SSE Infrastructure Index with 26 constituents has a market cap about \$200 billion, of which \$75 billion is tradable.

Overall, listed infrastructure and utility companies represent about 5%–6% of the equity market universe, or around 4% of GDP, globally. Asia has a weighting in the range of 10% and 20% in global infrastructure indices. There are some very different regional Asian indices in the market, covering infrastructure companies with a market capitalization of up to \$500 billion. This is about 2%–2.5% of GDP in Asia, which is over half the global percentage.

It is worth noting that the listed company universe is not fully “private” because of stakes held by public sector entities. Going forward, it would be important to analyze the shareholder structure and investment behavior of listed companies, as well as the contribution of small and medium-sized enterprises.

Much of the focus in recent years has been on private or unlisted infrastructure investments, especially by infrastructure equity funds but increasingly also by debt funds. Some investors have also started to take direct stakes in infrastructure projects, or provide private loans.

¹⁸ In terms of sector, it breaks down into 52% oil and gas storage and transportation, 17% toll roads, 12% airports, 10% ports, 4% electricity transmission and distribution, 3% water, and 3% diversified companies. By economy, the weightings are Australia 32%; PRC 23%; Japan 20%; Hong Kong, China 19%; Singapore 4%; and New Zealand 3%.

3.2.2 Infrastructure Funds

Dedicated infrastructure funds were first created in Australia in the 1990s, and were typically listed funds. Since the financial crisis, institutional investors have mostly moved to open-ended fund structures there. In Europe, the US, and elsewhere, private equity-type, closed-end infrastructure funds have been growing since the mid-2000s.

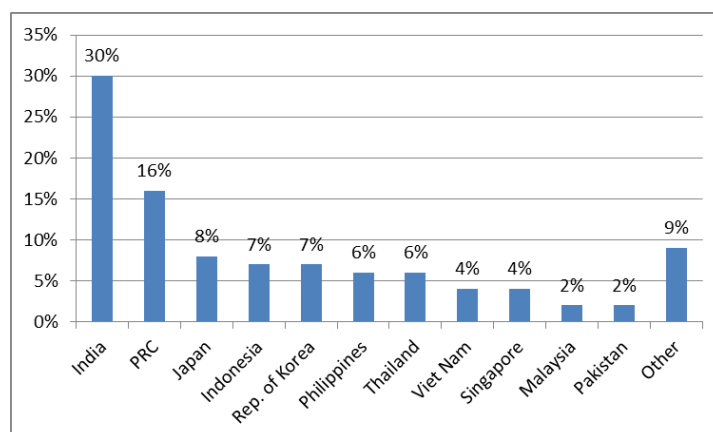
We now take a look at some figures for the capital raised by such funds, the volume of deals they generate, and the infrastructure managers and investors based in Asia. Consultant firm Towers Watson (2014) found assets of \$305 billion in direct infrastructure funds, of which 22% (\$67 billion) was invested in Asia.¹⁹ According to the data provider Preqin, about 400 infrastructure funds were launched worldwide over 2004–2014, with an aggregate volume of around \$300 billion. Annual figures have been rather volatile, with highs in 2007 (\$45 billion) and lows in 2009 (\$11 billion).

The majority of infrastructure funds are equity orientated. Only 39 debt funds were closed in the period 1998–2013 with a total volume of about \$30 billion, i.e., about 10% of total fundraising. However, the interest in infrastructure debt is on the rise: 31 debt/mezzanine funds are currently on the road, seeking a further \$23 billion. Their main focus is on European debt markets (Preqin 2015a).

Preqin (2014) recorded 73 Asia-focused private infrastructure funds with an aggregate capital raised of \$27 billion. In addition, 16 funds are currently on the road, seeking another \$10 billion. There are around 80 Asia-focused asset managers, which are mainly based in India (21%) or Singapore (18%), followed by Hong Kong, China; the US; and the PRC (9% each).

Around 700 transactions per year worldwide are undertaken by infrastructure funds, with a deal volume of about \$300 billion, i.e., 0.4% of world GDP. Preqin (2015b) registered around 100 deals per year within Asia in recent years, with an estimated annual deal value of around \$20 billion–\$30 billion, i.e., less than 10% of the global deal volume, or about 0.1%–0.2% of Asian GDP. India and the PRC posted the highest numbers of deals in the Preqin database (Figure 5).

Figure 5: Infrastructure Deals in Asia, by Country, 2010–2015



PRC = People's Republic of China.

Source: Preqin (2015b).

¹⁹ This is a survey of 589 “alternative” fund managers (i.e., outside conventional equity and bond assets) with assets under management of \$5.7 trillion. The weighting of infrastructure in this universe is about 5%, well behind real estate, private equity, and hedge funds.

In terms of sectors, 44% of all Asian deals completed were in energy, 22% in utilities, 16% in transportation, and 3% in telecommunications. Social infrastructure accounted for 13% of deals (education 5%, healthcare 5%, and government buildings 3%). Of all Asia-based deals on record, 39% were greenfield developments, 10% were at the brownfield stage, and 51% in the secondary market.

Looking forward, the primary focus of infrastructure investors appears to remain on the traditional markets in Europe and North America. A further \$95 billion of capital is currently being sought by around 150 new funds globally. Only 22 of them, seeking \$11 billion, have a specific focus on Asia, although there will be interest in the region also from global funds.

3.2.3 Direct Investment

In recent years, some investors have decided to “in-source” asset management. In this process, direct equity stakes in infrastructure projects and companies have become popular with institutional investors, such as large pension funds, especially in Canada, Australia, and Northern Europe. Also, several (Asian and other) SWFs have raised their interest in infrastructure assets, and so have other financial and industrial companies.

Insurance companies, especially in Europe, are increasingly involved on the infrastructure debt side with direct loans, either by taking over loans from banks or by providing longer-term direct credit to, for example, renewable energy projects. However, this requires adequate resources for credit analysis and risk management that many asset owners do traditionally not have. Several larger investors have started to build such specialist internal expertise.

In conclusion, private infrastructure investments, either directly or via funds, have been growing globally since the early 2000s. The number of infrastructure funds based in Asia, or targeting Asia, is lower than for Europe and North America. Infrastructure funds are reportedly generating around 100 deals per year in Asia, with a volume of \$20 billion–\$30 billion. This equates to 0.1%–0.2% of GDP, which is lower than the global average of about 0.4%.

3.3 Project Finance

Project finance has traditionally been used for both private and public infrastructure. Project finance statistics are often used for representations of private finance developments in infrastructure. However, it should be noted that project finance reaches beyond infrastructure sectors (e.g., oil, mining, and industrial sectors), while infrastructure investment reaches much further than project finance (especially corporate finance).

According to the data provider Dealogic (2015), the overall global project finance volume (equity and debt) was \$408 billion in 2014 from around 1,100 deals, down from the record level of \$437 billion in 2013. Annual volumes have moved around \$400 billion in recent years, i.e. about 0.5% of GDP. Regional and country shares varied considerably over the years. Project finance is generally highly leveraged. In 2014, 12% was financed by equity, 9% by bonds, and 79% by loans.

The deal volume of Asia (excluding the Indian subcontinent) was \$43 billion in 2014. It has ranged between \$40 billion–\$60 billion per year in recent years, i.e., about 0.2%–0.3% of GDP, and a global market share of 10%–15% (Table 4). The Indian subcontinent volume was \$46 billion in 2014. It fluctuated widely between a few billion in 2007 and over \$80 billion in 2010 and 2011, i.e., between 0% and 5% of GDP. The

global market share of the two Asian regions dropped to 22%, down from around 35% in 2009–2011. In terms of countries, India has been the second largest project finance markets in the world (behind the US).²⁰

Table 4: Project Finance Volume by Region

(\$ billion)

Region	2009	2010	2011	2012	2013	2014
North America	31	43	47	51	72	89
Latin America	34	19	30	42	48	57
Western Europe	54	75	74	55	77	68
Eastern Europe	11	20	28	8	9	12
Middle East/Africa	40	49	49	35	88	52
Australasia	17	19	37	83	38	43
Asia (excluding India)	50	48	52	63	46	43
Indian subcontinent	54	81	88	45	41	46
Total	291	355	406	382	418	408

Source: Dealogic (2015).

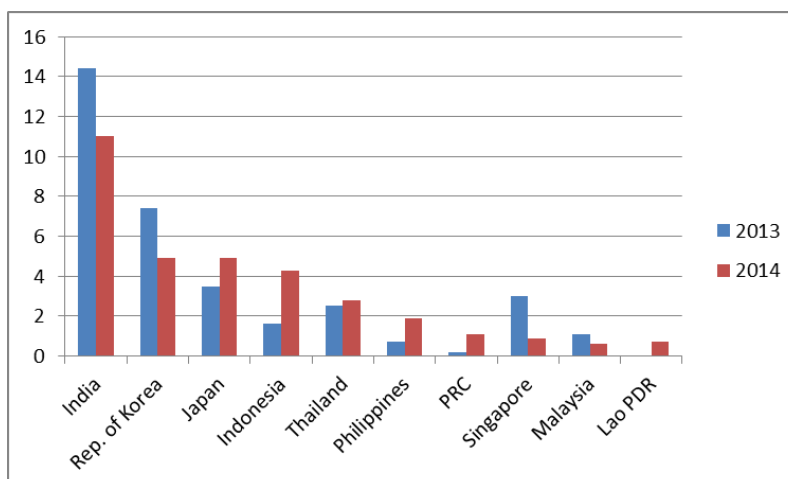
3.3.1 Project Finance Loans

Project finance debt markets took a hit during the financial crisis but have recovered since. As an alternative data source, Thomson Reuters (2015) concentrates on project finance loans. The global loan volume in 2014 was at a record \$258 billion, up 26% from 2013. In Asia, 150 transactions were recorded with a loan volume of \$33 billion in 2014, down from \$41 billion in 2013. This was a global market share of 13% (down from 20% in 2013) that was pretty evenly split between North Asia, South Asia, and Southeast Asia. In this database, too, India has been one of the largest markets with a volume of \$11 billion in 2014 (about 0.5% of GDP), and a peak of \$55 billion in 2010 (3% of GDP) (Figure 6).

In terms of infrastructure sector, in the Asia-Pacific region (including Australasia), 32% of the loan volume went into transportation and 26% into power, but only 1% into telecommunications and 0.4% into water, sewerage, waste, and recycling. Among other sectors, 19% was recorded for oil and gas, and 12% for mining in 2014.

²⁰ The other Asian countries change in the top-15 league tables every year. In 2014, Indonesia was 11th with a volume of \$8.2 billion and the Republic of Korea was 14th (\$7.7 billion). In 2013, Viet Nam (\$11 billion) was in 11th place. In 2012, Malaysia ranked 8th, the PRC 9th, the Republic of Korea 11th, and Indonesia 14th. In 2011, the PRC was in 11th place and Singapore in 14th place.

Figure 6: Project Finance Loan Volume in the Asia-Pacific Region
(\$ billion)



Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China.

Source: Thomson Reuters (2015).

3.3.2 Infrastructure and Project Bonds

The term “infrastructure bond” is used for different things. First, it is worth noting that some sovereign bonds have been earmarked for infrastructure, e.g., in Kenya (Inderst and Stewart 2014). Sub-sovereign bonds may also be dedicated to infrastructure investments.²¹ Municipal bonds are major infrastructure financing sources, especially in the US.

Second, utility and infrastructure companies often also issue corporate bonds. Such bonds may be part of corporate bond indices, although no major dedicated infrastructure bond index is known (except for Canada).

Third, there are project bonds in the narrow sense.²² They constituted about 10% of global project debt in the long term from 1994 to 2012. Project bond financing had a setback with the financial crisis, exacerbated by the demise of monoline insurers. However, markets have revived since. The volume was \$36 billion in 2013, i.e., a share of 9% of project finance. Volumes and shares have fluctuated considerably over the years (between 4% and 13%), but overall volumes have been small (less than 0.1% of global GDP) (Dealogic 2015).

Project bonds are historically more common in North America than in Europe. Canada, for example, has well-established project bond markets and a long experience of insurance companies being long-term investors in them. The EU project bond market has revived somewhat over the last few years. Although there is a history of debt securities for infrastructure in emerging markets and Asia, levels have been low. For example, the issuance volumes of Asian project bonds recorded in the Thomson Reuters and Project Finance International databases ranged between \$1 billion and \$3 billion in recent years (Kitano 2015,

²¹ Platz (2009) finds a relatively low volume of sub-sovereign bonds in Asia of about \$3 billion (from 43 issues) in the period 2000–2007, down from \$8 billion (from 13 issues) in the 1990s. Yoshino (2012) proposes government-issued “infrastructure revenue bonds” (in local currency) for Asia.

²² Project bonds are debt instruments issued by project finance companies. They are often tradable on secondary markets but can also be private placements. The backing for the bond is the cash flow generated by the project, while with corporate bonds it is the payment ability of the company.

Using a wider definition, Dailami and Hauswald (2003) analyzed 105 “infrastructure bonds” (mostly corporate bonds for financing infrastructure projects) in 20 emerging markets issued between 1993 and 2002 and denominated in US dollars. This set includes 43 Asian issues with a total volume of \$14 billion (13 issues are from Malaysia; 11 from the PRC; 10 from the Philippines; 3 from Thailand; 2 from Hong Kong, China and India; and 1 from the Republic of Korea and Indonesia).

Ehlers et al. (2014) found 1,625 infrastructure-related debt securities worldwide, with an annual average issuance of around \$50 billion in recent years.²³ During 2009–2013, 551 infrastructure bonds were issued in emerging Asia with a value of \$168 billion. The PRC market dominated with 340 issues at a value of \$142 billion, followed by Malaysia with 76 (\$5 billion), and Taipei, China with 64 (\$11 billion).²⁴ Without the PRC, the volume is still very low in emerging markets. In emerging Asia (excluding the PRC), it is only an annual of \$5 billion on average, or less than 0.1% of GDP, while including the PRC, it is about 0.4% of GDP.

The author notes the lack of depth and liquidity in the Asian infrastructure bond markets, especially for longer maturities, compared to North America (and partly also to Latin America:

- 98% of Asian issuance is in local currency.
- Issuance tends to be cyclical.
- The average maturity (9 years) is relatively short.

In comparison, the volume of syndicated loan finance in infrastructure in emerging Asia (excluding the PRC) over 2009–2013 was about \$210 billion. This implies a ratio of bonds to syndicated loans of 1:8. Asian infrastructure financing is rather loan-centric, as it is in Europe.²⁵

The market for Islamic bonds (*sukuk*) saw strong growth in recent years up to an annual volume of over \$100 billion (Rasameel 2014).²⁶ The majority of *sukuk* (62%) is issued by sovereigns, with Malaysia being the largest issuer by far. There is also *sukuk* by development banks such as the Islamic Development Bank. A smaller percentage is issued by corporates, including in infrastructure sectors (power and utilities constitute 9.4% of issuance, transport 7.2%, and telecoms 3.1%), and there is an emerging market for “infrastructure *sukuk*.”

In conclusion, the global project finance markets have recovered from the financial crisis. In Asia (excluding India), project finance volumes are at an annual value of about 0.2%–0.3% of GDP, i.e., roughly half the global average. India has been one of the largest (but fluctuating) markets in the world in recent years. Bank loans still dominate

²³ Their definition is relatively wide in terms of sectors. It includes infrastructure-related corporate and project bonds, but also includes project bonds by national and multilateral development banks.

²⁴ The PRC appears a special case in that report, where the high issuance (since 2009) is entirely due to state-owned enterprises with a perceived government guarantee. Traditionally, state-owned commercial banks held around 80% of infrastructure loan portfolios (Walsh et al. 2011).

²⁵ A financing source of growing importance in emerging markets has been export credit agencies, not the least to insure against currency and political risks. Export credit agencies were involved in syndicated loans, especially for larger infrastructure projects, with a value of about \$40 billion in the PRC and \$10 billion in emerging Asia (excluding the PRC) over the period 2009–2013 (Ehlers 2014).

²⁶ *Sukuk* are Islamic securities. They can be defined as certificates of ownership that grant the investor a share of an asset, along with the commensurate cash flows and risk.

Asian infrastructure project finance while project bond markets are still very small (less than 0.1% of GDP outside the PRC).

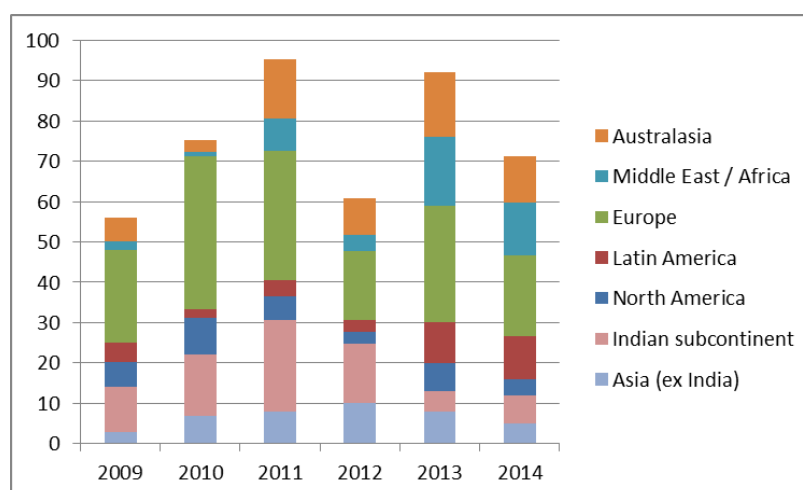
3.4. Public–Private Partnerships

PPPs have become increasingly relevant for public infrastructure investment as an alternative to spending by governments or (privatized) infrastructure companies. The United Kingdom (UK) and Australia are often seen as the most mature adopters, with PPPs accounting for around 10% and 5% of public investment in infrastructure, respectively (OECD 2014a). Various models and forms of PPPs have since been implemented in many countries (see, e.g., Nataraj [2007], Zen and Regan [2014], Gatti [2014], Engel et al. [2015], Kitano [2015]).

In a global database (Dealogic 2015), global PPP volumes have been in the region of \$60 billion–\$100 billion in total in recent years (around 0.1% of GDP). The 2014 total volume was \$72 billion, down from \$95 billion in 2013 and about 0.1% of global GDP. The share of PPP within project finance was 18% in 2014; traditionally, this share has ranged between 16%–25%. Transport and social infrastructure accounted for 69% of the volume.

Asia (excluding India) only posted PPP deals of less than \$10 billion per year, i.e., well below the global average. The Indian subcontinent shows relatively high but strongly fluctuating figures. PPP deals fell back from the highs in 2010–2011 to about \$5 billion in 2013–2014 (roughly 0.2% of GDP) (Figure 7).

Figure 7: Public–Private Partnerships Volume by Region
(\$ billion)



Source: Dealogic (2015).

3.3.3 Private Participation in Emerging Markets

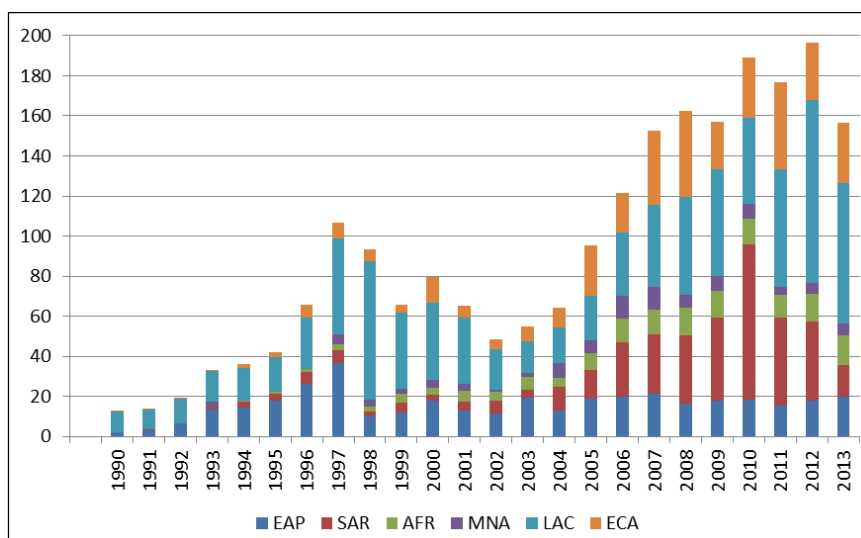
Governments in developing economies have been increasingly interested in attracting private capital for infrastructure investments. The Public-Private Infrastructure Advisory Facility (PPIAF) records “private participation in infrastructure” (PPI) in low and middle-income countries.²⁷ This includes PPP projects but also privatizations and other forms of private participation.

²⁷ Definition of PPI: Projects are considered to have private participation if a private company or investor is at least partially responsible for the operating costs and associated risks. Tracked projects have at least

In recent years, 250 to 400 PPI projects per year were recorded, with combined budgets in the range of \$150 billion–\$200 billion (PPIAF 2014), i.e., about 0.6%–0.8% of GDP.²⁸ In 2013, the volume was \$150 billion from 291 projects, a setback against previous years, especially in Brazil and India. Figure 8 shows a breakdown of PPIs by region. Latin America has traditionally the largest share.

Figure 8: Private Investment in Infrastructure in Emerging Markets and Developing Economies

(\$ billion)



EAP = East Asia Pacific; ECA = Europe and Central Asia; LAC = Latin America and Caribbean; MENA = Middle East and Northern Africa; SA = South Asia; SSA = Sub-Saharan Africa.

Source: PPIAF (PPI project database, March 2015); author.

East Asia and the Pacific's volumes have been in the range of \$15 billion–\$22 billion in recent years, i.e., 0.1%–0.2% of GDP. The PRC slowed down considerably in 2014, as troubles with local government financing vehicles affected new project funding (PPIAF 2015; Reuters 2015). Private investment in South Asia had strong growth in the 2000s, peaking at \$77 billion in 2010, but has fallen back since, with a 2013 volume of \$15 billion (about 0.6% of GDP). The Indian model is showing signs of strain.²⁹

Over the longer period, 1990–2014, deal volumes are by far highest in Brazil (\$468 billion) and India (\$330 billion). The PRC comes 5th with \$131 billion, Indonesia 8th with \$65 billion, the Philippines 9th with \$61 billion, and Malaysia 10th with \$60 billion.

For the East Asia Pacific region, 1,819 projects are recorded in the PPIAF database, with a total volume of \$389 billion—40% of the volume was in energy, 28% in telecoms,

25% private equity or in the case of divestitures, at least 5% private equity. The database classifies private infrastructure projects into four categories: management and lease contracts, concessions, greenfield projects, and divestitures (privatizations).

²⁸ The PPI Database focuses on four sectors: energy (excluding oil and gas extraction but including natural gas transmission and distribution), transportation, water and sewerage projects, and telecommunications services. PPIAF (2015) shows smaller figures because a new definition of "infrastructure" excludes the telecommunications sector.

²⁹ Private developers "have largely been dependent for project financing loans on state-owned banks. Because of high leverage structures and a combination of market forces and policy uncertainties, the sector has become highly indebted and several projects have been under stress to meet their debt servicing obligations. With worsening credit quality and peaked exposure limits, most banks are showing reluctance to participate in further credit expansion in the sector." (Ray 2015: 7)

23% in transport, and 8% in water and sewerage. Two-thirds were greenfield projects, 13% concessions, and 20% divestitures. For South Asia, there were 1,090 projects, with a total volume of \$383 billion (of which around 85% in India, 9% in Pakistan, 3% in Bangladesh, and 2% in Sri Lanka). The sector breakdown is 42% energy, 33% telecoms, 25% transport, and very little in water and sewerage; 76% were greenfield projects, 19% concessions, and 5% divestitures.³⁰

In summary, private participation in infrastructure has been growing over the years in emerging markets. In the East Asia Pacific region, PPI is only 0.1%–0.2% of GDP, and well below the global average. South Asia showed a strong up and down movement with a peak in 2010. PPPs have become an alternative financing mechanism in some places but many countries do still make very little or no use of PPPs. With the exception of India, PPP volumes are still small in Asia in absolute and comparative terms.

4. INSTITUTIONAL INVESTORS AS FINANCIERS

Institutional investment in infrastructure has become a much discussed topic in recent years, also in terms of public policy. Governments frequently call for a higher engagement of asset owners in the financing of infrastructure projects.³¹

Many investors have become interested in infrastructure as an “asset class” for their own reasons (Inderst 2010). In an environment of low interest rates in major markets, they are looking for alternative sources of income and better diversification.

Infrastructure investments potentially offer some useful characteristics for pension funds and insurance companies that have to match (often inflation-linked) annuity-type liabilities. Such assets are often expected to have long-term, predictable income streams, low sensitivity to business cycles, and low correlations to other asset classes. Project finance debt has exhibited relatively favorable default and recovery rates compared to corporate debt (Moody’s 2015). Finally, asset owners are also re-discovering “long-term investing”, trying to capture an “illiquidity risk premium” from infrastructure assets.

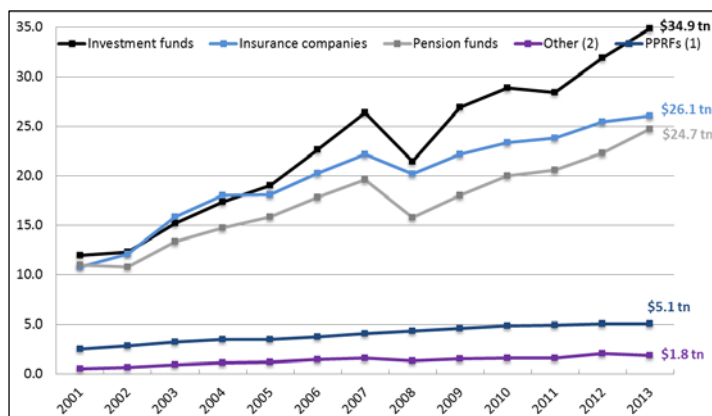
Institutional assets grew strongly in recent years. The Organisation for Economic Co-operation and Development (OECD) valued institutional assets in 2013 at \$92 trillion, of which \$25 trillion was in pension funds, \$26 trillion with insurance companies, \$5 trillion in public pension reserve funds, and \$2 trillion in foundations, endowments, and other institutions (Figure 9). Not shown in Figure 9 is the \$7 trillion in SWFs (SWFI 2015).³²

³⁰ Andrés et al. (2014) note a clear division across sectors in South Asia: privatization is the favored route in telecoms and energy, PPPs in transport, water, waste, and sewerage, and partly also in electricity transmission.

³¹ It is noteworthy that there was a “first wave” of institutional investor involvement in emerging markets infrastructure, including a number of Latin American and Asian social security and public pension funds in the 1990s (see, e.g., Ferreira and Khatami [1996]).

³² These figures do not include assets held by banks, non-financial corporations, central banks, or other government institutions. It is worth noting that there is also substantial wealth owned privately by households. BCG (2014) reports \$152 trillion of private financial wealth globally, of which \$15 trillion was in Japan and \$37 trillion in Asia (excluding Japan) in 2013. Asian wealth in particular is expected to grow rapidly. Some of the non-institutional capital may also be available for infrastructure investment over time, although this requires the establishment of appropriate investment management capabilities and instruments.

Figure 9: Institutional Investor Assets
(\$ trillion)



PPRF = Public Pension Reserve Fund, tn = trillion.

Source: OECD (2014b).

4.1. Asian Pension, Social Security, and Insurance Assets

In emerging markets, institutional assets are comparatively smaller but growing fast. McKinsey (2011) estimated the assets under management of pension funds in developing countries at \$2.3 trillion in 2010, i.e., about 8% of global assets. \$2.3 trillion in the insurance sector is about 10% in the global context. In contrast, SWFs are mostly based outside the OECD.

Asian pension and insurance assets were estimated at roughly \$10 trillion in 2010, i.e., a global share of about 18%. Asian pension funds held \$4.4 trillion of assets, of which the vast majority of \$3.3 trillion were in Japan, and \$0.5 trillion in the PRC. Similarly, Asian insurance companies held \$5.1 trillion, of which \$3.5 trillion were in Japan and \$0.6 trillion in the PRC. In terms of insurance assets, there is a big gap between advanced Asia (where insurance assets are 50%–70% of GDP) and developing Asia (less than 20% of GDP).

The OECD (2014b) recorded \$1.8 trillion of (autonomous) pension plan assets in Asia, i.e., about 7% of the global volume.³³ The highest volumes were for Japan with \$1,331 billion; Hong Kong, China with \$103 billion; the PRC with \$99 billion; the Republic of Korea with \$82 billion; and Thailand with \$23 billion. As a percentage of GDP, this equates to 29% for Japan; 38% for Hong Kong, China; 1% for the PRC; 7% for the Republic of Korea; and 6% for Thailand. Even the largest Asian funded pensions systems are well below the OECD average of 84% of GDP, with developing Asia at less than 5%.

There are several sizeable social security and public pension reserve plans in Asia, adding up to about \$2.5 billion. Among the largest funds are: Japan's Government Pension Investment Fund (about \$1.2 trillion), the Republic of Korea's National Pension Service (\$400 billion), the PRC's National Social Security Fund (\$200 billion), Singapore's Central Provident Fund (\$190 billion), Malaysia's Employees Provident Fund (\$180 billion), and India's Employee Provident Fund (\$116 billion) (OECD 2014c).

³³ Estimates of pension assets differ across data providers, depending on the definition of (private and public) pension funds, the inclusion of social security funds, investment funds, unfunded schemes (e.g., book reserves), and other factors.

In terms of size relative to GDP, they are about 60% of GDP in Singapore, 50% in Malaysia, 27% in Japan, 22% in the Republic of Korea, 16% in Sri Lanka, and less than 10% of GDP in a range of other countries (Musalem and Souto 2012). Most of these schemes traditionally run conservative investment policies with a high allocation to domestic government bonds and deposits (Blanc-Brude et al. 2013).

The Asian pension systems look relatively weak also in qualitative assessments. For example, the Melbourne Mercer Global Pension Index (Mercer 2014) ranks Singapore above average (band B), but the PRC, Indonesia, Japan, the Republic of Korea, and India are all in band D.³⁴

Finally, the fund management industry in Asia (including mutual funds, unit trusts, ETFs, private equity funds) is also comparatively small and concentrated in more developed economies. ADB (2015) estimates assets under management of about \$4 trillion for the ASEAN+3 countries (i.e., plus the PRC, Japan, and the Republic of Korea).

Overall, there are some distinctive features of the institutional investor base in Asia. Private pensions and insurance assets are comparatively small and rather concentrated. However, there are several very large public pension reserve and social security funds in the region. Asia also has a good share of SWF assets, plus massive capital with other, mostly public, institutions, including central banks.

4.2. Investors in Infrastructure

Most asset owners have traditionally been investors in infrastructure securities, e.g., as shareholders of infrastructure companies listed on public stock exchanges, in IPOs of privatized utility companies, or as buyers of corporate bonds or municipal bonds. This is true not only for OECD countries, but also for a range of Asian and other emerging markets that have developed their capital markets in recent decades.

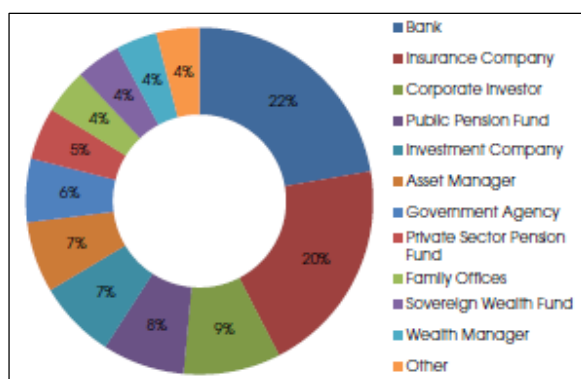
The situation is different for unlisted infrastructure investments. To start with pension funds in the leading countries, the average asset allocation for unlisted (or private) infrastructure is about 5%–6% of assets in Australia and Canada (Inderst and Della Croce 2013). Worldwide, an OECD (2014c) survey of large pension funds revealed \$70 billion of unlisted infrastructure equity investments and \$10 billion of infrastructure debt. However, infrastructure investments were only about 1% of the asset allocation of the whole investor group in the survey.³⁵

Insurance companies have traditionally hardly had any investments in unlisted infrastructure assets. However, several insurers and their asset management subsidiaries worldwide have become active in this space in recent times, especially in infrastructure debt.

Turning to the Asia-Pacific region, Preqin (2015b) tracked 295 infrastructure investors based in the region investing in infrastructure, i.e., 13% of their worldwide investor universe. The investor base is spread widely across investor types, with insurance companies and banks being the largest groups, with pension funds, foundations, and endowments less prominent compared to other regions (Figure 10).

³⁴ Ratings rank from A (best) to E (worst). The rating D indicates “a system that has some desirable features, but also has major weaknesses and/or omissions that need to be addressed.” (Mercer 2014: 7).

³⁵ Unfortunately, none of the five Asian Pension Reserve Funds surveyed reported on infrastructure investments.

Figure 10: Asia-based Infrastructure Investors

Source: Prequin (2015b).

The asset allocation to infrastructure of the largest 100 Asian investors is about \$65 billion, i.e., only 0.3% of total assets of about \$20 trillion. Of the top 100, 88 invest in private investment vehicles and 62 invest directly. Thirty of the top 100 investors are from Japan, 20 from the Republic of Korea, 13 from Australia, 11 from the PRC, and 10 from India. There is a notable rise of large Asian institutions on a global scale—there are now 15 of them among the top 100 global infrastructure investors, up from 5 in 2012.

Some Asian insurance companies are reported to have substantial (listed and unlisted) investments in infrastructure, especially in Japan; India; the Republic of Korea; and Taipei, China. Japanese pension funds also constitute an important element of the Asian investor base. The world's largest pension scheme, Japan's Government Pension Investment Fund (GPIF), revamped its investment strategy in 2014 with the intention to invest in alternative assets, including infrastructure.

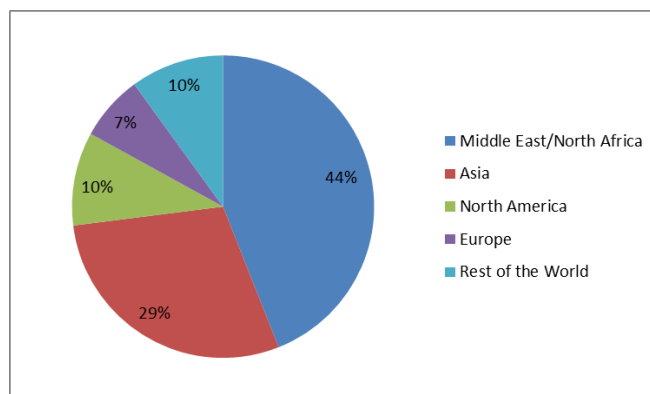
In summary, institutional investors, especially larger ones, have been increasing their unlisted infrastructure investments in recent years. Many smaller investors, but also some larger Asian reserve funds, have little or no exposure in this field. On average, the overall asset allocation to infrastructure is still small (globally about 1%–2% of assets, and it appears even lower in Asia).

4.3. Sovereign Wealth Funds

The assets of SWFs have grown to over \$7 trillion, with 40% of them based in Asia and 37% in the Middle East (SWFI 2015). SWFs have very diverse sources of funds (e.g., commodities), investment objectives (e.g., stabilization and pensions), and investment policies (ranging from risk-return criteria to economic and political influence) (Gelb et al. 2014).

Some SWFs have substantial infrastructure allocations while others have none. In the Prequin database, 60% of global SWFs invested in infrastructure in 2014, of which 44% are based in Middle East/North Africa and 29% in Asia³⁶ (Figure 11). Of the SWFs, 34% invest only directly in infrastructure, and 50% invest both directly and via funds.

³⁶ Large Asian SWFs investing in infrastructure include the China Investment Corporation, the PRC's State Administration of Foreign Exchange, the Government of Singapore Investment Corporation (GIC) and Temasek, the Hong Kong Monetary Authority, the Korean Investment Corporation, the Samruk-Kazyna in Kazakhstan, Malaysia's Khazanah Nasional, the Brunei Investment Agency, the Azerbaijan State Oil Fund, and the Timor-Leste Petroleum Fund. In addition, there are smaller (but often growing) SWFs in places like Viet Nam, Indonesia, Mongolia, and Turkmenistan.

Figure 11: SWFs Investing in Infrastructure, by Region

Source: Preqin (2013).

Direct investments by SWFs are estimated to be roughly 10% of assets. About \$500 billion was invested directly between 2005 and 2012, of which about \$55 billion went into transport infrastructure, \$60 billion into energy, and about \$20 billion into the telecommunications sector (TheCityUK 2013). Put together, this would imply a (still moderate) asset allocation percentage in infrastructure of roughly 2%.

Direct investments picked up in 2013 and 2014, with volumes of \$186 billion and \$117 billion. The US and the UK were the largest recipients, each accounting for around 16%. Other popular destinations included other EU countries and the PRC. The majority of SWF direct investments seem to go into financial services and real estate. There is a preference for existing assets rather than greenfield projects, thereby contributing to rising valuations (TheCityUK 2015).

Nonetheless, some SWFs have been seeking opportunities in EMDEs, e.g., Chinese funds with “infrastructure for resources” deals brokered in Africa. According to a survey by fund manager Invesco (2015), 17% of SWF infrastructure investments are in emerging markets. Assuming a 2% average asset allocation to infrastructure, this would imply a volume of about \$240 billion. This raises the interesting question as to whether SWFs could crowd out opportunities for other local and regional investors in these markets.

In conclusion, Asia has a large share of SWFs that are growing their assets and becoming increasingly involved in infrastructure. With an estimated average asset allocation of 2%, a number of them already have direct holdings in infrastructure assets, although mostly in established markets. Unfortunately, transparency on SWF investments is generally still low.

5. BARRIERS AND RISKS

The question is whether institutional investors could contribute more to the financing of infrastructure. Two points of qualification: First, it is often overlooked in this debate that pension funds, insurance companies, and other investors have been keen buyers of publicly listed infrastructure stocks and bonds for a long time. Second, investment in unlisted infrastructure is an ongoing process, as investor intention surveys indicate continued interest in this sector.

Actual and perceived barriers to infrastructure investment by institutional investors have been flagged in the past (e.g., Inderst [2009] and Della Croce [2011]). There are constraints on the supply side (e.g., lack of suitable projects, poor procurement processes, project size) and demand side (e.g., investor resources and capability,

portfolio concentration risk), as well as in the intermediation process and market structure (e.g., inappropriate, expensive investment vehicles; lack of secondary markets; weak capital markets) (Table 5).

Table 5: Barriers to Institutional Infrastructure Investment

Issues with government support for infrastructure projects	<ul style="list-style-type: none"> • Lack of political commitment over the long term • Lack of infrastructure project pipeline • Fragmentation of the market among different levels of government • Regulatory instability • High bidding costs
Lack of investor capability	<ul style="list-style-type: none"> • Lack of expertise in the infrastructure sector • Problem of scale of pension funds • Regulatory barriers • Short-termism of investors
Issues with investment conditions	<ul style="list-style-type: none"> • Negative perception of the value of infrastructure investments • Lack of transparency in the infrastructure sector • Misalignment of interests between infrastructure funds and pension funds • Shortage of data on infrastructure projects

Source: OECD (2014a).

Previous cases of investment in projects with poor returns and little economic value serve as timely reminders. Most investors have very little experience in infrastructure transactions and in managing infrastructure assets. Infrastructure is very heterogeneous, which does not make the task any easier.

From an investor perspective, there are risks inherent not only in infrastructure projects and companies but also in investment instruments and portfolios, including:

- construction and development risks of (greenfield) projects;
- operational, demand and market risks (e.g., changing traffic numbers);
- financial and interest rate risks (e.g., leverage, refinancing);
- governance standards (e.g., conflicts of interest, bureaucracy, corruption);
- legal, social and reputational risks (e.g., delays, failures, environmental issues);
- regulatory risks (e.g., changing regulation, cuts in subsidies, investor regulation); and
- political uncertainty (e.g., changes in government or infrastructure policies, expropriation risk).

Some of these hurdles are difficult to jump for foreign investors, especially in emerging markets with capital markets of low liquidity and currency risks that can hardly be hedged. Risk mitigation mechanisms need to be carefully evaluated (Schwartz et al. 2014). This requires good credit analysis and currency management, knowledge of local practices, reliable local partners, and, first and foremost, trust in the political system.

5.1.1 Investor Regulation

Investor regulation is often a main hindrance. There are three sets of regulation on the investor side that can be very relevant for infrastructure investment: solvency, accounting, and investment rules.

Institutional investors in different constituencies are subject to more or less strict regulatory regimes. Risk-based solvency regulations and fair value IFRS accounting rules for insurers and pension funds are seen as a potential obstacle to infrastructure investments, as they could lead to de-risking and pro-cyclical investment behavior (Severinson and Yermo 2012). For example, in the European Solvency II regime, capital charges are higher for less liquid assets, and bonds with longer maturities and lower credit ratings. However, the EU is in the process of somewhat reducing capital charges for a subset of lower-risk infrastructure assets.

In many countries, especially emerging markets, there are (quantitative and/or qualitative) investment restrictions investors have to abide by, which may hamper infrastructure investment (see, e.g., Vives [1999], City of London [2011], OECD [2014d]). In a survey of 32 countries, IOPS (2011) listed numerous examples of regulatory restrictions on alternative investments that affect both direct and indirect infrastructure investments.

About half of the reporting jurisdictions have qualitative restrictions on unlisted or non-transparent investments. Examples of quantitative limits include:

- restrictions on equity or corporate bond investments;
- investment in unlisted infrastructure companies (including Hong Kong, China, the Republic of Korea, and Japan);
- direct investments in projects (including Thailand);
- infrastructure funds or investments (including the PRC);
- alternative investments (including Pakistan);
- minimum ratings for bonds;
- constraints on leverage and the use of derivatives; and
- prohibitions or limits on foreign exposure (including India).

Such legal constraints on infrastructure and other investments may often have good justifications, such as the lack of transparency, the containment of excessive risks, liquidity requirements, etc. A number of countries have introduced special “positive” rules for infrastructure investments, such as India with minimum thresholds for insurers in infrastructure bonds. However, regulators should review investment regulations in light of their effect on long-term performance (such as the lack of investment opportunities and diversification), and the economy.

5.1. Institutional Investor Potential

Estimates of the institutional investor potential are particularly speculative, given the poor data situation. Also, institutional investors have very different objectives (including pensions, profitability, social, political) and different policies, also in respect of infrastructure. Investment behavior is influenced not only by law and regulation but also by considerations of diversification, liquidity, liability profile, scale and “investment culture.”

Expectations for future involvement need to be realistic for developed markets and even more so for EMDEs. Here is a simple calculation. A major asset allocation shift of 3%–5% by Asian institutional investors across the board (assuming assets of \$20 trillion) into infrastructure over 10 years would imply an average annual flow of about

\$60 billion–\$100 billion, or about 0.3%–0.5% of Asian GDP. Such an (optimistic) scenario would generate a substantial addition to the private finance flows into infrastructure. Nonetheless, it would still only amount a contribution of less than 10% of the projected investment needs.

There are several factors to consider in the discussion of the future potential:

- There needs to be a sufficient supply of suitable, investable infrastructure assets.
- The impact would also depend on the type of finance (equity or debt) and the availability of bank loans, given the leverage typical for infrastructure financing.
- Calculations also depend on the growth of private assets and especially changes of investor regulation. Appropriate investment management capabilities and instruments are needed for institutional assets (and even more so for individual savings).
- Given the relatively strong concentration of assets in a number of large public reserve funds and SWFs in Asia, much depends on their specific behavior.
- What assumptions can be made about the “infrastructure capital balance”? Currently, a lot of Asian capital seems to be going to Western markets, while the attractiveness of Asia’s infrastructure still appears to be sub-par for international investors.

6. CONCLUSIONS

This study evaluates infrastructure investment and finance in Asia from a global perspective. A “bigger picture” of demand and supply of capital for infrastructure is created by using a simple framework, i.e., percentages of GDP. There are major conceptual and data issues in this field, and infrastructure statistics need to be interpreted carefully. Asia is, of course, a highly heterogeneous continent, but some interesting features emerge from global comparisons, using the data currently available.

Historically, there has been a wide dispersion of infrastructure spending across regions and countries. Future investment requirements for economic infrastructure are estimated at around 4% of GDP globally, 6%–8% in emerging markets, and 6.5% in Asia. The capital stock is already high in some (East) Asian places but most countries would need to increase infrastructure investment considerably.

Developed countries worldwide tend to have a higher share of private financing in infrastructure than developing countries (the shares of public and private finance are, very roughly, 1:2 versus 2:1). This ratio varies considerably across Asia. Bank loans dominate Asian infrastructure project finance, implying a large maturity mismatch between short-term bank deposits and long-term project financing. There are considerable differences in the structure and openness of Asian capital markets, and there is scope for further development of securitization.

Corporate finance is a main element of private infrastructure finance. Listed infrastructure companies represent about 6% of the equity market universe, or 4% of GDP globally. Asia has a weighting in the range between 10% and 20% in global infrastructure indices. Asian infrastructure indices have a market capitalization of up to \$500 billion, about 2.5% of GDP.

Much of the focus in recent years has been on unlisted infrastructure investments, either directly or via funds, as they have been growing since the early 2000s. Asian

infrastructure funds are reportedly generating a deal volume of \$20 billion–\$30 billion per annum, i.e., 0.1%–0.2% of GDP, which is less than half the global average.

The global project finance markets have recovered from the financial crisis. Project finance in Asia (excluding India) runs at an annual value of about 0.2%–0.3% of GDP, i.e., roughly half the global average. India has been one of the strongest (but fluctuating) markets in the world in recent years. Project bond markets are still very small (less than 0.1% of GDP outside the PRC).

Private participation in infrastructure is only about 0.1%–0.2% of GDP in East Asia Pacific, well below the EMDE average. South Asia showed a strong up and down movement with a peak in 2010. With the exception of India, PPP volumes are still small in Asia, and many countries still make little or no use of PPPs.

Institutional investment in infrastructure is currently a much discussed topic. There are some distinctive features of the institutional investor base in Asia. Private pensions and insurance assets are comparatively small. However, there are several very large public pension reserves and social security funds in the region. Asia also has a good share of SWFs assets, plus important currency reserve funds and other public funds.

Asset owners worldwide have been traditional buyers of listed utility and infrastructure stocks and bonds. Since the mid-2000s, interest in unlisted vehicles, especially infrastructure funds, has risen. However, the overall allocation is still small (globally about 1%–2% of assets, and even lower in Asia). Some large investors have started to build substantial direct holdings in infrastructure projects, although much of the capital flows into established markets.

Infrastructure has specific risks for investors that need to be properly managed, and there are barriers and risks to higher involvement that need to be worked on. Investor regulation is often the main hindrance. Expectations on the future potential of (domestic and foreign) institutional investors need to be realistic. In Asia in particular, much depends on the specific behavior of the large public funds, and the (still low) attraction of international investors.

6.1. Lessons and Recommendations

Overall, the private sector still plays a relatively subdued role in Asia. The volumes of listed and unlisted investment instruments of project finance and PPP are well below the global average (with some exceptions), and still small compared to future investment requirements.

The involvement of institutional investors in the provision of infrastructure finance has been changing over time. Investing in listed infrastructure is typically undertaken along the usual lines of securities investing. Unlisted infrastructure as “alternative investments” is closer related to private equity and/or real estate. The experience of most investors is still very limited, if any. Nonetheless, some useful lessons can already be learned:

- Infrastructure assets are very heterogeneous. There are many dimensions, such as geography, sector, greenfield, brownfield, and secondary markets, regulated and unregulated, PPP and non-PPP, concessions, degree of inflation protection, and ultimate funding (user charges or availability payments).
- Infrastructure investing, especially direct investment, requires adequate size, resources, and good governance. For public (pension, social security, sovereign wealth) funds in particular, there is the risk of political motivation and interference—therefore clear financial objectives and good governance are paramount.

- There are major cycles in the valuation of assets, including periods with “too much capital chasing too few assets.”
- The financial crisis revealed risks at all levels: projects (e.g., excessive leverage, optimistic demand projections); funds (governance, conflicts of interest, fees); and asset management (concentration risk, lack of understanding).
- Infrastructure investment is inherently political. A lot depends on the trust put in the state authorities.

The infrastructure market has seen some ups and downs, and it has been evolving in several respects. New developments include:

- deeper scrutiny of projects and investment vehicles;
- a broader universe, including new regional markets, sectors, and specialist funds;
- open-ended, cheaper, more transparent funds;
- more direct investing;
- more infrastructure debt investment;
- co-investment by investors, syndicates, and capital pooling platforms for (smaller) pension funds (with or without public capital); and
- increasing awareness of climate change and “green” infrastructure (OECD 2015; Inderst et al. 2012).

There are also some important lessons for policy makers:

- Governments want private capital for new projects while most institutional investors prefer low-risk assets, i.e., a risk-preference mismatch. This is a key intermediation problem, and not easy to resolve. There is a debate in Australia, for example, about more “asset recycling”, i.e., the sale of operational public assets to build new infrastructure.
- Many countries are seeking to develop capital markets, e.g., for project bonds, but new markets take time and trust to evolve.
- Rule of law, political accountability, and continuity are paramount for investors. Investors express the need for consistent infrastructure policies (e.g., improving procurement processes, steady project pipelines, and good dialogue with the industry and investors).
- Retrospective changes to regulation and contracts are particularly harmful.
- Ultimately, it is not the financiers who pay for infrastructure services but the users or tax payers.
- There are advantages in having a mix of a domestic (e.g., for local knowledge) and foreign investor base (e.g., for external discipline and international standards).

Extensive recommendations have been made for policy makers on how to strengthen the role of private finance and institutional investors in infrastructure by many experts and organizations, such as the G20, OECD, and the MDBs. There are also more specific recommendations for Asia.³⁷

³⁷ See, e.g., Bhattacharyay et al. (2012), Basu Das and James (2013), Sheng (2014), Zen and Regan (2014), Ray (2015), and ADB (2015).

A number of countries have set up dedicated infrastructure or PPP agencies, national infrastructure banks or green banks. Such institutions can be instrumental in directing institutional investor involvement. New initiatives have also been started by international institutions such as the World Bank's Global Infrastructure Facility or the G20 Global Infrastructure Hub.

Governments can facilitate and incentivize private infrastructure investments in various ways (World Bank 2015b):

- i. Financial leveraging tools such as guarantees, insurance policies, credit enhancements (e.g. the European Project Bond Initiative).
- ii. The public sector can set up or co-invest in fund vehicles, e.g. a national or regional infrastructure fund.
- iii. Grants, tax exemptions and other fiscal incentives, etc.

The long-term costs and risks of such tools need to be carefully assessed. MDBs can play an important role as catalysts for private investments in various ways (project design, policy advice, co-investor, insurance, etc.). Private investors often appreciate the expertise and "political clout" of MDBs in new ventures.

Work needs to be done on all fronts, by governments, infrastructure businesses, investors, the financial industry, and academia. Asian governments in particular need to increase the attractiveness of private investment in infrastructure. Policy recommendations emphasized in this report include:

- i. Implement clear infrastructure policies, stable sector and PPP regulation, and effective government institutions. Reduce policy inconsistencies between different departments.
- ii. Expand the role of private long-term savings institutions with strong governance (such as autonomous pension funds and asset management).
- iii. Review investor regulation (and regulators), especially in regard to its effect on infrastructure investment.
- iv. Review sectoral regulation (in energy and transport, etc.), especially in regard to potential barriers for private investment.
- v. Increase the depth and breadth of local and regional capital markets (e.g., for project bonds, sub-national revenue bonds, and infrastructure funds).
- vi. Review the competitive situation in loan markets, especially the position of public banks.
- vii. Open markets for regional and international infrastructure investors.
- viii. Improve statistical information on infrastructure investment, transparency of investment vehicles, and disclosure on infrastructure projects.

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