

The Upcoming Four Trillion-Dollar Infrastructure Gold Rush

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IEMS Emerging Market Brief
Vol. 14-03, June 2014

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I. Introduction

The most populous emerging markets will need to spend roughly \$4 trillion by 2020 on infrastructure. The extra 350 million people born into emerging markets in the next decade will require infrastructure like water, energy, communication and transport in order to work. Since the 1970s, investment bankers and cabinet-level political leaders have seen sewage, bridges, roads and coal-burning energy plants as boring and dirty at best, and politically explosive at worst. It has been deemed much better to work on “global knowledge products” (whatever they are), rather than on a rail track that will displace thousands of families. Yet the infrastructure boom in fast-growing emerging markets like Indonesia, Turkey and China has made infrastructure fashionable again. Who needs infrastructure investment, and in which areas? How can investors benefit from the upcoming infrastructure “gold rush”?

In this report, we argue that investors (both at the retail level and in large construction and engineering companies) will need to spend significant sums of money to develop this \$4 trillion market. Construction companies, and the investors that fund them, will need to work with governments to develop infrastructure project ideas, arrange funding and, of course, build the projects. In the first section, we look at major markets that will (or at least should) experience an infrastructure spending gold rush in the next decade. We find that many of the usual suspects (like China and India) represent large profit opportunities. However, other countries, like Iran, the Philippines and Ukraine, represent important, overlooked opportunities. Spending in areas like water and transport represents large potential growth areas. The second section looks at governments’ capacity to pay. We assess how much funding governments will be able to provide, and how much residual demand remains for enterprising “design firms” to tap using private funding. The third section presents the engineering and construction companies most able to take advantage of

large-scale increases in infrastructure spending in the emerging markets we analyze. Many of these companies are listed on public stock exchanges, therefore potentially represent lucrative investments for both corporate and retail investors (like you). The fourth section provides lessons and recommendations for companies looking to grow their revenues in this expanding area of activity.

Disclaimer: We make specific recommendations for traded companies in this brief. We have not received any kind of payment from these companies, and our recommendations may not be appropriate for a particular investor’s portfolio. Please consult your locally licensed and registered investment advisor to discuss our recommendations.

II. Emerging Markets' Need for Big Four Infrastructure Investment

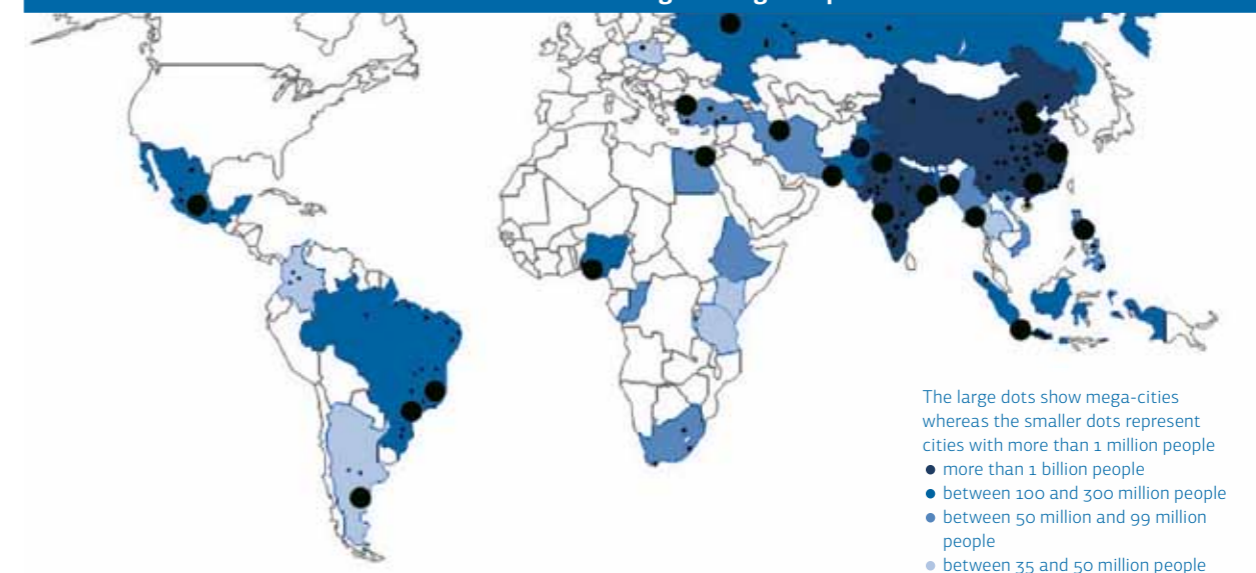
Emerging markets require infrastructure based on the size of their populations. Bigger and denser countries require more transport, energy, communications and water than smaller countries. Figure 1 shows the top 25 most populous emerging markets and the urban concentrations requiring infrastructure investment.

Let us put the infrastructure challenge into perspective. The Indonesian government must build a city the size of Rome every year to accommodate roughly the 2.5 million extra people born there. The Mexican authorities must build a new Kuala Lumpur every year to accommodate the extra 1.3 million people born there annually. Let us not forget China, a country whose government must raise a city the size of Bangkok each and every year from its vacant plains. India must create a new Mumbai each year. Most of us have seen whole new parts of cities added very quickly (like the Bilkent area outside of Ankara, or the new city of New Songdo in South Korea that was created from

scratch). We have seen Dubai and Doha grow skyward. Yet we do not stop to think about the revenues generated by the construction and engineering companies actually building those new urban centers.

Some urban centers present better opportunities than others for investors looking to capitalize on the upcoming infrastructure boom. Figure 2 shows the growth rates of populations in the fastest growing countries, and the speed of urbanization. The Sub-Saharan countries of Kenya, Congo and Tanzania have grown the fastest, both inside their cities and outside of them. Regardless of whether these governments can pay for infrastructure, these countries have the fastest growing infrastructure needs. The Asian countries of China, Vietnam and Bangladesh have rapid rates of urbanization, making investments in dense cities very profitable. The slow growing economies in Eastern Europe and Latin America represent less stellar opportunities. Infrastructure investment would likely consist of modernizing existing infrastructure,

Figure 1: World's Mega Cities Represent Mega-Opportunities for Construction and Engineering Companies



Source: World Bank for National Population figures and McKinsey for Urban Population data

rather than constructing whole new cities. The question mark countries in the Middle East have fast overall growth, but slow growth from within their cities. As mostly agrarian (subsistence) economies, their infrastructure needs remain far from certain. Companies looking to invest in each of these markets will most likely take a portfolio-based view of such investment.

What do we mean by infrastructure? Figure 3 shows an example of infrastructure used in the Turkish metropolitan center of Istanbul. City planners in Istanbul need to spend roughly \$30 billion per year to keep up the area's roads, airport, ports and rail access. In addition, they need to plan for city growth by developing new capacity as the population grows. City planners must do the same with water (sewage and fresh water), energy (generated through a number of ways, including coal,

The twenty-five most populous emerging markets will need about \$4 trillion in infrastructure investment in the coming decade

gas, petrol, nuclear and alternative energy), telecommunications (landlines, mobile phones and internet connections), as well as transport (roads, rail, ports and airports). Each new child raised in former Constantinople will require water, energy, communications and transport to function as a productive member of society and the global economy.

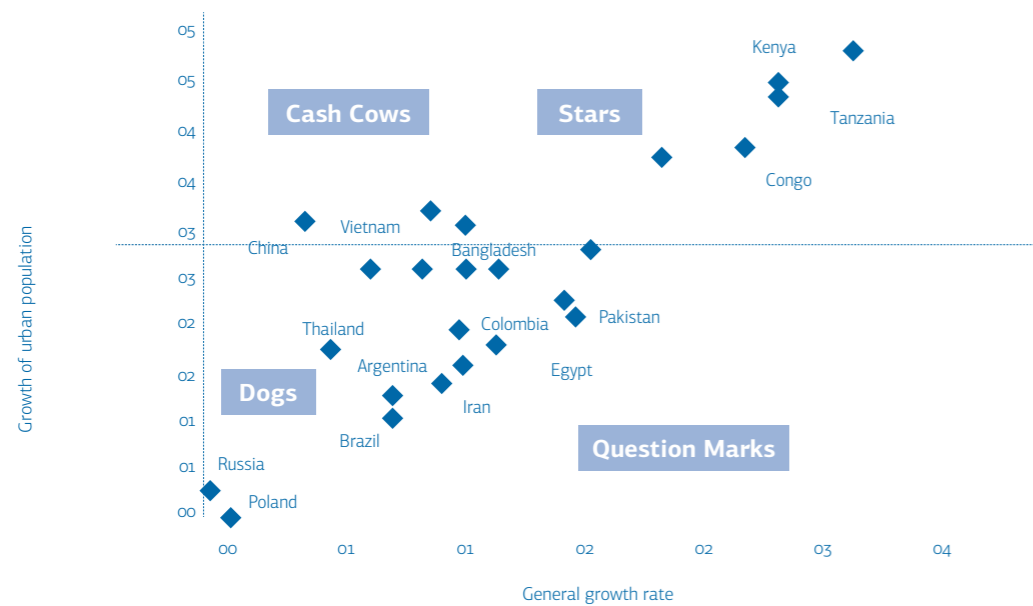
The twenty-five most populous emerging markets will need about \$4 trillion in in-

frastructure investment in the coming decade. Figure 4 shows the overall infrastructure requirements for these economies.

Emerging markets will need to invest least in water (fresh and sewage), as previous governments have done a relatively good job of providing this infrastructure. Water services need modernizing in many emerging market countries, however, for most emerging markets, providing water still remains a relatively low cost proposition. Investments in power will come to about \$630 billion, representing mostly new power generation. We assume that emerging markets will continue to use the least costly methods available. The information technology (IT) revolution will increase electricity consumption for most of the developing world. However, efficiencies in the production and transmission of this electricity have led to overall decreasing costs over time.

Telecommunications and transport represent the bulk of infrastructure investment needed in emerging markets, which have a long way to go towards fully capitalizing on the internet revolution. Most emerging markets of all income levels still require significant levels of internet backbone, household and commercial wiring, as well as server investment. Much of this investment will help fund entertainment, rather than genuinely economically productive activity. However, our job revolves around estimating demand, not passing judgment on it. Finally, transport represents about \$1.4 trillion in investment necessary by about 2020. Growing populations will need to travel further to go to work (sometimes even internationally), and growing volumes of international trade will require more advanced supply chains.

Figure 2: Infrastructure Investment in Various Countries Reflects Different Portfolio Needs



The figure shows population growth rates and the rates of urban population growth in 2011. We have labelled countries using the Boston Consulting Group (BCG) matrix to stress that infrastructure investment in each of these countries represents a global infrastructure company's portfolio decision.

Source: World Bank (2013).

Figure 3: Infrastructure Means Water, Transport, Energy and Telecoms

Transport

Istanbul needs roads, rail, ports and airports in order to move people and goods to work, home and around. Istanbul serves as a major domestic and international transport hub.

Telecommunications

Landlines, mobile phones and internet lines provide the basis for communications which fuel economic growth.



Energy

Every urban center requires energy to power its transport, communications, work and life. The main sources include coal, gas, petrol, nuclear and alternative (wind, solar, etc.)

Water

Roughly 2 litres per day keeps the doctor away. Besides residential water (and waste water use), businesses use water.

The figure illustrates the major infrastructure we discuss in this brief. Istanbul's 13.5 million people need per year about 1.6 billion cubic metres of water, approximately 100 million megawatt hours of electricity, 4 billion kilometres travelled, and about 400 million hours communicating (by phone, internet, etc.).

Figure 4: Total infrastructure investment needed in the 25 most populous countries

Areas	Items	Needed (Wanted) Investment
Power	Coal, gas, petrol, nuclear and alternative energy	\$628.5 billion
Water	Fresh water and sewage	\$415 billion
Telecoms	Landline, mobile phone and mostly internet connectivity	\$1.6 trillion
Transport	Roads, rail, airport and seaports	\$1.4 trillion

III. Effective Demand for Infrastructure (How Much Will They Pay?)

Public procurement activities in emerging markets (if they come in at anywhere near the lowest end of that of OECD members) will come to about \$4 trillion by 2020. What would that investment actually buy?

Figure 5 shows what these abstract figures mean in concrete terms. The roughly \$1.8 trillion China will spend on infrastructure will build an infrastructure equivalent to the gross metropolitan product of Tokyo. A country's GDP, tax collection capabilities and procurement contracting possibilities naturally limit its ability to expand its infrastructure. Such limited capabilities unsurprisingly affect Tanzania, Congo, Ethiopia and Kenya. Without a budget constraint, their infrastructure spending would approach Turkish or Argentine levels. As such, these countries will need to find ways of crowding in private investment.

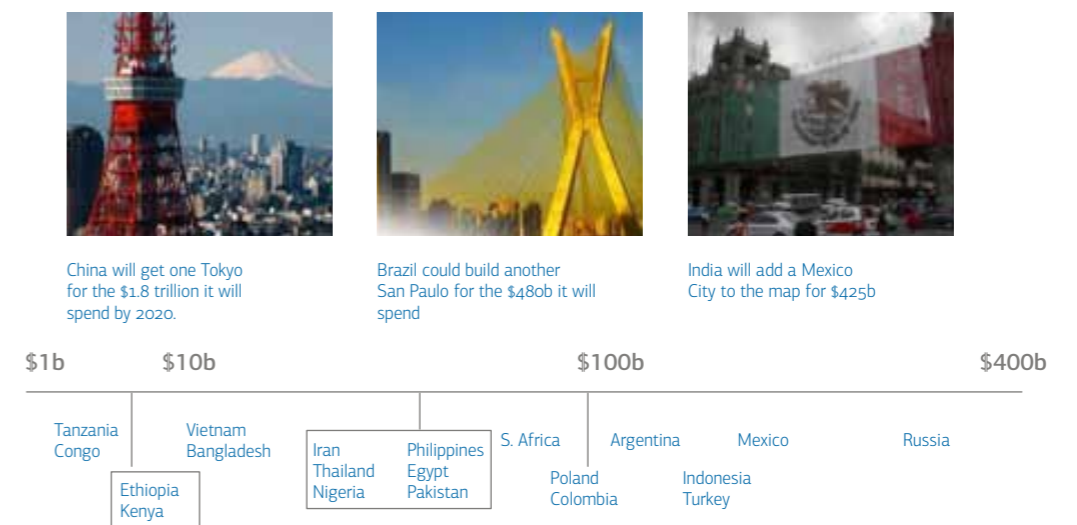
Past private investment in infrastructure tells us something about the extent to which a country will allow private investment in infrastructure in the future. Countries like Colombia

and Ukraine require very significant amounts of infrastructure investment, however, they have retained policies which prevent it. Differences between countries like Turkey and Ukraine illustrate the impact that policy can make on engineering and construction company prospects of winning contracts in these kinds of economies. Turkey has almost double the population of Ukraine, yet, as shown in Figure 6, the former has more than seven times more private investment in infrastructure than the latter. Media reports claim that China represents the largest opportunity for construction and engineering firms. However, looking at the data, Brazil represented a far larger opportunity for these companies than China in terms of the volume of private investment.

Which governments will be able to pay construction and engineering companies in the coming decade?

Figure 7 shows the countries most likely to buy infrastructure in the future, given their current state of public finances. China in particular

Figure 5: What Will \$4 trillion Buy In Emerging Markets By 2020?



The data in the figure shows the estimated total procurement of infrastructure-related goods, services and works between 2014 and 2020. We describe the methodology used to derive these estimates in the Appendix to this brief.

pays little on its relatively small level of debt, and maintains a high sovereign debt rating. The Chinese government, even without crowding in private investment, will be able to contract significant amounts of infrastructure-related goods, services and works. For countries like Turkey though, the prospects of obtaining government contracts for infrastructure look far less promising. Turkey has a moderate debt level (about 35% of GDP), although it has a widening budget deficit and relatively high interest rates on government debt. At the other extreme, India already has a high debt level (compared to GDP), and continuing budget deficits threaten to expand these debt levels further. With relatively high interest rates on government debt, we cannot see where the Indian Federal Government will find the resources it needs to expand investment in infrastructure.

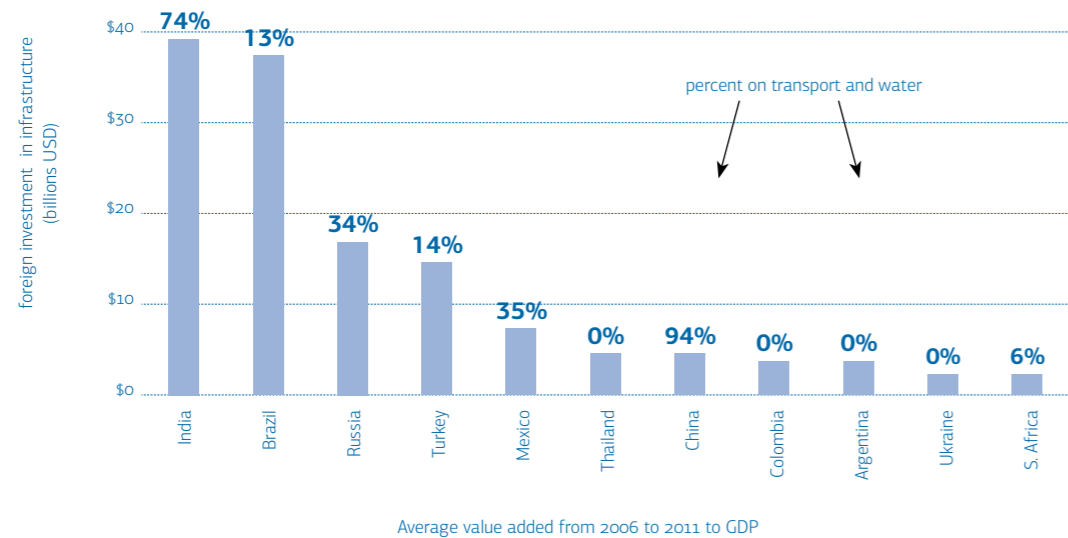
The ability to procure public contracts represents as important a consideration as the ability to pay for it. In some countries, large engineering companies can bid relatively easily

for infrastructure procurement contracts (e.g. in South Africa). In other countries, such as Egypt, Kenya and Turkey, firms have far more difficulty.

Figure 8 shows the ratings of a number of countries in terms of appraisal, selection, management and evaluation of the tender process for infrastructure projects. Complex procurement procedures have led to sub-optimal levels of infrastructure in the markets that need it the most, even in reasonably well-off economies like Brazil, Thailand and Turkey.

So, how much money will governments and private sector investors make available to fund this \$4 trillion demand? As we discuss later in this report, investors may supply any amount up to this limit. Government funding (through taxes) helps spread the risk of engaging in these investment activities to the private sector. However, as we have shown, many governments will find tax-and-spend financing expensive (given the borrowing and contracting costs we have illustrated above).

Figure 6: India, Brazil, Russia and Turkey Attracted the Most Investment In a Wide Range of Infrastructure



The data in the figure shows the amount of foreign investment in infrastructure, summed across investments in water, transport, energy and telecommunications for 2011.

Source: World Bank Private Participation in Infrastructure Investment Database (2013).

Figure 7: The Ability to Pay for Infrastructure in the Coming Decade

Country	Interest rates (10 year)	S&P Rating	Surplus (% GDP)	Debt (% GDP)	Demand for infrastructure*
Russia	7.3%	BBB	0%	8%	Good
China	3.6%	AA-	-2%	23%	Good
Colombia	6.8%	BBB	-1%	32%	Good
Indonesia	7.2%	BB+	-2%	23%	Good
Brazil	11%	BBB	3%	65%	Average
Turkey	8.3%	BB+	-3%	36%	Average
Mexico	5.5%	BBB	-3%	43%	Average
Thailand	3.7%	BBB+	-3.4%	44%	Average
Philippines	4.2%	BBB-	-2%	40%	Average
Nigeria	13.6%	BB-	-3%	18%	Average
Vietnam	9%	BB-	-4%	37%	Average
South Africa	7.5%	BBB	-5%	40%	Poor
Pakistan	12%	B-	-6%	50%	Poor
India	7.5%	BBB-	-6%	68%	Poor
Kenya	12.2%	B+	-5%	47%	Poor

* Economists differentiate between demand (for which customers can pay) from wants (where consumers may desire something, but they don't want to or can't pay for it). We have previously shown that governments need \$4 trillion investment in infrastructure, but many won't be able to pay for it. We have omitted countries without functioning public debt or securities markets (Iran, Ukraine, Tanzania, Egypt, Indonesia, Bangladesh, Congo, Ethiopia and Myanmar).

Figure 8: Getting Work in South Africa, Brazil and Thailand Is the Easiest and Turkey and Kenya the Hardest

	Appraisal	Selection	Managing	Evaluation
4	S. Africa	S. Africa	Thailand Brazil S. Africa	Thailand Brazil S. Africa
3	Brazil Thailand Bangladesh Pakistan Philippines Ukraine	Turkey Brazil Thailand Ukraine Bangladesh Philippines	Pakistan Philippines Turkey Kenya Bangladesh	Bangladesh Ukraine Pakistan Egypt
2	Egypt Kenya	Egypt Kenya	Ukraine	Kenya Turkey
1	Turkey	Pakistan	Egypt	Philippines

Source: Dabla-Norris (2010).

IV. Cashing In On the Infrastructure Gold-Rush

Investing in the global firms

Investors like individuals and portfolio managers will want to invest in this \$4 trillion opportunity by buying shares in the global “design firm” giants.

Figure 9 shows how the returns of the global construction and engineering companies compare with the global market portfolio and the largest company in the class. Global engineering and construction companies have generally performed in line with the market – beating the market slightly during the recession and under-performing during the recovery. Unsurprisingly, a diversified portfolio of construction and engineering companies has performed better than the largest company in the group, AECOM. Investors looking to take advantage of the upcoming investment boom in infrastructure should seek to invest in a diversified range of these companies, in the US as well as in emerging markets.

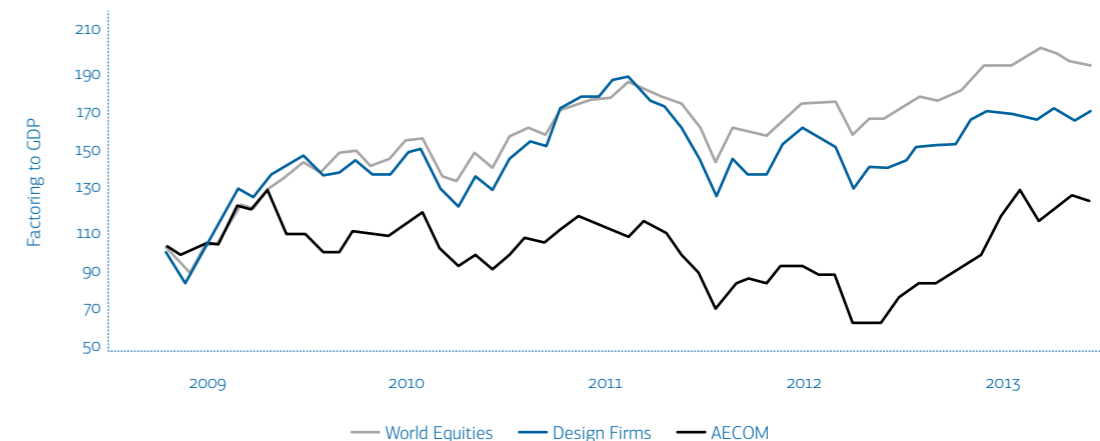
The top ten global “design firms” earned about \$20 billion in 2012. As we describe in Figure 10, no infrastructure industry exists per se,

and problems defining such an industry make research on the sector particularly difficult. The various activities that go into designing, building and maintaining cities go by a wide range of names and economic classifications. You will probably have heard of many of these companies, yet not been clear about the exact industry in which they work. Despite their importance, these companies actually earn relatively little revenue. The top companies (mostly from the petrol sector) on the Fortune Global 100 earned revenues over \$100 billion per year. In contrast, the largest of the global design firms booked a meager \$7.3 billion in 2012.

Investments in the global design firms may represent an important way to access cheaply and effectively the upcoming boom in infrastructure investment.

Figure 11 provides a vade mecum for the would-be retail or wholesale investor in global infrastructure. Of the \$20 billion these companies earned in 2012, roughly 40% of these funds came internationally (outside of their own country). For about half of these countries, international revenues mean revenues earned

Figure 9: Investing in Global Engineering and Construction Companies Provides a Partial Hedge Against Other Market Risks



The data in the figure shows an index of equity prices for First Trust ISE Global Engineering and Construction Index (FLM), Vanguard World Equities Index (VT), and AECOM (ACM) centered on January 2009.

outside of the USA. While some of these revenues came from other developed markets, an increasing share comes from the emerging markets we describe in this brief. For example, AECOM booked roughly \$3.5 billion out of its total \$7.3 billion in turnover in 2012 internationally (outside the USA).

These design firms provide numerous lessons for would-be competitors from developing markets like Russia. Firstly, as portfolio companies, they bring together a range of skills. AECOM staff can do a cost-benefit analysis of a tunnel, or advise on building it. They do not specialize in building bridges, roads, or even cities. They specialize in “design” – meaning they can design infrastructure from bespoke rails to entire megalopoli.

Secondly, these companies can provide the necessary scale for the infrastructure investments of the next decade. The Top 10 global design firms amass assets roughly equal to India’s entire publicly listed engineering and construction industry. The total assets these companies command eclipse those of listed and

public firms in 90% of the emerging markets we have reviewed in this report. Thirdly, they show that city building comprises far more than just construction. The largest construction companies (called “contractor firms” by specialists) hail from China. These include China State Construction & Engineering, China Railway Construction and China Railway Engineering.

Investing in emerging market firms

Many individual and portfolio manager investors from emerging markets cannot (or don’t want to) invest in the global design firms. However, by market capitalization and assets, many engineering and construction companies in emerging markets provide locally grown alternatives to the global design firms.

Figure 12 shows the size of engineering and construction sectors in the emerging markets we study in this report. In many countries, like Ukraine or Bangladesh, these companies either remain too small, or too private to provide the statistics needed for our comparisons.

Figure 10: What is a Design Firm?

Who builds the world’s cities? We cannot actually say for sure. Design firms do the layout, architecture and design of buildings, and even plan entire cities. Some famous names include AECOM and Arup. Building contractors do the actual construction, with famous names including Bechtel and Skanska. Most of these companies represent portfolios of projects, rather than companies as we think of them in the usual sense. Nike makes shoes and clothing. IBM makes computers. Yet AECOM can give advice on economic development policies, the design of an airport, or help arrange for builders to come and put a skyscraper together. The largest company, AECOM, weighs in at number 1907 on the Forbes 2000, with a market capitalization of only \$3.2 billion. On the other hand, China State Construction International weighs in at \$5.8 trillion.

Despite the importance of the infrastructure industry, the financial press rarely discusses these behemoths. You won’t find these design companies on a list of industrial sectors in the Wall Street Journal. You also won’t find them in one area of the Standard Industrial Classification (SIC) list. A company might be an engineering company (like Cardno), an engineering-consultancy company (like Tetra Tech), or a construction and civil engineering company (like Flatiron Construction). China State Construction represents a construction company (and a potential contractor if the firm decides to operate in earnest abroad). A Factiva search presents “construction” as an economic sector, yet it omits the companies that do all the intellectual side of the work. A good step toward seizing this \$4 trillion booty may lie in the naming of this industry!

Yet, in some cases, particularly China, India and Brazil, their construction and engineering companies rival those in many Western European countries.

The volatility of infrastructure funding represents one of the largest obstacles to the development of a homegrown design sector in emerging markets. Figure 13 provides an example from Brazil of the volatility of such investment. Investment in each of the four major infrastructure sectors we analyze can radically change from one year to the next. Changes in overall investment (summing over these four components) have varied significantly over the decade. Overall infrastructure decreased until about 2004, and then rose, with a bump in 2010. Volatility in Brazil’s private infrastructure in-

vestment represents the norm among emerging markets, rather than the exception.

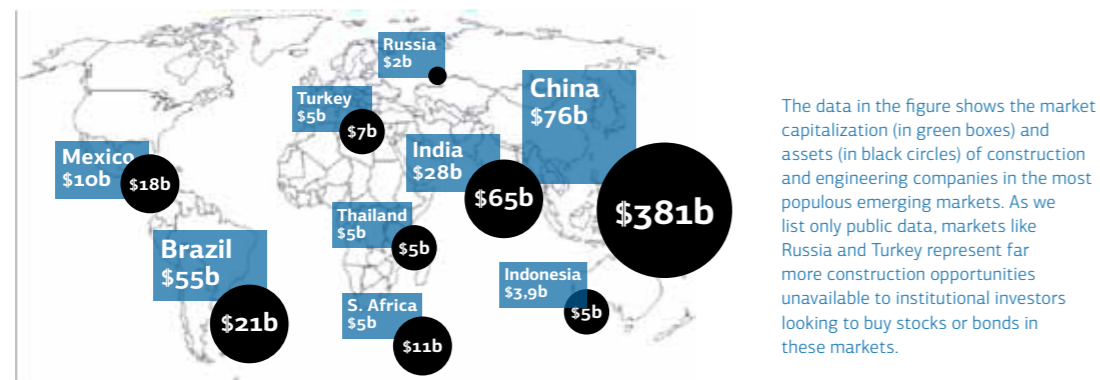
Cashing in on the emerging markets’ infrastructure “gold rush” requires significant, as well as sustained, investment in the years ahead. The global design firms have engaged in a great deal of work in these emerging markets. However, they have not been able to bring the kinds of investment needed to build entire cities from scratch. They remain bidders in large-scale procurements. What can these firms and their counterparts in the emerging markets do to make (rather than take) infrastructure markets?

Figure 11: A Primer on the Top 10 Global Design Firms

AECOM Technology Assets: \$5.7b Profit: \$57m Revenues: \$7.2b Employees: 46,800 Location: US Ticker: ACM Core competency: General building Offices in our EMs: 15 The premier engineering and consulting company. Take a trip to any foreign country and see their sign featured on a building site.		URS Corporation Assets: \$7b Profit: \$400m Revenues: \$5.8b Employees: 56,000 Location: US Ticker: URS Core competency: Transport Offices in our EMs: 10 From bridges to space centers, URS pulls in about 20% of its revenue outside the USA.	
Jacobs Engineering Assets: \$6.8b Profit: \$ - Revenues: \$5.2b Employees: 60,000 Location: US Ticker: JEC Core competency: Energy Offices in our EMs: 10 Airports, railroads and ports. About 40% of its revenue comes from abroad.		WorleyParsons Assets: \$ - Profit: \$350m Revenues: \$4.5b Employees: 40,000 Location: AU Ticker: WOR Core competency: Energy Offices in our EMs: 6 Like many other engineering companies, they do everything. From master planning a Ghanaian city, to Canadian port development.	
Fluor Corp. Assets: \$ - Profit: \$450m Revenues: \$4b Employees: 41,000 Location: US Ticker: FLR Core competency: Energy Offices in our EMs: 7 Texas-based energy company, with numerous “most admired” awards.		AMEC Plc Assets: \$ - Profit: - Revenues: \$3.9b Employees: 29,000 Location: UK Ticker: AMEC Core competency: Petrol Offices in our EMs: 2 A British energy company (roughly speaking the British version of Fluor), with a green energy bias.	
CH2M Hill Assets: \$ 2.7b Profit: \$ 450m Revenues: \$3.9b Employees: 30,000 Location: US Ticker: not listed Core competency: Transport Offices in our EMs: 14 Another portfolio company, with a penchant for US Government procurement.		Fugro Assets: \$ 3.9b Profit: \$ 290m Revenues: \$3.6b Employees: 13,900 Location: NL Ticker: FUR Core competency: Technical consultancy (geological, geotechnical & geoenvironmental) Offices in our EMs: - A full-on oil company, involved in exploration and production.	
SNC-Lavalin Assets: \$ - Profit: \$ 390m Revenues: \$3.4b Employees: 29,000 Location: CA Ticker: SNC Core competency: Engineering & construction Offices in our EMs: - Canada’s answer to a design firm, proving that smaller economies can copy the tried-and-true model internationally.		Arcadis Assets: \$ - Profit: \$ 80m Revenues: \$2.8b Employees: - Location: NL Ticker: ARCAD Core competency: Natural and built asset design and consultancy firm Offices in our EMs: 9 A UK firm, focused on surveying and construction.	

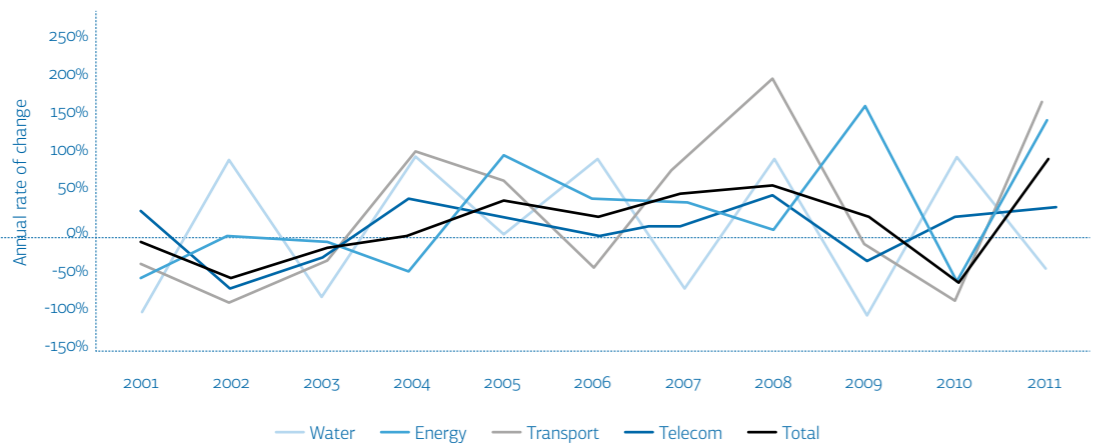
Source: ENR.com and company annual reports.

Figure 12: Assets and Revenues of Emerging Markets' Engineering and Construction Companies



Source: Dabla-Norris (2010).

Figure 13: Private Participation in Brazil's Infrastructure Investment Fluctuates Wildly from One Year to the Next



The data in the figure shows the rates of change of private investment (in current US dollar terms) in each of the four infrastructure sectors covered by the World Bank.

Source: World Bank's Private Participation in Infrastructure Database

V. Growing Emerging Markets for Infrastructure

Emerging market governments alone cannot and will not tax and procure \$4 trillion in infrastructure. What can design firms and investors alike do to crowd in infrastructure? Firms and investors in these firms can directly lobby both their own and foreign governments to adopt the WTO's Agreement on Government Procurement. They can provide capital to the smaller design firms in developing countries. They can buy 322,580 shares of ACM (which represents AECOM's ticker) with their \$10 million funding budget. Better still, they could ask for about 25 million shares of JPIN:IN (Jaypee Infratech's ticker symbol). They (you) can encourage water and transport companies (the hardest part of this market to reach) to issue shares and sell their debt more widely. Finally, all kinds of non-construction entities can profit from the upcoming infrastructure gold rush. Lawyers can help write the regulations governing how new rail lines work. Auditors can assess the risks of a communications breakdown. Even marketing firms and NGOs can grab a piece of the pie, by offering marketing and surveying services. All these service providers can issue shares in their own and foreign markets. The securitization of these professions in emerging markets will help capitalize this \$4 trillion boom.

Sign, Implement and Use the WTO Agreement on Government Procurement (GPA)

The WTO Agreement on Government Procurement represents one of the most important agreements that you have probably ever heard of. The Agreement requires governments to publicize information about their public procurement laws, regulations, and invitations to tender for goods, services and works. In theory, every time the governments of the largest economies want to procure a large bridge, port, or even city, they should let companies in the other large economies know. These economies include the members of the OECD and some others, like Hong Kong, Iceland, Israel, Korea, Taiwan, and conspicuously, Armenia.

Many of the governments which could benefit most from liberalization in procuring infrastructure-related goods, services and works have only just started to open up. Figure 14 shows the status of several observer governments to the WTO Committee on Government Procurement. Only China and Ukraine have declared their interest in acceding to the Agreement. What about the other countries? Protected infrastructure markets hurt engineering and

Figure 14: Governments Negotiating Membership and Contacts

Country	Procurement transparency score**	Observer Date	Representative Agency
Argentina	99	24 February 1997	Ministry of Economy
China*	91	21 February 2002	Ministry of Commerce
India	76	10 February 2010	Ministry of Commerce and Industry
Indonesia	90	31 October 2012	None provided
Russia	87	29 May 2013	Ministry of Foreign Affairs
Turkey	94	4 June 1996	Ministry of Economy
Ukraine*	78	25 February 2009	None provided
Vietnam	72	5 December 2012	Industry and Trade Info. Center

* In the process of accession.

** Shows transparency scores from Global Integrity (a Washington-based NGO) in 2011, or the latest year available. The score has a maximum of 100.

construction companies that cannot compete abroad. Governments like India and Indonesia also suffer, as they pay far more for far less infrastructure. Business people in these countries, as well as the countries doing business with them, should write to the relevant WTO representative agency and encourage them to accede to the Agreement.

Implementing the Agreement on Public Procurement represents a far more important step than signing it.

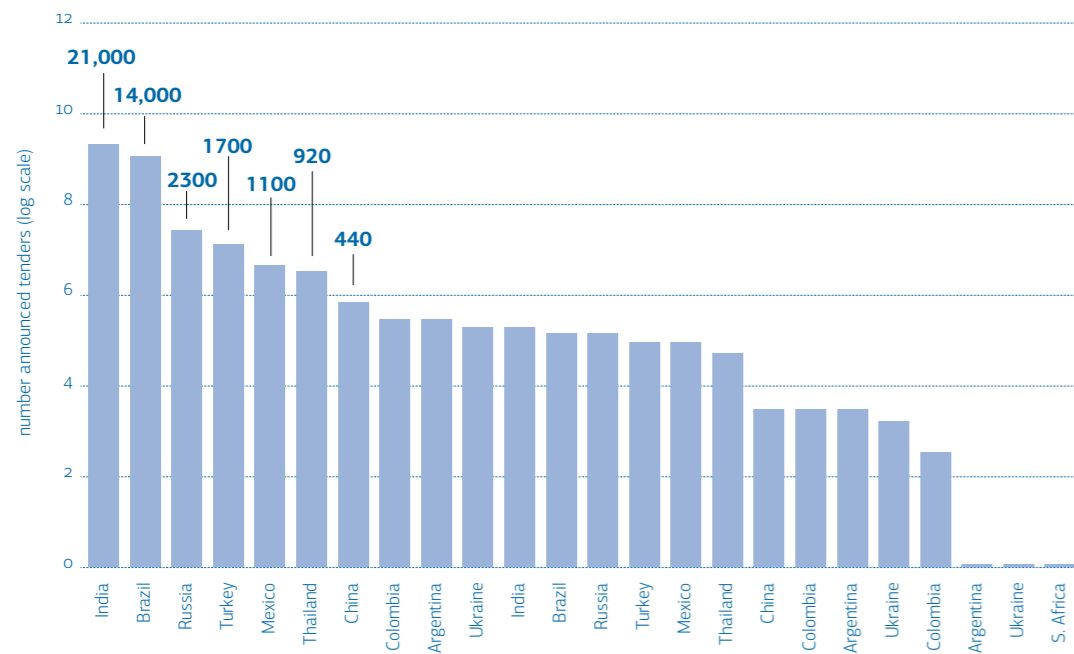
Figure 15 shows the number of infrastructure and construction tenders published on a popular website. Large economies like Brazil and Mexico have few tenders listed on these sites, with much of their related work reserved for local firms and large companies which know how to navigate local government bureaucra-

cies. Even for large economies like Turkey or South Africa, the number of tenders easily accessible to up-and-coming builders looking to cross borders remains extremely small. In theory, most governments announce public procurements on their procurement agency's website. These statistics show that this information does not filter out widely, if at all.

Provide capital to fledgling design companies in emerging markets

Construction and engineering companies in emerging markets certainly do not lack opportunities for potential work. So why does so much work go to global design firms? Why do potentially profitable infrastructure projects go unbuilt?

Figure 15: The Number of Announced Tenders Does Not Correspond to the Size or Importance of the Infrastructure Market



The data in the figure shows the number of infrastructure and construction tenders advertised on Globaltenders.com on 5 July 2013.

Many portfolio managers and institutional investors simply do not know about these infrastructure firms and the kinds of returns they can generate from them. Figure 16 shows an equity price index of three infrastructure-related shares that we have chosen at random. Readers should keep three features about these companies' equity in mind. Firstly, if they had invested in companies like Japee Infratech they would have tripled their money in just over 3 years. Secondly, these shares offer something for every investor. Investors in the Mexican Development and Employment Promotion Company would have experienced very steady returns over the period (albeit losing a bit of money). Thirdly, when all three shares are combined into one single portfolio, their overall risk falls and returns increase significantly. Imagine holding equal shares in Vietnamese and Mexican infrastructure stocks. You would have broken even with very little variance in the prices of your shares. When you combine these two with an equal weighting of the Indian stock, you would have profited without much of the price variance experienced by Japee alone.

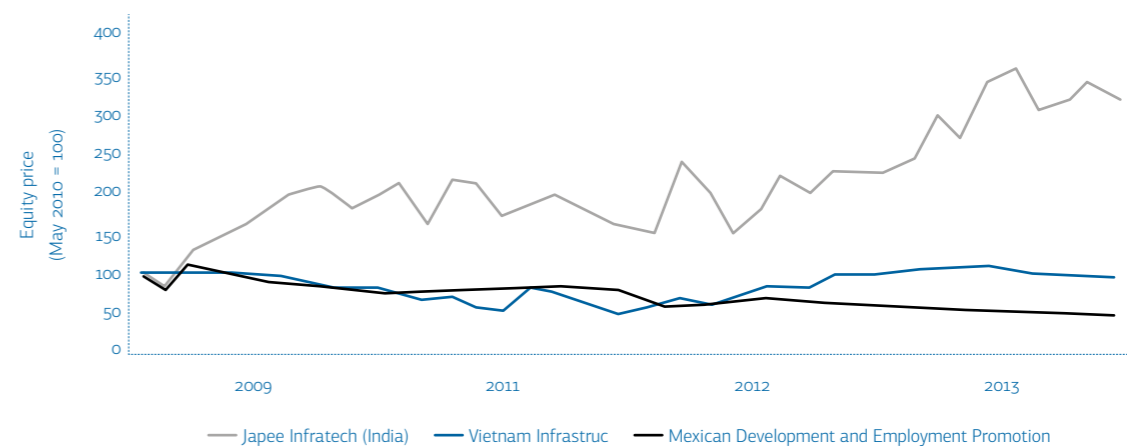
Which emerging market infrastructure-related companies can investors put capital into?

Figure 17 shows the names of some of the largest of these companies by market capitalization and by assets. Many of these largest companies represent relatively small concerns, compared to the global design firms. However, with assets of over \$5 billion, the largest Brazilian infrastructure companies could compete with their global rivals. With a market capitalization of \$1.6b, Indonesian companies like Ino-visi Infracom could do so too. Why then don't more investors choose these companies?

Unfortunately, these companies lack the good fortune to originate from countries that have encouraged foreign openness to their goods and services (see our recommendation with regard to the WTO Agreement above).

For investors willing to invest indirectly through a collective investment scheme, a wide range of infrastructure companies can be tapped. Four large global infrastructure exchange-traded funds (or ETFs) supposedly dominate the market for indirect investment in these companies. Yet iShares Global Infrastructure (IGF)

Figure 16: Infrastructure Firms in Emerging Markets Can Provide Both Returns and Much Needed Portfolio Co-variance



The data in the figure shows the index of equity prices for three construction and engineering firms in emerging markets (in this case India, Vietnam and Mexico).

invests less than 10% of its capital in emerging market infrastructure companies. The iShares S&P Emerging Markets Infrastructure Index Fund (EMIF) has over 50% of its capital invested in China (28%) and Brazil (32%). The FTSE/Macquarie Global Infrastructure 100 invests entirely in upper-income economies (with more than half of the ETFs' capital in the USA). Only PowerShares Emerging Markets Infrastructure Portfolio (PXR) provides a broad range of investment in emerging market infrastructure companies (and we provide its holdings in the Appendix). Investors should allocate more capital to emerging market infrastructure companies. Mutual fund and portfolio managers should offer a broader range of emerging market companies for investors to tap. In practice that may mean placing a number of Ukrainian and Bangladeshi infrastructure shares into mutual funds that Wall Street brokers then sell -to institutions.

Invest in former public goods like water and transport

Water and transport represent public goods. Attempts to privatize the former in emerging

If they had invested in companies like Japee Infratech they would have tripled their money in just over 3 years

markets have generally led to civil unrest (think Bolivia). The efficient and low cost railways of Western Europe show that investors can only recoup their investments indirectly. However, investing in water and transport may still represent viable alternatives for investors. Much of the research recently conducted shows that the question is not whether to privatize or not. Rather, governments and investors should focus on privatizing appropriately (or privatizing the optimal amount of water and transport service, given the country's level of development).

How can institutional investors and portfolio managers, as well as construction companies looking to diversify abroad, take advantage of new opportunities to participate in emerging market opportunities related to supposedly public goods like water and transport?

Figure 18 shows several publicly traded

companies that invest in water and transport infrastructure in emerging markets. We show the maximum share price as a percent of the minimum share price in 2012 to show that these companies' equity prices do not remain very stable (and are thus uninteresting). Many of these shares (like any shares in general) would have produced extremely good returns if the investor had timed their purchases and sales well. These shares also provide investors with both exposure to these developing infrastructure markets, as well as volatility, which they can use to offset risks in other parts of their portfolios.

These companies represent a drop in the proverbial bucket. Most of the emerging markets we have studied have very little (if any) private resources invested in their water and transport sectors. The largest economies like China, Russia, India, Brazil, Mexico, and so forth have private participation in these supposedly public goods. Yet Figure 19 shows the woeful under-investment in these sectors in the countries that need it the most. Total investment in these countries since 2000 has totaled \$16.4 billion – roughly three times the size of Ireland's water sector-related investments alone. Such

investments will not come anywhere near close enough to providing for the needs of future Ukrainian, Indonesian and Kenyan workers.

Private sector funding can fill most, if not all, of this gap, considering that the largest water and waste infrastructure providers account for about \$1 billion in revenues. MWH Global obtains roughly 80% of its revenue from water and waste. The company earned about \$590 million internationally in 2012. Brown and Caldwell (a US-only water provider) earned \$282 million in revenue in the same year. The revenues alone of these two companies account for the total private investment in the water sector in Thailand for the previous decade. Incorporating local water providers (at least partially) as publicly held corporations could provide capital (and revenue generating possibilities) in emerging markets.

From Artistic to Practical Master Planning

Many urban master plans remain pieces of art rather than implementable projects.

Jakarta Garden City Master Plan shows one of the many examples of the beautiful master

Figure 17: Larger Infrastructure Companies in/from Harder to Reach Markets

Name	Assets	Name	Market Cap
Indonesia			
Pembangunan Perumahan	\$790m	Inovisi Infracom TBK	\$1.6b
Adhi Karya Persero TBK	\$696m	Jaya Konstruksi Manggala PR	\$475m
Thailand			
Italian-Thai Development PCL	\$1.7b	Italian-Thai Development	\$619m
Ch Karnchang PCL	\$120m	Ch Karnchang PCL	\$412m
Vietnam			
Ho Chi Minh City Infracom	\$244m	Vietnam Const & Import	\$131m
Development Invest Const	\$234m	Quoc Cuong Gia Lai Jsc	\$84m
Brazil			
Construtora Mendes Jr Engr	\$5.5b	Rossi Residencial SA	\$1.3b
Gafisa SA	\$5.7b	Gafisa SA	\$1.1b

* We list different companies, as the top companies by market capitalization may not have the largest amount of assets in their country and/or category (and vice versa). Source: Computstat (2013).

Figure 18: Returns to Investments in Unsexy Infrastructure

Company	Ticker	Max return 2012*	Recent News
Water			
Tetra Tech	TTEK	29%	Recently won \$500m in US government contracts in rule of law in developing countries, showing that the idea of "core competences" does not function very strongly in this sector.
Pentair	PNR	50%	Completely unremarkable, and that's how it should be. Pentair's news consists only of water trade shows and executive moves.
Veolia Environ.	VE	47%	A recent contract to provide services to Marafiq (a leading Saudi Arabian water services operator) shows the aggressive stance this company has taken in emerging markets.
Transport			
Atkins	ATK.L	62%	Next to AECOM and possibly Arup, Atkins represents one of the most visible names on construction sites across the emerging world and is even active on construction sites near London!
STV Group	STVGL	87%	Mostly featured in UK news, this company earned \$263 million in revenue last year.
Michael Baker	BKR	44%	A \$2.5 billion beachfront property development contract in Oman formed reason enough to open a Middle East office, and that's probably just the beginning.

* Maximum return refers to the 2012 52-week high equity price divided by the 2012 lowest price.

plans designed for large urban areas. These plans provide for green areas, environmentally friendly mixed-use (working and living) areas, and easy access to transport. Type the city of your choice and the words “master plan” into Google and you will certainly find one. These master plans look like cities from The Lord of the Rings, because the design firms that create them have no responsibility for implementing them. In fact, no government agency or contractor has the legal or administrative obligation to make these master plans a reality. Interestingly, no statistical analyses yet exist assessing the number of these plans which have actually been implemented.

If the design firms put together projects to execute these master plans, the revenues will spread far beyond the likes of AECOM and their local cousins. Figure 20 shows some of the professions that must participate in implementing multi-project infrastructure-related master plans. Draughtsmen (the men and women who draw the pretty pictures) represent an important part of the process. So do the research companies that ask the current residents if they want a new train station or park. However, these master plans almost always fail to include the lawyers who must revise local planning ordinances, the public finance experts who must

advise the city government on how to budget for recurrent capital expenditures, and so forth.

Auditing represents a core activity in master planning. Few policymakers and even business people understand the role audits play in every phase of the infrastructure master planning process. Auditors assess risks related to the plan, the extent to which the plan matches local and national development goals, and so forth. Auditing also ensures that bankers chose the best methods of long-term finance, and that legal counsel drafts the appropriate regulations. Such widespread participation of auditors in this process shows the importance of the role in urban design and infrastructure planning. In validation of this conclusion, readers should note that an audit firm has helped pay for this study, and that its main author is himself an internal auditor).

Professional service firms can prepare for this wave of infrastructure in a number of ways. Lawyers and marketing firms can help relay to taxpayers in many of these low-tax paying countries (particularly India and Russia) the importance of paying taxes and monitoring procurement-related public expenditure. Most readers would laugh at that recommendation. However, such trends have underpinned large increases in spending in Brazil, South Africa,

Mexico and Turkey. These professional service firms should also let the design firms and construction companies know about their services far more aggressively. When you approach many URS project managers and tell them they should consider an analysis of local regulations or model economic impacts, many still stare with incredulity. Few tender proposals consider the range of services we describe in Figure 20, which would help ensure the long-term sustainability of many of these infrastructure procurements.

These shares also provide investors with both exposure to these developing infrastructure markets, as well as volatility, which they can use to offset risks in other parts of their portfolios

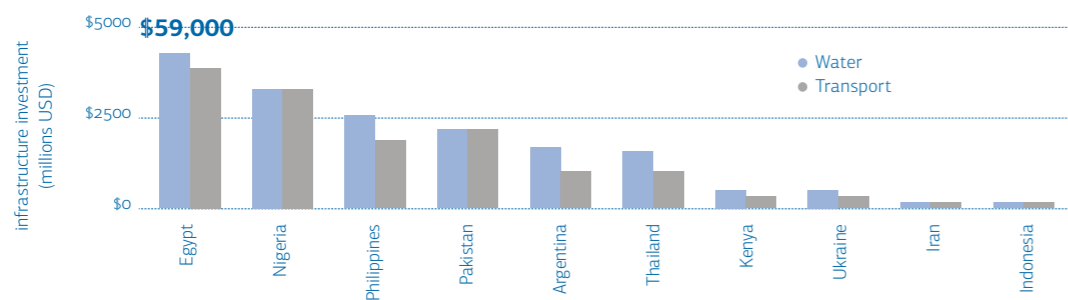
Using design firm development to deepen equity markets

In OECD countries, tying long-term infrastructure development to stock markets seems extremely dubious. However, the present crisis notwithstanding, the overall trend shows that equity market development correlates with infrastructure development. In the USA, the first publicly traded corporations emerged to fund large infrastructure, like a bridge over Boston’s Charles

River. Building large expressways in Moscow, Cairo, Kiev and Mexico City can ease infrastructure burdens. More importantly, the projects set up as corporations to collect the money for these projects can offer savers a \$50 million vehicle for doing just that, and, moreover, a pension to draw on in old age. Such securities (either stocks or debt issued by these projects) then go into other portfolios, serve as bank collateral, and are key to what economists call the “money multiplier.”

In all the emerging markets we have studied for this report, the private securitization of

Figure 19: Investment in Water and Transport Is a Pittance of the Value of Total Domestic and Foreign Infrastructure Investment



The data in the figure shows the total cumulative investment in transport and water infrastructure in selected emerging markets from 2000 to 2012. Egypt had almost \$60 million in transport infrastructure investment (putting the country off the scale).

Source: World Bank Private Participation in Infrastructure database (2013).

Figure 20: Not Only Design Companies Will Benefit From The \$4 Trillion Bonanza

Phase of implementation	Companies involved	Description
Design	Design firms, auditors	From zoning to designing buildings and common amenities (like stadiums, rail stations, and so forth), design represents the area on which municipal authorities focus the most.
Finance	Banks, finance companies and auditors	Local governments have little authority to crowd-in private sector finance for infrastructure. National authorities are naturally wary of local authorities engaging in borrowing and certain types of securitization.
Procurement	Materials providers	Usually matched with the design phase, governments have a solid sense of the procurement of goods, services and works.
Ordinance drafting	Law firms	Usually completely lacking in any large-scale infrastructure and master planning expertise.
Consultation	Marketing companies	Consultation is usually deemed too risky for local governments, which try to limit public engagement in these areas.
Quality Control	Consulting companies and auditors	How well have railroads and highways been built? Do ports and train stations generate the revenue previously anticipated? Quality control can help fix design problems before they sap resources from the broader infrastructure development program.

* Maximum return refers to the 2012 52-week high equity price divided by the 2012 lowest price.

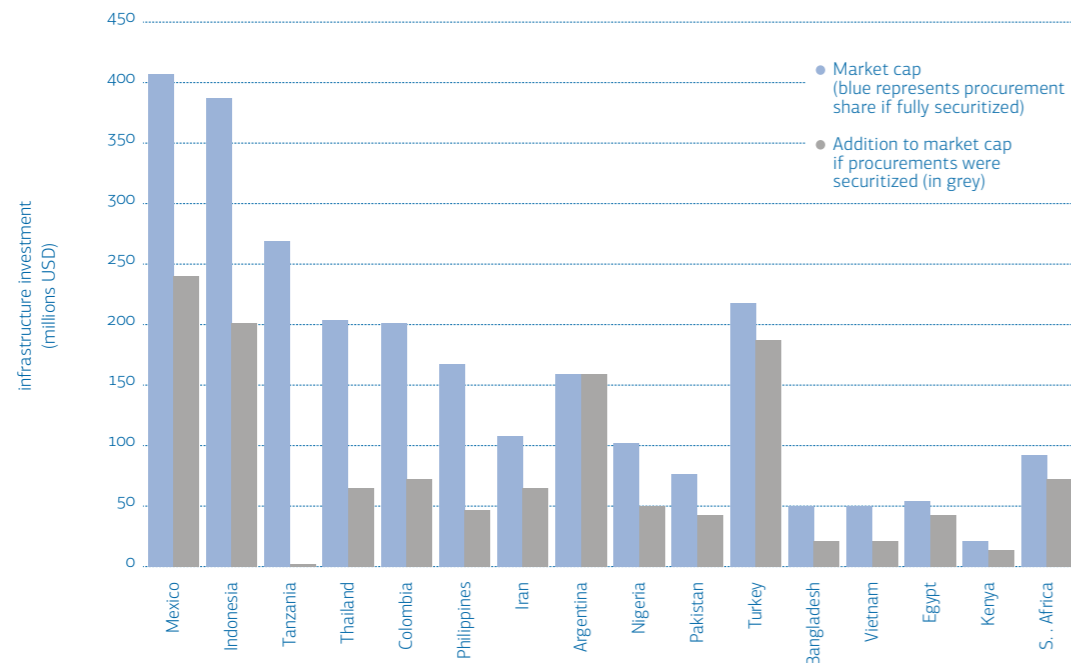
even a modicum of infrastructure investment would expand equity markets significantly.

Figure 21 shows the effect of this securitization, namely the breaking up of infrastructure projects into companies and selling their shares to the general and investing public. In Mexico, such infrastructure investment would represent about half the value of the Mexican Bolsa (stock market). In Argentina and Turkey, investments of this nature would increase the size of each country's traded securities by about 10%. Relatively small increases in the size of the Egyptian or Kenyan equities markets likely reflect investors' inability to absorb investments in very large projects. Gross national product in these countries would need to grow before large-scale securitization would increase the size of these stock markets.

Participants in all stages of an infrastructure project should consider using se-

curitization as they build emerging markets' \$4 trillion dollars worth of projects. Governments can tender projects already incorporated as corporations (and tender shares along with project specifications). Design firms can sell off projects as special purpose vehicles (though the name has nasty connotations in post-Lehman financial markets). Emerging market firms can issue their own shares more widely on the world's exchanges as a way of pooling the risks inherent in the shares of any one project. Emerging markets' construction and engineering "designer firms" can serve as surrogate portfolios, assembling the shares of 200 or more projects in various emerging markets' corporatized projects. A financing method like this one would make companies like Indonesia's Wijaya Karya Persero, or the Mexican Grupo Carso, far less risky, bigger and more financeable.

Figure 21: Infrastructure Investment Could Promote Stock Market Development in Many Countries in Need of Such Development



The data in the figure shows the value of market capitalization and the value of infrastructure procurement over the next 6 years, assuming a simplistic 4% spend relative to GDP.

Source: World Bank (2013).

VI. Conclusions

Emerging market governments will need to invest about \$4 trillion in order to meet residential and commercial demand for infrastructure. In this brief, we have looked at the water (including waste water), telecoms, transport and energy infrastructure needed in the most populous emerging markets. We can't tell the reader where planners and builders should place each bridge or wireless antenna. However, we could exploit patterns in overall spending in advanced OECD markets to predict how much infrastructure investment emerging market governments need to make. Using reasoning redolent of the "law of large numbers", we can draw country specific idiosyncrasies in broad patterns and show the additional infrastructure spending needed by these emerging markets.

We argue that investors in both OECD and emerging markets could invest far more in infrastructure companies. We identify some of the major infrastructure companies for retail and investment firm customers looking to take advantage of this upcoming boom. Investors putting money in the global "design firms" can obtain broad coverage of this trend, but lesser known companies in emerging markets need the capital and can arguably use it far more profitably. An investment in a Thai, Russian, Mexican or other construction and engineering company we have identified in this brief may help investors take advantage of the upcoming emerging market infrastructure "gold rush."

We also identify ways that governments and companies can make the most out of these infrastructure-related needs. The WTO Agreement on Government Procurement can open up markets to a range of lower cost and higher quality foreign design and construction firms. The Agreement can also encourage emerging market firms to increase their assets and revenue abroad, thereby entering the league of design firms reserved for OECD member firms. Many infrastructure firms, in both the OECD and emerging markets, remain in private hands. By listing, they can obtain more capital and increase their exposure in emerging markets. Finally, other professions can also "get in" on the infrastructure boom. Lawyers, auditors, and even marketing firms will see a fair amount

of residual demand generated from large infrastructure projects. They should seek work in this area.

Appendix: How Did We Arrive At Our Estimates?

State of play in infrastructure market sizing

Among the OECD countries, infrastructure needs assessments have become extremely well developed. Figure A shows one example from the USA of a cost-benefit analysis of infrastructure investments in water, energy, transport and communications (and several other areas). It is conducted by way of a locality-by-locality analysis, focusing on the major risks to infrastructure posed by obsolescence. As the USA represents a well-developed infrastructure network, they

rightly focus on the costs incurred by disruptions to the country's energy, transport, water and telecom infrastructure. Replacing and upgrading aging infrastructure represents an important part of infrastructure renewal. However, in countries like China, which grow extremely rapidly, we need to analyze more than the state of existing infrastructure. We need to assess future requirements, often in areas of infrastructure (like mobile telephony) where infrastructure does not yet exist.

Other reports attempt to assess the state of infrastructure in emerging markets. Figure B

Figure A: Example from the USA of an infrastructure funding gap assessment



Source: Dabla-Norris (2010).

Figure B: Other infrastructure reports and market sizings

Institution	Description and critique
WEF/KPMG	Specifically use a GDP measure of required infrastructure and place spending needs at about \$1 trillion.
McKinsey Global Institute	Estimate a total \$57 trillion in the infrastructure needed across all markets. Roughly \$2.5 trillion in necessary additional targeted infrastructure (far closer to our own estimates).
RBS	Estimate a total \$20 trillion need for infrastructure across all markets. They do not explicitly state marginal increased needs, though their growth projections look very similar to our own.
E&Y	Another GDP-based estimate of total required infrastructure spending (put at about \$57 trillion). They do provide some consideration of population as a driver of infrastructure and major urban centers.
OECD	Their report Infrastructure to 2030 provides the most comprehensive overview of infrastructure needs, however it only looks at the OECD economies. Using their methodologies to assess infrastructure needs in emerging markets seemed like a logical extension of the analysis.

shows examples of some of the more prominent studies. We found almost 200 reports assessing aggregate or sector-specific infrastructure needs worldwide. However, we could not use most of them, because they consisted of estimates, without any explanation as to how the authors reached these evaluations (mostly sourced from investment banks). In other cases, the existing reports consisted of surveys of executives. Finally, we found references to large studies conducted by companies like Morgan Stanley and Booz-Allen Hamilton, however, these reports had been removed from the internet at the time of our study. As a result, we could not evaluate the extent to which these reports provided reliable estimates of infrastructure spending needs.

While preparing this brief, we analyzed a number of other studies and reports. Many use GDP as a rule of thumb for infrastructure spending needs. This approach, epitomized by the relatively frequently cited McKinsey Global Institute, argues that infrastructure needs correspond with economic size. Larger economies have more factories, produce more things that need to be shipped to foreign parts, and so forth. Figure C shows why such an approach generates completely inaccurate estimates, at least for fast-growing emerging markets. The fastest

growing economies, like the Congo or Kenya, need to expand their water, energy, telecoms and transport infrastructure far faster than places like Russia. Per dollar of GDP, Kenya adds about four more people than Russia. These people do not require less water than Russians. In fact, they require more, because they need to develop an infrastructure that covers a much smaller proportion of their population. Using the McKinsey method, these infrastructure-starving economies require far less investment than economies like Russia and Argentina, which have already made significant investments in infrastructure. Using GDP as a proxy for infrastructure needs is just not sensible.

We follow the disaggregated approach followed by the OECD. In the OECD study, the authors break down infrastructure needs according to population. For water, they estimate the number of people and companies that need fresh water by country. For energy, they break down energy needs by population (both residential and commercial). They calculate how various methods of energy production can meet this demand, such as production using coal, gas, petrol, nuclear and alternative methods. Finally they ascertain the quantity and methods of supplying extra energy to match demand.

Our infrastructure model

Our infrastructure gap model places the needs of an expanding population at the heart of the analysis.

Figure D provides a representation of the way we conducted our analysis. Firstly, we had to calculate the need for water, energy, transport and telecoms for populations in each emerging market. We roughly know from OECD estimates the value of these services required by population. We use OECD averages as our baseline, because if emerging markets like Kenya or Thailand want in the future to produce outputs at the same level as the OECD member states (namely as upper-income countries), they will need an upper-income country infrastructure. Secondly, with these needs in hand, we estimate the extent to which existing populations are underserved by existing infrastructure. The World Bank provides data on access to electricity and other statistics that allow us to guess how many people do not have access to infrastructure, both inside urban areas and outside of them. We know the cost of maintaining infrastructure in these urban and rural areas (thanks to the OECD data). We also know the cost of adding enough capacity to ensure universal coverage in a country's principally urban areas. We refer to these as in-

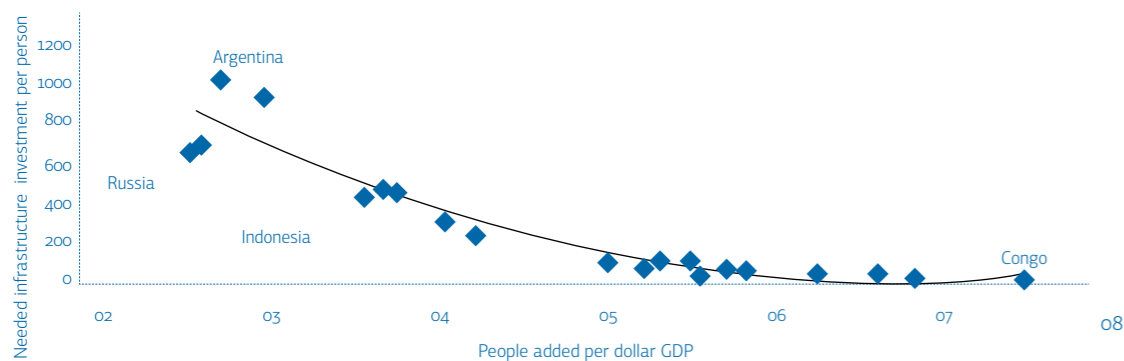
fra-marginal costs (think of these as trying to fill the circle surrounding a city in Figure D).

We also include the cost of scaling up infrastructure as populations (particularly urban) grow. Think of these costs as expanding the circle shown in Figure D to build around the city as populations expand. In reality, cities become denser, and also expand outward. However, in order to illustrate our method, the reader can think of the extra costs of adding energy, water, telecoms and transport services as simply adding rings of such infrastructure around existing population centers. The third step in our analysis then, consists of estimating the cost of providing the marginal (or extra) population with more of the aforementioned services. The fourth step involves filling in the lattice between cities – figuring out how much it costs to pipe water and provide energy, telecom services and transport links between urban areas. This approach cannot give precise estimates, though it probably represents far more reliable calculations than a simplistic measure using GDP as a base to determine infrastructure needs.

How do we estimate the sizes of populations in these countries, the cost of expanding the necessary infrastructure, and so forth?

Figure E shows the main variables we used in our analysis, and the way we used them. We

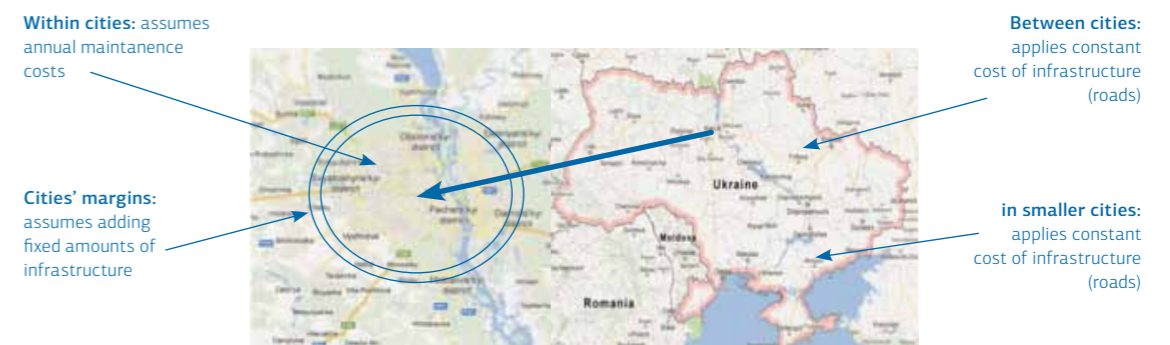
Figure C: Using a Ratio to GDP Erroneously Results in Fast-Growing Countries Needing Less (not more) Infrastructure



Arguing that infrastructure investment needs grow with GDP is like arguing that rich families need more cars than poor ones. Clearly, if poor families want to go to the same types of jobs as rich families, they need even more cars (and the offer of taxi services) to supplement their income. This logic underpins infrastructure needs based on population rather than GDP.

Source: World Bank and McKinsey (2012).

Figure D: Model of Infrastructure Needs in Emerging Markets



We estimate how much infrastructure (water, telecoms, electricity, roads and transport) is needed per person and how much presently exists. We multiply this "infrastructure gap" by an estimated average cost per person in order to arrive at our estimates.

Source: Dabla-Norris (2010).

Figure E: Variables Used in Our Analysis of Infra-Marginal and Marginal Infrastructure Needs

Variable	Source	How we used this indicator
General variables		
Population	World Bank	Population formed the basis of our analysis. The demand for and value of infrastructure come from people, not from GDP.
Percentage of urbanization	World Bank	Using this data, we can estimate how quickly cities will grow (both due to population increase and migration from rural areas).
Energy		
Access to electricity	World Bank	We must calculate the amount of resources needed to provide electricity to the current population, before we can plan for future generations.
Alternative and nuclear energy (% of total energy use)	World Bank	We have to plan for a future in which alternative energy use grows. We have assumed that our countries will increase energy from alternative sources to about 5% of the energy total.
Average cost per kilowatt hour	OECD and various	We must estimate the average cost per kilowatt hour as generated from a variety of methods. In practice, several countries subsidize certain ways of generating electricity, hence our estimates will be slightly off.
Transport		
Air transport, freight (million ton-km) and passengers carried	World Bank and airline industry data.	Each airport can accommodate a certain volume of passengers and cargo. We know average passenger numbers and cargo amounts for OECD economies. We calculate the gap between emerging markets and OECD countries. We also know how much it costs to transport passengers and cargo per km, so by multiplying these costs by the gap (in cargo and passengers), we can calculate the air transport gap.
Rail tracks (total route-km), goods transported (million ton-km)	World Bank and rail industry data.	We know the rail track coverage per square kilometer from the OECD countries. We calculated the difference between the number of rail emerging markets and the capacity they "should have". A simple internet search provides rail costs per km and transport costs.
Container port traffic (TEU: 20 foot equivalent units), Liner shipping connectivity index (maximum value in 2004 = 100) and Quality of port infrastructure, WEF	World Bank and shipping industry data.	We know the amount of port traffic in OECD countries, as well as their average connectivity indices and the quality of their infrastructure. We know from industry data the cost of constructing and running a port (per TEU).
Motor vehicles (per 1,000 people), road (km of road per 100 sq. km of land mass), and goods transported (million ton-km)	World Bank and trucking industry data.	We calculate average vehicle use in the OECD countries, road penetration and the goods transported. Calculating the difference with emerging markets poses little problem, and we know the cost of laying highways and sending goods by truck over 100 kms of good road.
Water		
Annual freshwater withdrawals - industry (% of total freshwater withdrawal), improved water source (% of population with access), improved water source - urban (% of urban population with access)	World Bank and water industry sources.	World Bank data provides information about the scarcity of water (and waste water) in emerging markets. We know how much water processing plants cost to build, operate and maintain (plus or minus several tens of millions of dollars). Fortunately, the provision of water has become less complex than that of energy or telecommunications in recent years. Innovations in water provision promise to revolutionize this industry, but we do not incorporate any of the recent innovations into our analysis.
Communications		
Motor vehicles (per 1,000 people), road (km of road per 100 sq. km of land mass), and goods transported (million ton-km)	World Bank and trucking industry data.	We calculate average vehicle use in the OECD countries, road penetration and the goods transported. Calculating the difference with emerging markets poses little problem, and we know the cost of laying highways and sending goods by truck over 100 kms of good road.
Fixed broadband Internet subscribers (per 100 people), and Secure Internet Servers (per 1 million people)	World Bank (and industry estimates)	We know how much more connected the OECD is than most emerging markets. Internet connectivity is economic destiny. We know how much it costs to lay fiber optic lines and to wire houses. Calculating the needs of the non-wired in emerging markets represents a relatively easy task.

had to remain flexible, as clearly some costs, transport for example, would be far more or far less in places like Africa. We did not want to turn a short report into a doctoral dissertation, delineating each step in our calculation methods. As such, we wanted to provide only enough information for our readers to reproduce our estimates, without overwhelming them in the detail. For readers interested in using our estimates, we encourage you to match our "orders of magnitude", rather than try to match our exact figures.

Company assessment

We used standard research databases to identify the companies that would be able to provide much of this infrastructure. Figure F shows the relatively scarce number we could find in order to predict which companies would/could profit most from the upcoming infrastructure gold rush. We specifically looked at SIC codes 1500 to 1800, and 8100 to 8110 (covering construction, engineering and consulting companies, which we hope cover the "design firms" of the emerging markets). Countries like China have even more of these enterprises than many developed Western European countries (making their cat-

egorization as an emerging market very dubious for our purposes). On the databases we referred to, other countries, such as Turkey, only had the information of five companies listed.

As of 2013, investors interested in taking advantage of the "gold rush" could look at four Exchange-Traded Funds (ETFs). All four have had negative yield-to-dates in 2013 - the iShares S&P Global Infrastructure Index Fund (IGF), the iShares S&P Emerging Markets Infrastructure Index Fund (EMIF), the PowerShares Emerging Markets Infrastructure Portfolio (PXR) and the SPDR FTSE/Macquarie Global Infrastructure 100 (GII).

However, these provide the retail investor with an exposure to this market and insight into the potential "design firms" of the future.

Figure G shows the holdings of the PowerShares EMI Portfolio. Many of the infrastructure companies in the portfolio come from developed markets. However, a number represent construction and engineering companies whose data we do not have access to. Indirect access through ETFs, mutual funds and other forms of institutional investment may come to represent an important way in which investors can obtain access to these companies.

Figure F: Companies We Used in Our Study

Country	Number of companies (market cap)	Variability of market cap	Number of companies (assets/revenue)	Variability of assets*
Argentina	5	0.6	4	0.7
Brazil	17	3.5	7	1.2
China	58	1.7	58	2.7
Indonesia	12	1.3	12	0.6
India	102	5.0	98	3.2
Mexico	10	1.3	7	1.2
Nigeria	6	1.5	4	-
Russia	3	1.5	1	-
Thailand	33	1.3	7	1.9
Turkey	5	1.0	5	0.9
Vietnam	132	2.5	26	0.9
South Africa	19	1.7	15	1.4

Only 12 of the 25 countries we studied have publicly traded infrastructure-related companies. The lack of these companies in places like Pakistan and Nigeria represent an opportunity, not only for foreign companies, but domestic as well.

* Each variability indicator represents the standard deviation divided by the mean.

Source: Compustat

Figure G: PowerShares Emerging Markets Infrastructure Portfolio

Country	Ticker	Share	Name
Brazil	VALE	3.00	Vale SA ADR
Brazil	MYPK3	1.29	Iochpe-Maxion SA
Brazil	GGB	1.04	Gerdau SA ADR
Brazil	MAGG3	1.04	Magnesita Refratarios SA
Brazil	MMXM3	0.37	MMX Mineracao e Metalicos SA
Brazil	PMAM3	0.53	Parapanema SA
Brazil	WEGE3	0.53	WEG SA
Brazil	SID	0.37	Cia Siderurgica Nacional SA ADR
Mexico	ICA	2.25	Empresas ICA SAB de CV
Mexico	PINFRA	1.67	Promotora y Operadora de Infraestructura SAB de CV
Mexico	CX	2.38	Cemex SAB de CV ADR
Mexico	GCARSOA1	0.44	Grupo Carso SAB de CV
China	914	3.13	Anhui Conch Cement Co Ltd
China	358	2.02	Jiangxi Copper Co Ltd
China	390	1.44	China Railway Group Ltd
China	2009	1.38	BBMG Corp
China	1186	1.23	China Railway Construction Corp Ltd
China	347	1.10	Angang Steel Co Ltd
China	3993	0.95	China Molybdenum Co Ltd
China	1072	0.95	Dongfang Electric Corp Ltd
China	1829	0.34	China Machinery Engineering Corp
China	3339	1.08	Lonking Holdings Ltd
China	MIDAS	0.69	Midas Holdings Ltd
China	2626	1.04	Hunan Nonferrous Metal Corp Ltd
China	1800	0.63	China Communications Construction Co Ltd
China	2727	0.81	Shanghai Electric Group Co Ltd
China	3323	0.49	China National Building Material Co Ltd
China	38	0.45	First Tractor Co Ltd
China	1618	0.98	Metallurgical Corp of China Ltd
China	1133	0.37	Harbin Electric Co Ltd
S. Africa	WBO	1.99	Wilson Bayly Holmes-Ovcon Ltd
S. Africa	MUR	1.98	Murray & Roberts Holdings Ltd
S. Africa	PPC	1.48	PPC Ltd
S. Africa	AEG	0.81	Aveng Ltd
S. Africa	ASR	0.81	Assore Ltd
S. Africa	ARI	1.23	African Rainbow Minerals Ltd
Malaysia	DLG	2.61	Dialog Group BHD
Malaysia	IJM	1.56	IJM Corp Bhd
Malaysia	WCTH	0.97	WCT Holdings Bhd

Figure G: PowerShares Emerging Markets Infrastructure Portfolio

Malaysia	GAM	1.91	Gamuda Bhd
India	LTOD	0.69	Larsen & Toubro Ltd GDR
India	MHID	0.98	Mahindra & Mahindra Ltd GDR
India	SLT	0.22	Sterlite Industries India Ltd ADR
Indonesia	SSIA	1.04	Surya Semesta Internusa Tbk PT
Indonesia	INTP	0.82	Indocement Tunggal Prakarsa Tbk PT
Indonesia	WIKA	0.82	Wijaya Karya Persero Tbk PT
Indonesia	TBIG	0.70	Tower Bersama Infrastructure Tbk PT
Indonesia	UNTR	0.52	United Tractors Tbk PT
Indonesia	ADHI	0.52	Adhi Karya Persero Tbk PT
Indonesia	INCO	0.35	Vale Indonesia Tbk PT
Indonesia	SMCB	0.34	Holcim Indonesia Tbk PT
Indonesia	ANTM	0.29	Aneka Tambang Persero Tbk PT
Indonesia	SMGR	0.92	Semen Indonesia Persero Tbk PT
Russia	MNOD	1.78	MMC Norilsk Nickel OJSC ADR
Russia	LSRG	0.65	LSR Group GDR
Russia	MTL	0.34	Mechel ADR
Russia	NLMK	0.17	Novolipetsk Steel OJSC GDR
Russia	MMK	0.32	Magnitogorsk Iron & Steel Works GDR
Russia	SVST	0.24	Severstal OAO GDR
Other emerging markets			
Turkey	TKFEN	1.28	Tekfen Holding AS
Turkey	CIMSA	0.58	Cimsa Cimento Sanayi VE Tica
Philippines	MPI	1.11	Metro Pacific Investments Corp
Chile	BESALCO	0.89	Besalco SA
Chile	SALFACOR	0.83	Salfacorp SA
Malaysia	LMC	0.83	Lafarge Malaysia Bhd
Malaysia	MMHE	0.40	Malaysia Marine and Heavy Engineering Holdings Bhd
Egypt	OCIC	0.63	Orascom Construction Industries
Other upper-income markets			
Australia	LEI	0.50	Leighton Holdings Ltd
Switzerland	ABB	3.20	ABB Ltd
Sweden	ATCOA	2.99	Atlas Copco AB
France	AREVA	0.20	Areva SA
Taiwan	9933	2.48	CTCI Corp
Taiwan	1102	2.38	Asia Cement Corp
Taiwan	2002	1.90	China Steel Corp
Taiwan	2006	1.54	Tung Ho Steel Enterprise Corp
Taiwan	2515	0.76	BES Engineering Corp
Taiwan	2059	1.08	King Slide Works Co Ltd

Figure G: PowerShares Emerging Markets Infrastructure Portfolio

Taiwan	2504	1.05	Goldsun Development & Construction Co Ltd
France	ALO	1.35	Alstom SA
Chile	CAP	1.30	CAP SA
Singapore	SMM	0.56	SembCorp Marine Ltd
Singapore	HYF	1.14	Hyflux Ltd
S. Africa	RLO	0.96	Reunert Ltd
UK	EVR	0.48	Evraz PLC
Taiwan	1101	3.33	Taiwan Cement Corp
USA	CAT	3.21	Caterpillar Inc
USA	PLL	1.53	Pall Corp

Source: PowerShares (Emerging Markets Infrastructure Portfolio)

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