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

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13.1 Introduction

Good infrastructure is key to both economic growth and social and ecological development. Globally, infrastructure investment requirements are enormous, 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 thin, the private sector is asked to play a bigger role in infrastructure financing.

This study evaluates infrastructure investment and finance in Asia from a global perspective. It provides an overview of infrastructure needs and the various sources of private finance, both 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 (SWFs), and other investors are seeking investment opportunities in this field but experience is mostly limited. Moreover, as they all have their own different objectives and constraints, they are not a homogenous group.

Given the importance of these subjects, there seems to be surprisingly little about them known. Information is typically scarce, and definitions of “infrastructure” vary widely. Nonetheless, it is important to look at the “bigger picture” of the supply of and demand for capital for infrastructure. This chapter gathers the available information into

a simple framework, i.e., percentages of gross domestic product (GDP), in order to reach a better understanding of the “orders of magnitude” in this field. Further studies may provide more detail in particular areas.

13.2 Infrastructure Financing Needs

13.2.1 Historical Perspective

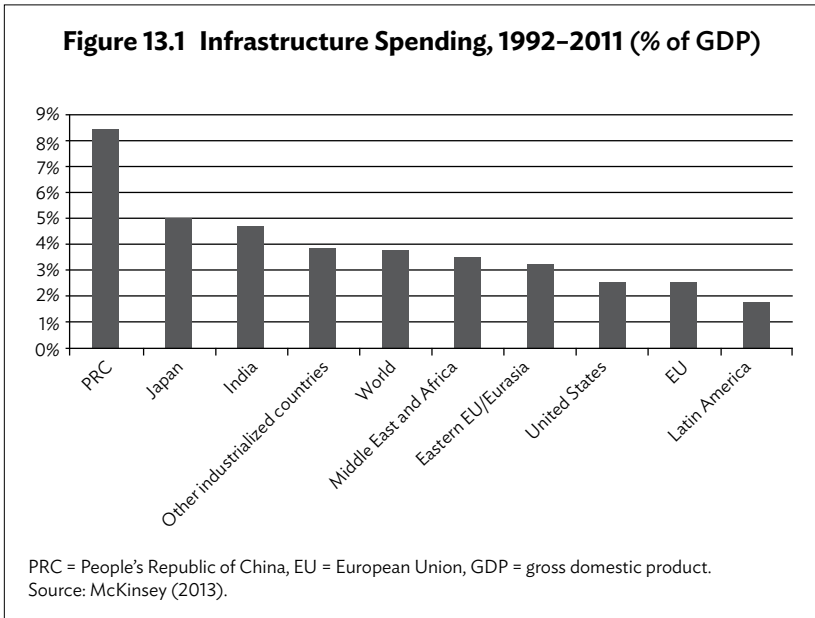
We take historical infrastructure spending as a starting point. About 3.8% of world GDP has been spent on economic infrastructure over the last 20 years, i.e., around \$2.4 trillion per year (applied to the 2010 GDP). Infrastructure investment in both the United States (US) and the European Union (EU) amounted to 2.6% of GDP; this percentage was much higher in East Asia (5.0% in Japan and 8.5% in the People’s Republic of China [PRC]) (Figure 13.1) (McKinsey 2013).¹ 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%. This rise was primarily driven by East Asia, whereas Latin America in particular lagged behind.

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 from the public sector, \$50 billion–\$100 billion from official development assistance, and \$138 billion from private participation in infrastructure (PPI). Relative to GDP, this spending share was 4.2% globally; 6.8% in the East Asia and the Pacific region; 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, Europe, and Central Asia.²

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—roughly 1.5% of GDP in Indonesia, 2.0% in Thailand and the Philippines, and 3.5% in Malaysia (Goldman Sachs 2013). The Republic of Korea falls in

¹ The chapter covers seven sectors of economic infrastructure (roads, rail, ports, airports, power, water, and telecommunications), merging data from different sources: International Transport Forum for transport, IHS Global Insight for energy (including generation) and telecommunications, and Global Water Intelligence for water.

² Country groups of developing countries as defined by the World Bank (2015a). For simple reference: the world GDP in 2012 was about \$72.0 trillion, of which Asia accounted for \$21.0 trillion (30%), East Asia and the Pacific \$18.5 trillion (26%), South Asia \$2.5 trillion (4%), and emerging Asia \$13.0 trillion (18%). Asia holds close to 60% of the world’s population.



the middle with a spending share of 4.3%. For the South Asia region, Andrés, Biller, and Herrera Dappe (2014) report that investment increased from 4.7% of GDP in 1973 to 6.9% in 2009, driven mainly by electricity generation.

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

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

13.2.2 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 chapter focuses on the financial aspects of the topic, as opposed to the physical. Future investment needs are not easily quantifiable, and financing gaps (i.e., the difference between the capital

Table 13.1 Global Infrastructure Investment Needs to 2030 (% of world GDP)

Water		1.3
Telecommunications		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).

needed and the capital available) even less so. This study considers some of the main estimates in this respect.

Global Estimates

The Organisation for Economic Co-operation and Development (OECD 2006, 2007, 2012) produced some groundwork in a sectoral analysis starting in the mid-2000s. Infrastructure needs in key economic sectors add up to more than \$80 trillion until 2030, i.e., about \$3 trillion per year, or more than 4% of the world GDP (Table 13.1). Top-down estimates produce similar results.³ Based on these figures, the World Economic Forum (WEF 2012) calculated a global infrastructure financing gap of about \$1 trillion per year (1.25% of GDP).

Most estimates concentrate on the infrastructure needed to keep

³ There are two basic estimate approaches: top-down and bottom-up. 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.

pace with “normal” economic and demographic growth, rather than any “social optimum.”⁴ Investment to mitigate and adapt to climate change 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, global estimates could rise to \$3.5 trillion–\$5 trillion per year (roughly 5%–7% of GDP) (WEF 2013).

Infrastructure Capital Stock and Productivity

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

McKinsey (2013) estimated that infrastructure stock amounted to about 70% of GDP for most major countries; this figure was also considered a global average. Japan is a significant outlier on the upper side, with infrastructure stock at 179% of GDP; this is driven especially by road infrastructure. This figure is 76% in the PRC and 58% in India, compared to 30%–50% in Southeast Asian countries (International Monetary Fund 2014). In the Asian context, it is worth noting that past “overinvestment” in some places may permit lower future spending.

Emerging Markets and Asia

Infrastructure investment needs are expectedly higher in EMDEs than in developed markets. Using a top-down, multisectoral model, World Bank experts estimated the level of these needs at 6.6% of GDP on average in developing countries. New investments would amount to 2.6%

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

of GDP, and operation and maintenance 4.0% of GDP. However, a very wide spread exists between low-income (12.5%), lower-middle income (8.2%), and upper-middle income countries (2.3%). Actual investment levels in 2008 were estimated at 5.0% in low-income countries, 3.3% in lower-middle income countries, and 1.0% in upper-middle income countries (Estache 2010; Fay et al. 2011).

According to Bhattacharya, Romania, and Stern (2012), to keep pace with the demands of rapid urbanization and economic growth, developing economies must 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.⁵ Thus, a spending gap of approximately \$1 trillion per year is projected for developing economies. The East Asia and the Pacific region would require the highest share of this (35%–50%), followed by South Asia (20%–25%). In terms of sectors, electricity accounts for the largest share (45%–60%).⁶

Several regional studies have also estimated 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 \$8.2 trillion (in 2008 prices) in infrastructure investments during 2011–2020.⁷ In terms of sectors, about half of these investments should go to energy, about one-third to 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 (5.0%). Relative to GDP, however, infrastructure needs are very high in South Asia (especially for roads), amounting to 11.0% of GDP against the regional average of 6.5% (Table 13.2). Values of more than 8.0% are also seen in a number of other Asian countries (Afghanistan, Cambodia, the Kyrgyz Republic, Lao People's Democratic Republic, Mongolia, Tajikistan, Uzbekistan,

⁵ This includes climate change mitigation and adaptation investments of \$200 billion–\$300 billion per year.

⁶ An alternative study by the Royal Bank of Scotland (2011) projected that infrastructure demand in emerging markets would rise to \$19.2 trillion for 20 years through 2030, with Asia accounting for the largest share, at \$15.8 trillion. Over the previous 20 years, infrastructure spending was estimated at \$7.4 trillion, of which \$5.1 trillion was in Asia (\$2.9 trillion in the PRC, \$1.3 trillion in India, and \$0.3 trillion in the Republic of Korea).

⁷ This breaks down to \$776 billion of national investments each year (estimated using a top-down approach), and \$29 billion for regional infrastructure each year (estimated using a bottom-up approach).

Table 13.2 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, Telecom = telecommunications.
Source: Bhattacharyay (2012).

and Viet Nam).

Andrés, Biller, and Herrera Dappe (2014) found annual investment requirements in South Asia of \$140 billion–\$210 billion (in 2010 prices), or 6.6%–9.9% of GDP. In an analysis of four ASEAN countries, Goldman Sachs (2013) produced a figure of \$550 billion through 2020, substantially higher than past spending and government estimates (\$427 billion).⁸

In summary, future investment needs in global economic infrastructure are somewhat higher (more than 4% of GDP) than past spending. 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 infrastructure investment substantially over a longer period, whereas others already have a high capital stock.

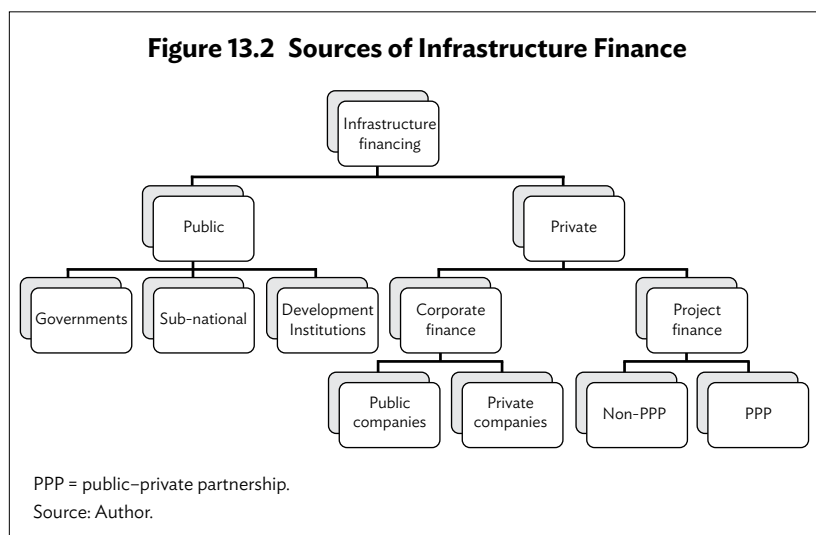
Investment in social infrastructure and to achieve green targets or development goals (e.g., the United Nations Millennium Development Goals) would require additional resources, but little is known about the necessary size of these investments. On the other hand, there is potential for substantial efficiency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

13.3 Supply of Capital

⁸ This figure is the 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).

Next, it is necessary to consider the composition of infrastructure finance, supply of private capital, and investment vehicles. The main categories are outlined in Figure 13.2, and include the following:

- (i) Public or private sources of finance. Public capital comes from central, regional, local, and other government institutions, plus national development banks and multilateral development banks (MDBs), such as the World Bank, ADB, or the Islamic Development Bank.
- (ii) Private capital is provided in two main forms: corporate finance (on the balance sheet, from infrastructure companies' own resources) and project finance, a contractual financing arrangement much used for infrastructure.⁹
- (iii) Within corporate finance, one can distinguish between listed (publicly traded) and unlisted (private) companies. Within



⁹ Project finance is the financing of long-term infrastructure, industrial, extractive, environmental, and other projects (including social, sports, and entertainment PPPs) based on a limited recourse financial structure whereby 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.

project finance, one can distinguish between public–private partnership (PPP) and non-PPP arrangements.¹⁰

- (iv) Infrastructure companies can operate in regulated or unregulated sectors.
- (v) There is typically a mix of equity and debt finance. Infrastructure and PPP projects in particular are often highly leveraged.

13.3.1 Sources of Infrastructure Finance

Public and Private Finance

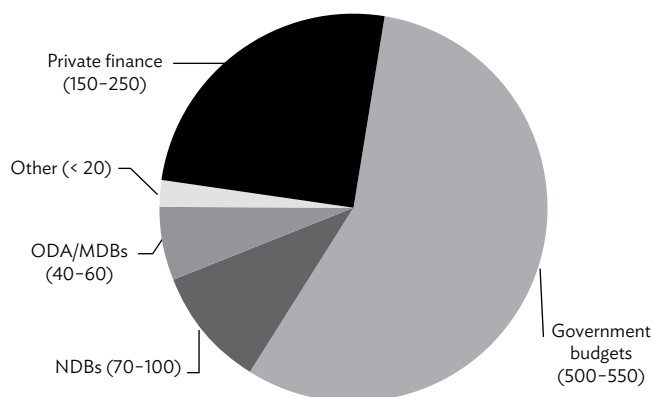
Since the Second World War, the public sector has traditionally played a central role in the ownership, financing, and delivery of infrastructure services. Private participation rose in several countries from the 1980s, due to privatization and, from the 1990s, through PPP schemes. Today, most developed countries, with the notable exception of Japan, have a higher share of private financing in infrastructure than do developing countries. For example, in the EU, the ratio of public to private financing is about 1:2 in old member states and 1:1 in new member states (Wagenvoort, De Nicola, and Kappeler 2010). About 70% of the United Kingdom’s (UK) economic infrastructure is funded by private sources (Her Majesty’s 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). Bhattacharya, Romania, and Stern (2012) use similar figures (Figure 13.3).

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

¹⁰ A PPP is an arrangement between the public and private sectors for the purpose of delivering a project or service traditionally provided by the public sector. A private sector consortium typically forms a special purpose vehicle to develop, build, maintain, and operate the asset for the contracted period. The risk sharing depends on the specific contract.

Figure 13.3 Sources of Infrastructure Finance in Emerging Markets and Developing Economies (\$ billion)



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

Source: Bhattacharya, Romania, and Stern (2012).

Official development assistance flows to the Asian infrastructure sector grew to about \$12 billion in 2013 (Llanto, Navarro, and Ortiz 2015). National development banks and MDBs have historically played an important role in Asia by providing loans, guarantees, and advice for infrastructure development, and catalyzing private sector finance. The new Asian Infrastructure Investment Bank and the New Development Bank of the BRICS countries (Brazil, the Russian Federation, India, the PRC, and South Africa) are designed to provide further finance.

Loan Financing and Capital Markets

Private capital investment, including infrastructure and project finance, is traditionally highly dependent on bank loans in most countries outside North America. Since the financial crisis, the impacts of bank recapitalization and stricter regulations (e.g., Basel III) have been widely felt, especially by European banks. However, very expansive monetary policies have boosted a recent recovery. In addition, 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.

Although Asia has historically high savings rates, it faces 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, 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, securitization and capital markets could be used more strongly in infrastructure finance. Several Asian countries made efforts to develop domestic capital markets in the 1980s and 1990s. Countries such as the Republic of Korea, Malaysia, and Thailand were early users of infrastructure bonds, corporate bonds, and listed equities (Kumar et al. 1997; Park 1998; Walsh, Park, and Yu 2011). However, considerable differences exist in the depth and structure of capital markets, such as in the use of state guarantees.

In comparison to other regions, there is scope for further development of Asian bond markets in particular (Ehlers 2014; ADB 2015; Burger, Warnock, and Cacadac Warnock 2015). In addition, some markets are more open than others to foreign investors.¹¹

Conceptual and Data Issues

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

A discussion of the demand for and supply of capital for infrastructure encounters several major conceptual issues. This chapter touches on some of these, such as in estimating infrastructure investment needs and financing gaps.

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

¹¹ For example, Ray (2015) produced a table with foreign direct investment restrictions in five Asian countries. The International Organization of Securities Commissions (2012) compares the value of foreign direct investment to stock market capitalization. This ratio is around 30% in economies like the Republic of Korea, Malaysia, and Taipei, China, but only 1% in the PRC.

- (i) physical characteristics (e.g., roads, bridges, pipelines, and cables);
- (ii) sectors (including economic infrastructure sectors such as transport, energy, water, and waste, and sometimes also social infrastructure, such as education and health);
- (iii) public and private infrastructure (new projects versus maintenance);
- (iv) economic characteristics (e.g., monopolies, networks, scale, and barriers to entry);
- (v) regulatory regimes (e.g., for utilities and airports);
- (vi) contractual approaches (e.g., project finance, PPP, and concessions); and
- (vii) 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 many gray and controversial areas exist (see, e.g., Beeferman and Wain [2012]; Inderst [2013]).

There are also major issues related to *data*, which are typically scattered in many places, incomplete, and not necessarily fully representative. Data problems include the following:

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

It is clear that infrastructure statistics must be interpreted very carefully. National and international organizations could contribute

significantly to the “public good” by helping to improve the statistical information. Next, it is necessary to consider the main building blocks of data available, keeping in mind the earlier categorizations and caveats.

13.3.2 Investment Vehicles

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

- (i) equity and debt (bonds and loans) investments;
- (ii) listed and unlisted investment vehicles;
- (iii) direct and indirect investment routes (via investment funds);
and
- (iv) commercial funds, or funds sponsored by governments or national or international development institutions.¹²

For example, investors can contribute to infrastructure debt finance by providing a loan to a particular project, buying a project bond, or investing in a pooled vehicle. Table 13.3 provides an overview of the main investment instruments. The range of vehicles tends to be larger

Table 13.3 Infrastructure Investment Vehicles

		Direct	Indirect
Equity	Listed	<ul style="list-style-type: none"> • Shares of transport, energy, water, utility and other infrastructure companies • MLPs, YieldCos 	<ul style="list-style-type: none"> • Listed infrastructure fund • Investment trust • Indices, ETFs, derivatives
	Equity	<ul style="list-style-type: none"> • Direct investment in private companies or projects • Co-investment • Investor platforms, alliances 	<ul style="list-style-type: none"> • Unlisted infrastructure fund (closed-end or open-end) • PPP fund • Fund-of-fund

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¹² There are many examples of commercial funds, especially in the Republic of Korea and India. Examples of public or publicly supported funds include the Asia Infrastructure Fund, the ASEAN Infrastructure Fund, InfraCo Asia, the Philippine Investment Alliance for Infrastructure Fund, the Infrastructure Development Finance Company Limited’s Indian Infrastructure Fund, and the PRC’s Silk Road Fund.

Table 13.3 *continued*

		Direct	Indirect
Debt	Bonds	<ul style="list-style-type: none"> • Corporate bond • Project bond, PPP bond • Government infrastructure bond, <i>sukuk</i> • 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 or mezzanine fund

ETF = exchange-traded fund, MLP = master limited partnership, PPP = public-private partnership.
Source: Author.

in developed markets, although there are many practical examples of the use of different instruments in EMDEs (Inderst and Stewart 2014).

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.

Infrastructure has become an important element of stock markets due to the privatization of electricity, gas, water, telecommunications, and other utility companies. Some countries have also privatized transport assets, such as airports, ports, toll roads, bridges, and tunnels. Asian privatizations accounted for 22% of the global volume during 2013–2014 (Fondazione Eni Enrico Mattei 2014).¹³ 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

¹³ Revenues from asset privatizations during 1988–2014 are estimated at roughly \$3 trillion worldwide. 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 (Fondazione Eni Enrico Mattei 2014).

estimated global stock market capitalization, a percentage similar to that estimated by Standard and Poor's (S&P) (2007).

With the emergence of the infrastructure investment theme in the mid-2000s, all of the major index providers began offering specialist infrastructure equity indices. Major differences exist between indices in terms of the countries and sectors covered, the number and size of stocks included, and the particular index methodology.¹⁴ Regional and country weightings vary widely, with Asia, including Japan, normally ranging between 10% and 20%.¹⁵ Some examples of indices indicate the relevance and structure of these markets.

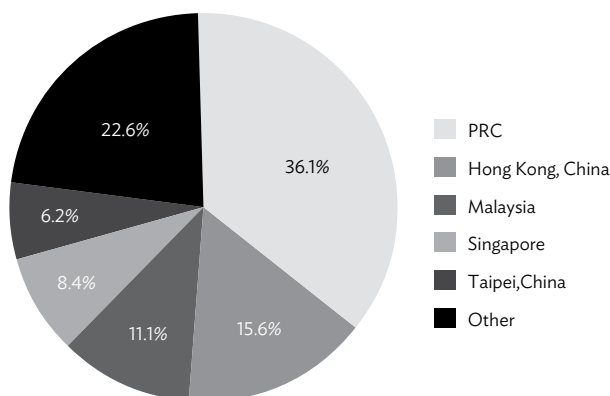
Global emerging market infrastructure indices are usually dominated by Asian companies, ahead of Latin America. For example, Asia has a combined weighting of about 71% in the Dow Jones Brookfield Emerging Markets Index (of which the PRC accounts for 27%; Hong Kong, China 14%; and India 10%), and about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

Dedicated regional Asian infrastructure indices also show a high degree of variation. The MSCI All Country Asia ex Japan Infrastructure Index has 64 constituents with a total market capitalization of \$365 billion. The economy weightings are shown in Figure 13.4. In terms of sectors, telecommunications companies make up a sizeable percentage (61%); China Mobile alone has a weighting of 23%. Electrical utilities make up 17% of the index and gas utilities make up 10%. 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. While this includes Japan, it does not include

¹⁴ One of the main issues concerns the sectors and subsectors included or excluded in these indices, especially telecommunications, industrials, oil and gas, construction, services, or diversified companies. Some extreme examples of indices contain over 80% utility stocks.

¹⁵ For example, the Financial Times Stock Exchange Global Infrastructure Index has 839 constituents with a market cap of \$2.1 trillion. Of the companies, 291 are based in Asia—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 accounts for 11%, the PRC 2%, and Hong Kong, China 2%). The 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 accounts for about 5%, Japan 4%, Singapore 3%, and Hong Kong, China 0.4%) (figures as of March 2015).

**Figure 13.4 Example of an Asian Infrastructure Index
(economy weightings, %)**



Source: MSCI (2015).

telecommunications stocks.¹⁶ The Dow Jones Brookfield Asia/Pacific Infrastructure Index has 23 constituents (of which about 35% are from Australasia), with a combined market capitalization of about \$100 billion. Oil and gas stocks account for over half of this index.¹⁷

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 Bombay Stock Exchange India Infrastructure Index (with 30 stocks and a market cap of about \$140 billion), and the Financial Times Stock Exchange-Infrastructure Development Finance Company Limited 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;

¹⁶ In terms of sectors, this consists of industrials (47%), utilities (43%), and energy stocks (11%). In terms of economies, this covers Japan (29%); the PRC (23%); Hong Kong, China (17%); Singapore (9%); Malaysia (8%); Thailand (5%); the Republic of Korea (4%); Indonesia (3%); and the Philippines (3%).

¹⁷ In terms of sectors, oil and gas storage and transportation account for 52%, toll roads 17%, airports 12%, ports 10%, electricity transmission and distribution 4%, water 3%, and diversified companies 3%. In terms of economies, Australia accounts for 32%; the PRC 23%; Japan 20%; Hong Kong, China 19%; Singapore 4%; and New Zealand 3%.

and the new Shanghai Stock Exchange 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 of 10%–20% in global infrastructure indices. Regional Asian indices in the market vary widely, covering infrastructure companies with a market capitalization of up to \$500 billion. This is about 2.0%–2.5% of GDP in Asia, more than 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.

Private or unlisted infrastructure investments have received much attention, especially from infrastructure equity funds but also increasingly from debt funds. Some investors have also started to take direct stakes in infrastructure projects, or provide private loans.

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, the number of private equity-type, closed-end infrastructure funds have been growing since the mid-2000s.

Next, we consider some figures for the capital raised by such funds, the volume of deals that 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.¹⁸ According to the data provider Preqin, about 400 infrastructure funds were launched worldwide during 2004–2014, with an aggregate volume of around \$300 billion. Annual figures have been rather volatile, with highs of \$45 billion in 2007 and lows of \$11 billion in 2009.

The majority of infrastructure funds are equity-oriented. Only 39 debt funds were closed in 1998–2013 with a total volume of about \$30 billion, i.e., about 10% of total fundraising. However, interest in

¹⁸ This is a survey of 589 “alternative” fund managers (i.e., outside conventional equity and bond assets) with \$5.7 trillion in assets under management. The weighting of infrastructure in this universe is about 5%, well behind real estate, private equity, and hedge funds.

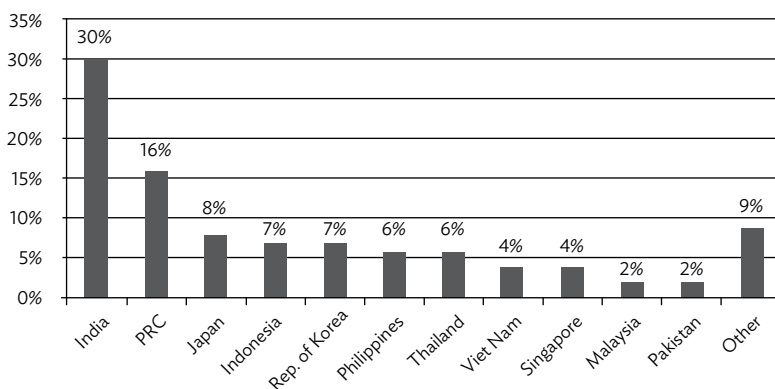
infrastructure debt is increasing: 31 debt and/or mezzanine funds are currently “on the road”, seeking to raise a further \$23 billion from investors. These are focused mainly on European debt markets (Preqin 2015a).

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

Worldwide, around 700 transactions per year 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 in Asia since 2008, 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 Asia’s GDP. India and the PRC posted the highest numbers of deals in the Preqin database (Figure 13.5).

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.

Figure 13.5 Infrastructure Deals in Asia, by Country, 2010–2015



PRC = People’s Republic of China, Rep. = Republic.
Source: Preqin (2015b).

Looking forward, infrastructure investors appear to remain primarily focused on the traditional markets in Europe and North America. Globally, around 150 new funds are seeking a further \$95 billion of capital; only 22 of them, seeking \$11 billion, focus specifically on Asia, although global funds will also express interest in the region.

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. In addition, several (Asian and other) SWFs have raised their interest in infrastructure assets, as have other financial and industrial companies.

Insurance companies, especially in Europe, are increasingly involved in infrastructure debt 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, which many asset owners do not traditionally have. Several larger investors have begun to build such specialist internal expertise.

In conclusion, private infrastructure investments, either directly or via funds, have been growing globally since the early 2000s. Fewer infrastructure funds are based in Asia, or target Asia, relative to 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, lower than the global average of about 0.4%.

13.3.3 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), whereas 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 since 2011, i.e., about

Table 13.4 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).

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.

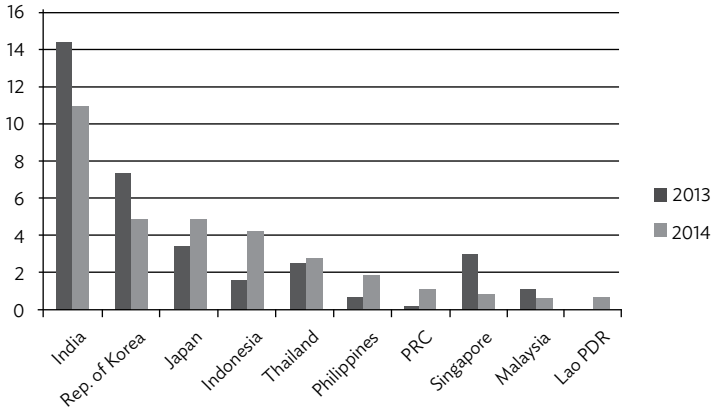
The deal volume of Asia (excluding the Indian subcontinent) was \$43 billion in 2014. It has ranged from \$40 billion to \$60 billion per year in recent years, i.e., about 0.2%–0.3% of GDP, and a global market share of 10%–15% (Table 13.4). The Indian subcontinent's deal volume was \$46 billion in 2014. It fluctuated widely between a few billion in 2007 and over \$80 billion in 2010 and 2011 (0%–5% of GDP). The global market share of the two Asian regions dropped from around 35% in 2009 to 22% in 2011. In terms of countries, India has been the second-largest project finance market in the world (behind the US).¹⁹

Project Finance Loans

Project finance debt markets were impacted by the financial crisis but have since recovered. As an alternative data source, Thomson Reuters (2015) concentrates on project finance loans. The global loan volume in 2014 reached a record \$258 billion, up 26% from 2013. In Asia, 150 transactions

¹⁹ The ranking of the other Asian countries in the top-15 league tables changes every year. In 2014, Indonesia was ranked 11th with a volume of \$8.2 billion and the Republic of Korea, was 14th (\$7.7 billion). In 2013, Viet Nam (\$11.0 billion) was ranked 11th. In 2012, Malaysia ranked 8th, the PRC 9th, the Republic of Korea, 11th, and Indonesia 14th. In 2011, the PRC was ranked 11th, and Singapore 14th.

Figure 13.6 Project Finance Loan Volume in the Asia and the Pacific Region (\$ billion)



PRC = People's Republic of China, Lao PDR = Lao People's Democratic Republic, Rep. = Republic.
Source: Thomson Reuters (2015).

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), which was pretty evenly split between North, South, and Southeast Asia. According to this database, India has been one of the largest markets with a volume of \$11 billion in 2014 (about 0.5% of GDP), and a peak volume of \$55 billion in 2010 (3% of GDP) (Figure 13.6).

In terms of infrastructure sector, in the Asia and the Pacific region (including Australasia), 32.0% of the loan volume went to transportation and 26.0% to power, but only 1.0% to telecommunications and 0.4% to water, sewerage, waste, and recycling. As for the other sectors, 19.0% was recorded for oil and gas, and 12.0% for mining in 2014.

Infrastructure and Project Bonds

The term “infrastructure bond” is used to denote different things. First, it is worth noting that some sovereign bonds have been earmarked for infrastructure, such as in Kenya (Inderst and Stewart 2014). Sub-sovereign bonds may also be dedicated to infrastructure investments.²⁰

²⁰ Platz (2009) finds a relatively low volume of sub-sovereign bonds in Asia of about \$3 billion (from 43 issues) in 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.

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 in Canada).

Third, project bonds in the narrow sense constituted about 10% of long-term global project debt from 1994 to 2012.²¹ Project bond financing experienced a setback with the financial crisis, exacerbated by the demise of monoline insurers. However, markets have since revived. The volume was \$36 billion in 2013, representing 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 as insurance companies as long-term investors therein. The EU project bond market has revived somewhat over the last 3–4 years. Although emerging markets and Asia have a history of debt securities for infrastructure, 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 since 2010 (Kitano 2015).

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, Packer, and Remolona (2014) found 1,625 infrastructure-related debt securities worldwide, with an annual average issuance of around \$50 billion in recent years.²² During 2009–2013, 551 infrastructure bonds were issued in emerging Asia with a value of \$168 billion. The PRC’s market dominated with 340 issues at a value of \$142 billion,

²¹ 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, whereas with corporate bonds it is the company’s ability to pay.

²² 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.

followed by Malaysia with 76 (\$5 billion), and Taipei, China with 64 (\$11 billion).²³ Without the PRC, the volume is still very low in emerging markets. In emerging Asia (excluding the PRC), the annual value is only \$5 billion on average, or less than 0.1% of GDP, but including the PRC, it is about 0.4% of GDP.

The author notes the lack of depth and liquidity in 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, and 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.²⁴

The market for Islamic bonds (*sukuk*) saw strong growth in recent years, reaching an annual volume of over \$100 billion (Rasameel 2014).²⁵ The majority of *sukuk* (62%) are issued by sovereign issuers, with Malaysia being by far the largest issuer. Development banks such as the Islamic Development Bank also issue *sukuk*. A smaller percentage is issued by corporates, including in those infrastructure sectors (power and utilities constitute 9.4% of issuance, transport 7.2%, and telecommunications 3.1%), and there is an emerging market for “infrastructure *sukuk*.”

In conclusion, the global project finance market has recovered from the financial crisis. In Asia (excluding India), annual project finance volumes represent about 0.2%–0.3% of GDP, 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 Asian infrastructure project finance whereas project bond markets are still very small (less than 0.1% of GDP outside the PRC).

²³ The PRC appeared to be a special case in that report, with a high issuance (since 2009) entirely due to state-owned enterprises with a perceived government guarantee. Traditionally, state-owned commercial banks have held around 80% of infrastructure loan portfolios (Walsh, Park, and Yu 2011).

²⁴ 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) during 2009–2013 (Ehlers 2014).

²⁵ *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.

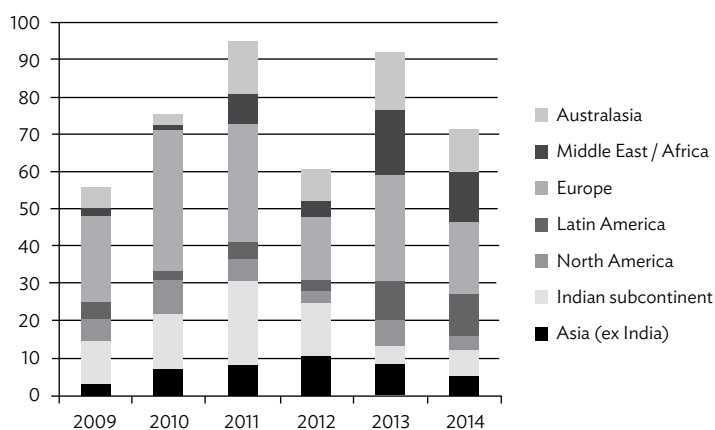
13.3.4 Public-Private Partnerships

PPPs have become increasingly relevant for public infrastructure investment as an alternative to spending by governments or (privatized) infrastructure companies. The UK and Australia are often seen as the most mature adopters, with PPPs accounting for around 10% (UK) and 5% (Australia) of public investment in infrastructure (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, Fischer, and Galetovic [2014], Kitano [2015]).

According to global database Dealogic (2015), global PPP volumes have totaled \$60 billion–\$100 billion (around 0.1% of GDP) since 2009. In 2014, the 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 been 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. Relatively high but strongly fluctuating figures are reported for the Indian subcontinent. PPP deals fell from a peak of over \$15 billion in 2010–2011 to about \$5 billion in 2013–2014 (roughly 0.2% of GDP) (Figure 13.7).

Figure 13.7 Public-Private Partnerships Volume by Region (\$ billion)



ex = excluding.

Source: Dealogic (2015).

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.²⁶ This includes PPP projects, privatizations, and other forms of private participation.

Since 2007, 250–400 PPI projects per year were recorded, with combined budgets of \$150 billion–\$200 billion (PPIAF 2014), i.e., about 0.6%–0.8% of GDP.²⁷ In 2013, the volume was \$150 billion from 291 projects, a decline from previous years, especially in Brazil and India. Figure 13.8 shows a breakdown of PPIs by region. Latin America traditionally has the largest share.

The East Asia and the Pacific region’s volumes have been \$15 billion–\$22 billion since the mid-2000s, i.e., 0.1%–0.2% of GDP. Volume growth in the PRC slowed considerably in 2014, as difficulties with local government financing vehicles affected new project funding (PPIAF 2015; Reuters 2015). Private investment in South Asia grew strongly in the 2000s, peaking at \$77 billion in 2010, but has since fallen back, with a 2013 volume of \$15 billion (about 0.6% of GDP). The Indian model is showing signs of strain.²⁸

Over a longer period, 1990–2014, deal volumes were by far highest in Brazil (\$468 billion) and India (\$330 billion). The PRC came fifth with \$131 billion, Indonesia eighth with \$65 billion, the Philippines ninth with \$61 billion, and Malaysia tenth with \$60 billion.

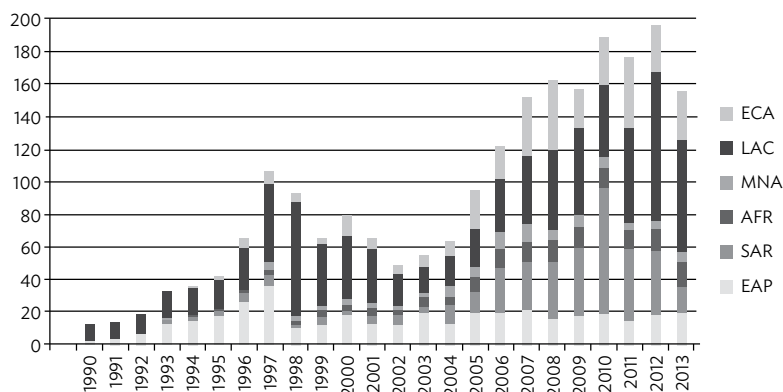
For the East Asia and the Pacific region, 1,819 projects are recorded in the PPIAF database, with a total volume of \$389 billion—40% of the volume was in energy, 28% in telecommunications, 23% in transport,

²⁶ Projects are considered to involve 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 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).

²⁷ 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. The PPIAF (2015) shows smaller figures because a new definition of “infrastructure” excludes telecommunications.

²⁸ 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).

Figure 13.8 Private Investment in Infrastructure in Emerging Markets and Developing Economies (\$ billion)



AFR = Africa, EAP = East Asia and the Pacific, ECA = Europe and Central Asia, LAC = Latin America and Caribbean, MNA = Middle East and Northern Africa, SAR = South Asia.
Sources: PPIAF (PPI project database, March 2015); author.

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 there were around 85% in India, 9% in Pakistan, 3% in Bangladesh, and 2% in Sri Lanka). The sector breakdown is 42% energy, 33% telecommunications, 25% transport, and very little in water and sewerage; 76% were greenfield projects, 19% concessions, and 5% divestitures.²⁹

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

²⁹ Andrés, Biller, and Herrera Dappe (2014) note a clear division across sectors in South Asia: privatization is the favored route in telecommunications and energy, and PPPs in transport, water, waste, and sewerage, and partly also in electricity transmission.

13.4 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.³⁰

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.

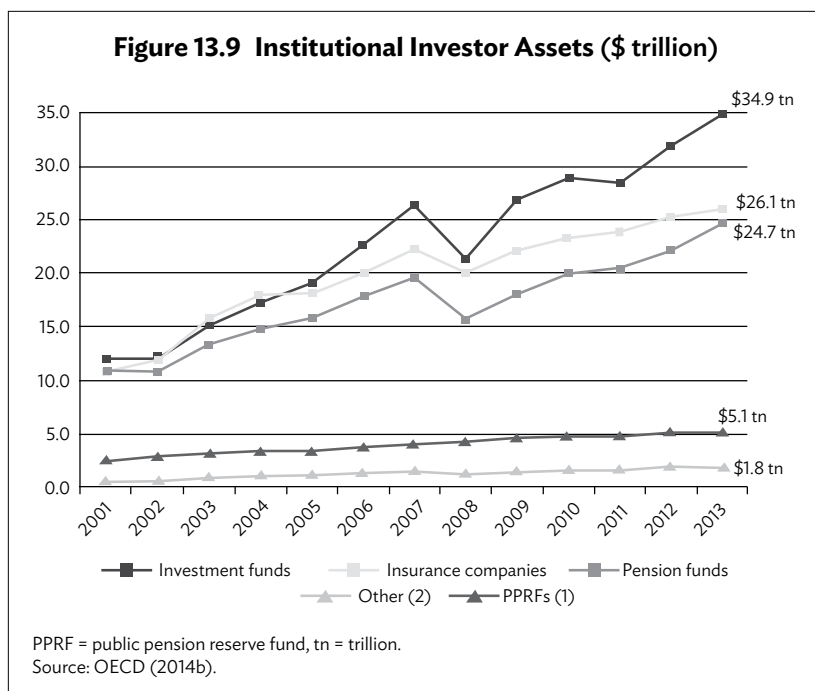
Institutional assets grew strongly in recent years. The OECD valued institutional assets in 2013 at \$92 trillion, of which \$25 trillion was in pension funds; \$26 trillion with insurance companies; \$5 trillion in public pension reserve funds; and \$2 trillion in foundations, endowments, and other institutions (Figure 13.9). Not shown in Figure 13.9 is the \$7 trillion in SWFs (SWFI 2015).³¹

13.4.1 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, which

³⁰ 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]).

³¹ These figures do not include assets held by banks, nonfinancial corporations, central banks, or other government institutions. It is worth noting that there is also substantial wealth owned privately by households. Boston Consulting Group (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.



is about 8% of global assets. The \$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 was 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.³² The highest volumes were for Japan with \$1,331 billion; Hong Kong, China with

³² 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.

\$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).

In terms of size relative to GDP, these funds account for 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, Coquemas, and Georgieva 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, India, Indonesia, Japan, and the Republic of Korea are all in band D.³³

Finally, the fund management industry in Asia (including mutual funds, unit trusts, exchange traded funds, and 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., ASEAN 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.

³³ 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).

13.4.2 Investors in Infrastructure

Most asset owners have traditionally been investors in infrastructure securities, for example, as shareholders of infrastructure companies listed on public stock exchanges, in initial public offerings 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.³⁴

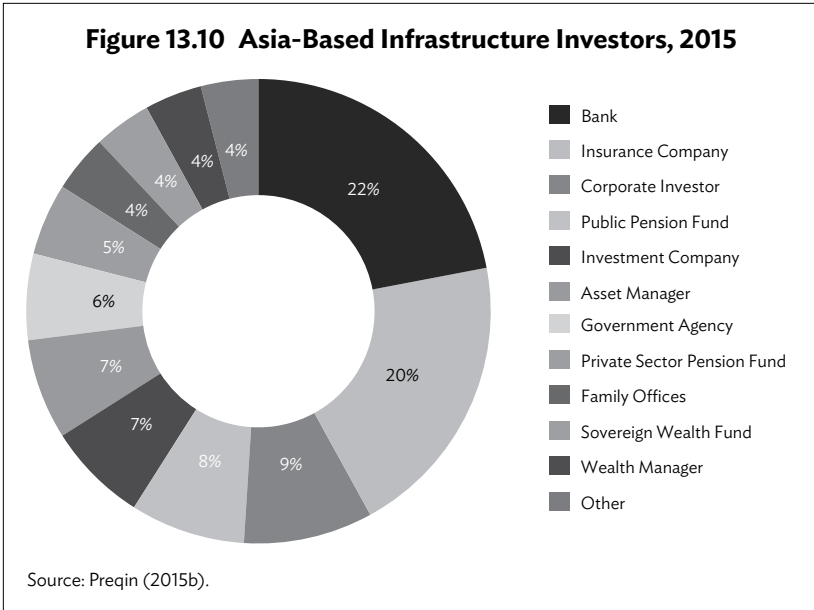
Insurance companies have traditionally had hardly any investments in unlisted infrastructure assets. However, several insurers and their asset management subsidiaries worldwide have become active in recent times, especially in infrastructure debt.

Turning to the Asia and the Pacific region, Prequin (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 13.10).

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

³⁴ Unfortunately, none of the five Asian Pension Reserve Funds surveyed reported on infrastructure investments.



funds also constitute an important element of the Asian investor base. The world’s largest pension scheme, Japan’s Government Pension Investment Fund, revamped its investment strategy in 2014 with the intention to invest in alternative assets, including infrastructure.

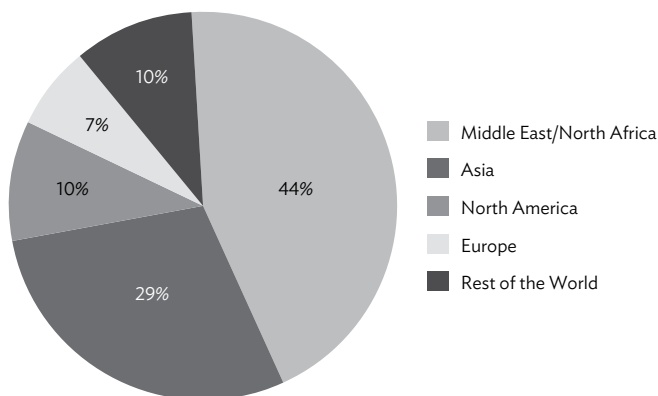
In summary, institutional investors, especially larger ones, have been increasing their unlisted infrastructure investments in recent years. Many smaller investors, but also some larger Asian reserve funds, have little or no exposure in this field. On average, the overall asset allocation to infrastructure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

13.4.3 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 whereas others have none. In the Preqin database, 60% of global SWFs invested

Figure 13.11 Sovereign Wealth Funds Investing in Infrastructure, by Region



Source: Preqin (2013)

in infrastructure in 2014, of which 44% are based in the Middle East and/or North Africa and 29% in Asia (Figure 13.11).³⁵ Of the SWFs, 34% only invest directly in infrastructure, and 50% invest both directly and via funds.

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 increased 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

³⁵ 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.

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, such as PRC 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.

13.5 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 13.5).

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.

Table 13.5 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).

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

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

Some of these hurdles are difficult for foreign investors to jump, 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, Ruiz-Nuñez, and Chelsky 2014). This requires good credit analysis and currency management, knowledge of local practices, reliable local partners, and, first and foremost, trust in the legal and political system.

13.5.1 Investor Regulation

Investor regulation is often a main hindrance. There are three sets of regulations 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 International Financial Reporting Standards accounting rules for insurers and pension funds are seen as a potential obstacle to infrastructure investments, as they could lead to de-risking and procyclical 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 by which investors have to abide, that may hamper infrastructure investment (see, e.g., Vives [1999]; City of London [2011]; OECD [2014d]). In a survey of 32 countries, the International Organisation of Pension Fund Supervisors (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 nontransparent investments. Examples of quantitative limits include:

- (i) restrictions on equity or corporate bond investments;
- (ii) investment in unlisted infrastructure companies (including Hong Kong, China, the Republic of Korea; and Japan);
- (iii) direct investments in projects (including Thailand);
- (iv) infrastructure funds or investments (including the PRC);
- (v) alternative investments (including Pakistan);
- (vi) minimum ratings for bonds;
- (vii) constraints on leverage and the use of derivatives; and
- (viii) 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, and liquidity requirements. 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.

13.5.2 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, and 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 to a contribution of less than 10% of the projected investment needs.

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

- (i) There needs to be a sufficient supply of suitable, investable infrastructure assets.
- (ii) 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.
- (iii) Calculations also depend on the growth of private assets and especially changes in investor regulation. Appropriate investment management capabilities and instruments are needed for institutional assets (and even more so for individual savings).
- (iv) 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.
- (v) What assumptions can be made about the “infrastructure capital balance”? Currently, a lot of Asian capital seems to be

going to Western markets, whereas the attractiveness of Asia's infrastructure still appears to be subpar for international investors.

13.6 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 4.0% of GDP globally, 6.0%–8.0% 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 year, 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 the East Asia and the Pacific region, well below the EMDE average. South Asia showed a strong cyclical 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 as to 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.

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 more closely related to private equity and/or real estate. The experience of most investors, if any, is still very limited. Nonetheless, some useful lessons can already be learned:

- (i) 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).
- (ii) Infrastructure investing, especially direct investment, requires adequate size, resources, and good governance. For public (pension, social security, and sovereign wealth) funds in particular, there is the risk of political motivation and interference—therefore clear financial objectives and good governance are paramount.
 - (iii) There are major cycles in the valuation of assets, including periods with “too much capital chasing too few assets.”
 - (iv) The financial crisis revealed risks at all levels: projects (e.g., excessive leverage and optimistic demand projections); funds (governance, conflicts of interest, and fees); and asset management (concentration risk and lack of understanding).
 - (v) 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:

- (i) deeper scrutiny of projects and investment vehicles;
- (ii) a broader universe, including new regional markets, sectors, and specialist funds;
- (iii) open-ended, cheaper, more transparent funds;
- (iv) more direct investing;
- (v) more infrastructure debt investment;
- (vi) co-investment by investors, syndicates, and capital pooling platforms for (smaller) pension funds (with or without public capital); and
- (vii) increasing awareness of climate change and “green” infrastructure (Inderst, Kaminker, and Stewart 2012; OECD 2015; ADB 2017b).

There are also some important lessons for policy makers:

- (i) Governments want private capital for new projects but most institutional investors prefer low-risk assets which implies 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.
- (ii) Many countries are seeking to develop capital markets (e.g., for project bonds), but new markets take time and trust to evolve.

- (iii) 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).
- (iv) Retrospective (generally, negative to private investors) changes to regulation and contracts are particularly harmful.
- (v) Ultimately, it is not the financiers who pay for infrastructure services but the users or taxpayers.
- (vi) There are advantages to 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 Group of 20, the OECD, and the MDBs. There are also more specific recommendations for Asia, including in this book.³⁶

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, the Group of 20 Global Infrastructure Hub, or the T20 infrastructure working group.

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

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

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, pilot and demonstration, etc.). Private investors often appreciate the expertise and "political clout" of MDBs in new ventures.

³⁶ See, e.g., Bhattacharyay, Kawai and Nag (2012), Basu Das and James (2013), Sheng (2014), Zen and Regan (2014), Ray (2015), and ADB (2015, 2017a and 2017b).

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 chapter 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 with regard to its effect on infrastructure investment.
- (iv) Review sectoral regulation (in energy, transport, etc.), especially with 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
- (ix) investment vehicles, and disclosure on infrastructure projects.

References

- Asian Development Bank (ADB). 2015. *Local Currency Bonds and Infrastructure Finance in ASEAN+3*. Manila: ADB.
- ADB. 2017a. Meeting Asia's Infrastructure Needs. Manila: ADB.
- ADB. 2017b. Catalyzing Green Finance: A Concept of Leveraging Blended Finance for Green Development. Manila: ADB.
- Andrés, L., D. Biller, and M. Herrera Dappe. 2014. Infrastructure Gap in South Asia: Infrastructure Needs, Prioritization, and Financing. World Bank Policy Research Working Paper 7032. Washington, DC: World Bank.
- Basu Das, S., and C. James. 2013. Addressing Infrastructure Financing in Asia. *Institute of Southeast Asian Studies Perspective* 27. 6 May. Singapore: Institute of Southeast Asian Studies.
- Beeferman, L., and A. Wain. 2012. Defining Matters. Harvard Law School Paper. Cambridge, MA: Harvard University.
- Bhattacharya, A., M. Romania, and N. Stern. 2012. *Infrastructure for Development: Meeting the Challenge*. London: London School for Economics, Centre for Climate Change Economics and Policy, and G24.
- Bhattacharyay, B. N. 2012. Estimating Demand for Infrastructure 2010–2020. In *Infrastructure for Asian Connectivity*, edited by B. N. Bhattacharyay, M. Kawai, and R. Nag. 19–79. Cheltenham: Asian Development Bank Institute (ADBI)/ADB and Edward Elgar.
- Bhattacharyay, B. N., M. Kawai, and R. Nag, eds. 2012. *Infrastructure for Asian Connectivity*. Cheltenham: Asian Development Bank Institute (ADBI)/ADB and Edward Elgar.
- Blanc-Brude, F., F. Cocquemas, and A. Georgieva. 2013. Investment Solutions for East Asia's Pension Savings. EDHEC-Risk Institute Publication. May 2013.
- Boston Consulting Group. 2014. *Global Wealth 2014: Riding a Wave of Growth*. Boston Consulting Group.
- Burger, J., F. Warnock, and V. Cacdac Warnock. 2015. Bond Market Development in Developing Asia. ADB Economics Working Paper 448. Manila: ADB.
- City of London. 2011. Insurance Companies and Pension Funds as Institutional Investors: Global Investment Patterns. Trusted Sources. November 2011.
- Dailami, M., and R. Hauswald. 2003. The Emerging Project Bond Market. World Bank, Policy Research Paper 3095. Washington, DC: World Bank.
- Dealogic. 2015. Project Finance Review. Full Year 2014.

- Della Croce, R. 2011. Pension Funds Investment in Infrastructure: Policy Actions. Organisation for Economic Co-operation and Development (OECD) Working Paper on Finance, Insurance and Private Pensions 13. Paris: OECD.
- Delmon, J., and V. Delmon. 2011. *International Project Finance and PPPs: A Legal Guide to Key Growth Markets*. Alphen aan den Rijn: Wolters Kluwer International.
- Ehlers, T. 2014. Understanding the Challenges for Infrastructure Finance. Bank for International Settlements Working Paper 454. Basel: Bank for International Settlements.
- Ehlers, T., F. Packer, and E. Remolona. 2014. Infrastructure and Corporate Bond Markets in Asia. In *Financial Flows and Infrastructure Financing*, edited by A. Heath and M. Read. Sydney: Reserve Bank of Australia.
- Engel, E., R. Fischer, and A. Galetovic. 2014. *The Economics of Public-Private Partnerships. A Basic Guide*. Cambridge: Cambridge University Press.
- Estache, A. 2010. Infrastructure Finance in Developing Countries: An Overview. *European Investment Bank (EIB) Papers* 15(2): 60–88.
- Fay, M., M. Toman, D. Benitez, and S. Csordas. 2011. Infrastructure and Sustainable Development. In *Post-Crisis Growth and Development*, edited by S. Fardoust, K. Yongbeom, and C. Sepúlveda. Washington, DC: World Bank.
- Ferreira, D., and K. Khatami. 1996. Financing Private Infrastructure in Developing Countries. World Bank Discussion Paper 343. Washington, DC: World Bank.
- Fondazione Eni Enrico Mattei. 2014. *The Privatization Barometer Report 2013/2014*. Milan: Fondazione Eni Enrico Mattei.
- Gatti, S. 2014. Government and Market-Based Instruments and Incentives to Stimulate Long-Term Investment Finance in Infrastructure. Paris: OECD Publishing.
- Gelb, A., S. Tordo, H. Halland, N. Arfaa, and G. Smith. 2014. Sovereign Wealth Funds and Long-Term Development Finance. World Bank Policy Research Working Paper 6776. Washington, DC: World Bank.
- Goldman Sachs. 2013. ASEAN's Half a Trillion Dollar Infrastructure Opportunity. *Asia Economic Analyst* 13(18): 1–18.
- Greer, I. 2015. Why Global Investors Aren't Making Inroads into Infrastructure Funding in Asia. Standard and Poor's.
- Her Majesty's Treasury. 2014. *National Infrastructure Plan*. London: Her Majesty's Treasury.
- Inderst, G. 2009. Pension Fund Investment in Infrastructure. OECD Working Paper on Insurance and Private Pensions 32. Paris: OECD.

- _____. 2010. Infrastructure as an Asset Class. *EIB Papers* 15(1): 70–104.
- _____. 2013. Private Infrastructure Finance and Investment in Europe. EIB Working Paper 2. Luxembourg: EIB.
- Inderst, G., and R. Della Croce. 2014. Pension Fund Investment in Infrastructure: A Comparison between Australia and Canada. OECD Working Paper on Finance, Insurance and Private Pensions 32. Paris: OECD.
- Inderst, G., C. Kaminker, and F. Stewart. 2012. Defining and Measuring Green Investments: Implications for Institutional Investors' Asset Allocations. OECD Working Paper on Finance, Insurance and Private Pensions 24. Paris: OECD.
- Inderst, G., and F. Stewart. 2014. Institutional Investment in Infrastructure in Emerging Markets and Developing Economies. Public–Private Infrastructure Advisory Facility (PPIAF) Publication. Washington, DC: World Bank Group.
- International Monetary Fund (IMF). 2014. *World Economic Outlook*. Washington, DC: IMF.
- International Organisation of Pension Fund Supervisors (IOPS). 2011. Pension Fund Use of Alternative Investments and Derivatives: Regulation, Industry Practice and Implementation Issues. IOPS Working Paper on Effective Pension Supervision 13. Paris: IOPS.
- International Organization of Securities Commissions. 2012. *Development and Regulation of Institutional Investors in Emerging Markets*. Madrid: International Organization of Securities Commissions.
- Invesco. 2015. *Global Sovereign Asset Management Study 2015*. Atlanta, GA: Invesco.
- Kitano, Y. 2015. Infrastructure Financing in Asia. Current Situation and Future Outlook. *Nomura Journal of Capital Markets* 6(4). Spring 2015.
- Kumar, A., D. Gray, M. Hoskote, S. Klaudy, and J. Ruster. 1997. Mobilizing Domestic Capital Markets for Infrastructure Financing. World Bank Discussion Paper 377. Washington, DC: World Bank.
- Llanto, G., A. Navarro, and M. K. Ortiz. 2015. Infrastructure Financing, Public–Private Partnerships, and Development in the Asia-Pacific Region. Draft discussion paper submitted to the Asia-Pacific High-Level Consultation on Financing for Development meeting. 29–30 April. Jakarta.
- McKinsey. 2011. *The Emerging Equity Gap: Growth and Stability in the New Investor Landscape*. McKinsey Global Institute.
- _____. 2013. *Infrastructure Productivity: How to Save \$1 Trillion a Year*. McKinsey Global Institute.
- Mercer. 2014. Melbourne Mercer Global Pensions Index. Australian Centre for Financial Studies and Mercer.

- Moody's. 2015. Default and Recovery Rates for Project Finance Bank Loans 1983–2013.
- MSCI. 2015. MSCI All Country Asia ex Japan Infrastructure Index (USD). March 2015.
- Musalem, A. R., and P. Souto. 2012. Assessing the Governance and Transparency of National Public Pension Funds. *Review of European Studies* 4(2): 148–167.
- Nataraj, G. 2007. Infrastructure Challenges in South Asia: The Role of Public–Private Partnerships. ADBI Discussion Paper 80. Tokyo: ADBI.
- Organisation for Economic Co-operation and Development (OECD). 2006. *Infrastructure to 2030: Telecom, Land Transport, Water and Electricity*. Paris: OECD Publishing.
- _____. 2007. *Infrastructure to 2030, Volume 2: Mapping Policy for Electricity, Water and Transport*. Paris: OECD Publishing.
- _____. 2012. *Strategic Transport Infrastructure Needs to 2030*. Paris: OECD Publishing.
- _____. 2014a. *Pooling of Institutional Investors Capital. Selected Case Studies in Unlisted Equity Infrastructure*. Paris: OECD Publishing.
- _____. 2014b. *Pension Markets in Focus*. Paris: OECD Publishing.
- _____. 2014c. *Annual Survey of Large Pension Funds and Public Pension Reserve Funds 2014*. Paris: OECD Publishing.
- _____. 2014d. *Annual Survey of Investment Regulation of Pension Funds*. Paris: OECD Publishing.
- _____. 2015. *Mapping Channels to Mobilise Institutional Investment in Sustainable Energy, Green Finance and Investment*. Paris: OECD Publishing.
- Park, T. K. 1998. Private Infrastructure Development in Asia. *Journal of Project Finance* 4(3): 25–33.
- Platz, D. 2009. Infrastructure Financing in Developing Economies: The Potential of Sub-Sovereign Bonds. Department of Economics and Social Affairs Working Paper 76. New York, NY: United Nations Department of Economics and Social Affairs.
- Public–Private Infrastructure Advisory Facility (PPIAF). 2014. *2013 Global PPI Update*. PPIAF, World Bank Group.
- _____. 2015. *2014 Global PPI Update*. PPIAF, World Bank Group.
- Preqin. 2013. Infrastructure Spotlight. November.
- _____. 2014. Infrastructure Spotlight. May.
- _____. 2015a. Infrastructure Spotlight. January.
- _____. 2015b. Asian Infrastructure. Preqin Special Report, June 2015.
- PricewaterhouseCoopers. 2014. Capital Project and Infrastructure Spending. Outlook to 2015.
- Rasameel. 2014. *2013 Annual Global Sukuk Report*. Rasameel Structured Finance.

- Ray, S. 2015. Investment Finance and Financial Sector Development. ADBI Working Paper 522. Tokyo: ADBI.
- Reuters. 2015. China Infrastructure Push Runs up Against Project Delays. 21 May.
- Royal Bank of Scotland. 2011. The Roots of Growth. Projecting EM Infrastructure Demand to 2030. Emerging Markets Strategy, Royal Bank of Scotland.
- Rosenberg Real Estate Equity Funds (RREEF). 2011. Listed Infrastructure: A Growing Landscape—Are You Ready? RREEF Research. RREEF America LLC.
- Schwartz, J., F. Ruiz-Nuñez, and J. Chelsky. 2014. Closing the Infrastructure Finance Gap: Addressing Risk. In *Financial Flows and Infrastructure Financing*, edited by A. Heath and M. Read. Reserve Bank of Australia.
- Sengupta, R., S. Mukherjee, and M. Gupta. 2015. Financing for Infrastructure Investment in the G-20 Countries. National Institute of Public Finance and Policy Working Paper 2015-144. New Delhi: National Institute of Public Finance and Policy.
- Severinson, C., and J. Yermo. 2012. The Effect of Solvency Regulations and Accounting Standards on Long-Term Investing: Implications for Insurers and Pension Funds. OECD Working Paper on Finance, Insurance and Private Pensions 30. Paris: OECD.
- Sheng, A. 2014. Capital Market Development in Asia and the Pacific Region. Pacific Trade and Development Working Paper 36-03.
- Sovereign Wealth Fund Institute. 2015. Sovereign Wealth Fund Direct Infrastructure Investments, 2003–2014. Sovereign Wealth Fund Institute, Trend Report, 25 February.
- Standard and Poor's. 2007. Listed Infrastructure Assets—A Primer. Standard & Poor's.
- TheCityUK. 2013. Sovereign Wealth Funds. Financial Markets Series, March.
- _____. 2015. Sovereign Wealth Funds. Financial Markets Series, June.
- Thomson Reuters. 2015. Project Finance Review. Full Year 2014.
- Towers Watson. 2014. Global Alternatives Study. July.
- Vives, A. 1999. Pension Funds in Infrastructure Project Finance: Regulations and Instrument Design. *Journal of Structured Finance* 5(2): 37–52.
- Wagenvoort, R., C. De Nicola, and A. Kappeler. 2010. Infrastructure Finance in Europe: Composition, Evolution and Crisis Impact (3 May 2011). *EIB Papers* 15(1): 16–39.
- Walsh, J., C. Park, and J. Yu. 2011. Financing Infrastructure in India: Macroeconomic Lessons and Emerging Market Case Studies. IMF Working Paper WP/11/181. Washington, DC: IMF.

- World Bank. 2015a. World Development Indicators. Washington, DC: World Bank.
- _____. 2015b. Capital Market Instruments to Mobilize Institutional Investors to Infrastructure and SME Financing in Emerging Market Economies: Report for the G20. Washington, DC: World Bank.
- World Economic Forum (WEF). 2012. Strategic Infrastructure. WEF.
- _____. 2013. The Green Investment Report. WEF.
- Yoshino, N. 2012. Global Imbalances and the Development of Capital Flows among Asian Countries. *OECD Journal: Financial Market Trends* 2012(1).
- Zen, F., and M. Regan, eds. 2014. Financing ASEAN Connectivity. Economic Research Institute for ASEAN and East Asia Research Project Report 2013, 15. Jakarta: Economic Research Institute for ASEAN and East Asia.