

## Infrastructure versus other Investments in the global economy and stagnation hypotheses: What do company data tell us? \*

by

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*This paper uses data drawn from 10 000 global companies in 75 advanced and emerging countries, to look at trends in infrastructure and other non-financial industries in light of the talk of stagnation. There appears to be a twin paradox in the global economy: some companies and industries are possibly over-investing, driving down returns on equity (ROEs) versus the cost of capital and creating margin pressure globally, while others carry out too little long-term investment in favour of buybacks and the accumulation of cash. This pattern is associated with a shift in the centre of gravity of world economic activity towards emerging markets. Most of the over-investment appears to be occurring in the extremely strong growth of emerging market sales and investment in non-infrastructure companies, much of which is being financed from rapidly growing debt since the financial crisis. Global value chains, emerging market policies of financial repression, low interest rates, taxation incentives, natural resource endowments and other factors determine where investment is stronger and where it is restrained. Potential problems of debt-financed over-investment in non-infrastructure industries in emerging markets and the incentives for buybacks are identified as major policy issues that need to be addressed if sustainable growth is to be achieved. Evidence on the role of causal factors (sales, GDP, the return on equity, the cost of equity and debt and a measure of financial openness) on corporate capital spending is presented. Finally some policy recommendations are made.*

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## I. Introduction

At a recent meeting the Governor of the Reserve Bank of Australia asked the following question (Stevens, 2014):

*“Why do financial institutions and investors see so little risk, while companies investing in the real economy see so much risk?”*

This is perhaps the most important question facing policy makers today. Unconventional monetary policy in zero rates and quantitative easing (QE) have done exactly what was intended – they have forced investors to take more risk. This has supported the banking sector and financial markets have run up very well indeed. But outside of the USA, this has not been followed by real economic growth led by an investment cycle within the private sector. Unemployment remains high, and in Europe’s periphery youth unemployment rates are at unprecedented extremes. Emerging markets, too, have slowed and borrowing to fund investment has accelerated. These developments have led some to argue that the world economy may be entering a period of stagnation reflected in a secular decline in the natural rate of interest. Most often a significant role in this process is attributed to the puzzle of weak investment and particularly infrastructure investment. If growth is to move into a more sustainable phase, and potential output and jobs are to be restored, then long-term investment in infrastructure will have to play a greater role alongside an investment cycle in the much larger non-infrastructure industries. However, while many hypotheses about the causes of the lack of responsiveness of private investment to easy monetary policy have been outlined, there has been no systematic analysis of actual private infrastructure investment and its relationship with investment in other industries. In large part this is because of a lack of consistent data amenable to empirical study.

This paper sets out some of the possible hypotheses for lack of investment (despite ‘zero rates’) in the world economy. National accounts data provide little insight into the issues relating to private infrastructure investment, and such numbers that are available certainly cannot be matched with the corresponding financial aspects of the companies doing the investment. A data set for the private listed sector is constructed based on 10 000 global companies in 75 countries, dividing the industries between infrastructure and (non-financial) other industries. Capital spending, the way it is funded and the alternative uses of funding are collected for each company and aggregated to give a clear picture of what is happening in different groupings of countries. These data are then compared to some of the hypotheses about stagnation that economists have been debating.

Section II sets out some of the stagnation hypotheses. The investment and sales data of the companies covered are discussed in section III, where the *prima facie* cases for signs of stagnation in major parts of the world economy (if present) are identified. The debt-equity ratios and financial flow data exactly matched to these same companies are presented in section IV. The matched data for the return on equity, the cost of equity and debt funding cost are also considered in this section. A measure of financial openness is set out in section V. Section VI then combines the company data and the openness measure to look at key causal factors in the determinants of infrastructure and general industry capital spending in an econometric panel regression study. Finally, many of the threads are drawn together and some policy comments are offered in section VII.

## II. The various hypotheses offered to explain stagnation

### *The Wicksell natural rate decline and liquidity trap ideas*

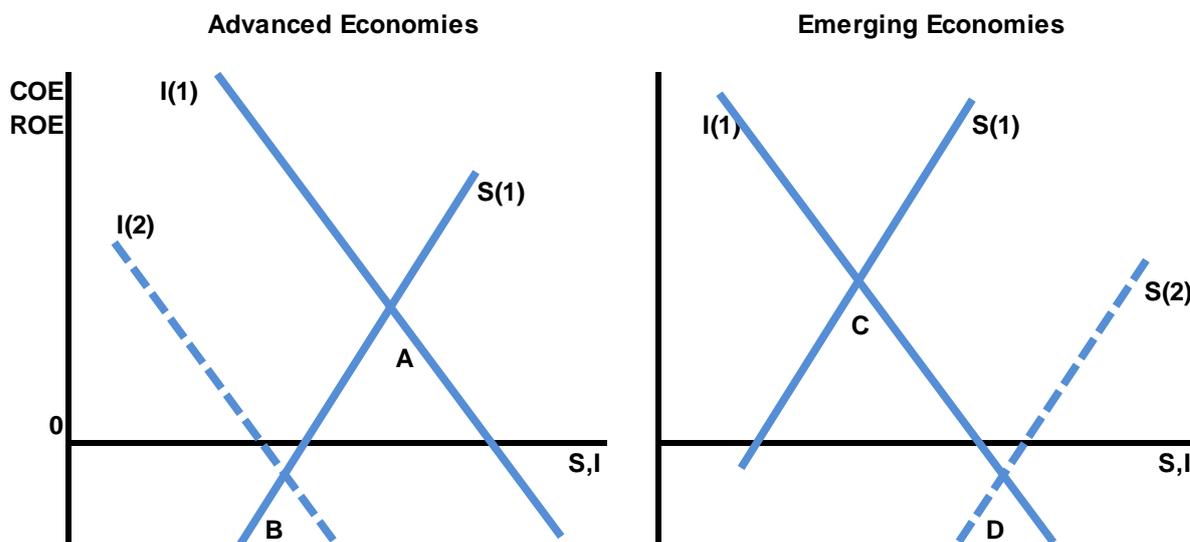
Lawrence Summers (2014) associates the stagnation thesis with a fall in natural real interest rate, and calculates that potential GDP is 5% below its pre-crisis level. He suggests that 50% of this can be attributed to weaker investment, 40% to fewer hours worked and 10% due to total factor productivity decline. He cites six factors in investment supply and demand associated with the fall in real rates: that IT/digital firms like Apple, Face Book, WhatsApp, and Google generate mountains of cash for little investment; population growth is declining; income wealth inequality generates more saving; the relative price of capital goods has collapsed; disinflation requires only a lower pre-tax real interest rate to generate the required after tax rate; and the huge accumulation of low risk Treasury securities in an uncertain environment is suggestive of uncertainty. For policy he touches on the need for low nominal rates: if the natural real rate is lower, then the actual rate determined by monetary policy in a low inflation world needs also to be low. He does note, however, the issue of the Japan disease; i.e. allowing zombie companies easily to refinance themselves when they should in fact close.

The lack of demand as the source of stagnation is emphasised by Paul Krugman<sup>1</sup> who, like Summers, also cites population growth slowing in the USA, and Robert Gordon's (2013) decline in innovation. Following the crisis, the economy has moved into a Keynesian liquidity trap zone where monetary policy cannot help. Policy makers are failing to deliver rates low enough to get the economy going. He takes on Bill White's (2012) argument that there is a need to raise interest rates to avoid future crises. There is no sign of inflation and the economy may need liquidity generated 'bubbles' to achieve something like full employment.

Glenn Stevens in his annual Anika Foundation speech (Stevens, 2014) focuses on the limits to monetary policy, which played an essential role in fixing the banks following the crisis: a necessary but not sufficient condition for growth. He describes unconventional monetary policy as unsterilised intervention in asset markets, the aim of which is to raise risk taking. However, he notes that this is not taking the form of entrepreneurial risk taking in business investment. Citing strong patents data, Stevens is sceptical of the Summers/Gordon view that declining innovation is the cause of stagnation. Instead, he cites the possibility of past 'over-investment', as is widely accepted to have occurred in Japan in previous decades. It is questionable, however, whether one can observe this in the critical infrastructure area around the globe where bottlenecks in emerging markets are evident. In the end Stevens ponders whether it is not animal spirits that are too low, and he emphasises the need to reduce uncertainty (for example by completing financial regulation), and to ensure that international trade remains free (as opposed to what many countries have been doing since the crisis<sup>2</sup>).

Stagnation as formulated by a shift in the marginal efficiency of investment schedule to the left might then cross the savings schedule at some low or negative return on equity/cost of equity, moving from point A to B in the left panel of Figure 1.<sup>3</sup> This could be due to a deterioration of animal spirits. But for advanced economies this could also be due to interconnectedness with what is happening in emerging markets: for example a strong rightwards shift in the saving schedule, essentially sliding down the investment schedule in emerging market locations and requiring less investment in the West to meet world consumer demand (as illustrated by the shift from point C to D in the right panel)<sup>4</sup>. The interconnectedness arises as global value chains including emerging economies shift the centre of gravity of investment, production and employment. These shifts are associated with falling returns on equity.

Figure 1. Wicksell-like diagram



Source: Authors' illustration.

### *Over-investment and emerging markets*

Over-investment will occur when managers invest too much in projects that do not create shareholder value – or more specifically, when returns are less than the cost of equity resulting in the negative net present values of investments. Where this happens collectively, due to the mispricing of risk or to the presence of inappropriate economic policy in a country or region, financial crises can emerge, particularly where the investment was debt financed. Systemic crises with these characteristics already occurred in Japan and in Asia in the late 1990s. The emerging market development ‘model’ involves elements of trade protectionism, managed exchange rates versus the dollar, financial repression (capital controls, financial regulations, interest rate ceilings) and other policies such as ownership restrictions, local content requirements, approvals processes for FDI, etc. Financial repression in particular is associated with high saving which is then intermediated into heavy investment via state-owned banks (the rightward shift in the saving curve noted earlier).<sup>5</sup>

### *Governance issues that reduce the efficiency of capital in emerging markets*

A shift up of the marginal efficiency of capital schedule would correct the tendency toward lower returns, but this requires reforms of the above restrictive policies. Instead these factors are often compounded by governance problems of an ‘upstream’ variety which serve to reduce returns per unit of investment. These include regulations and red tape, bribery and corruption (and corrupt procurement processes), unclear property rights and long judicial processes in the event of disputes. Many governments restrict foreign ownership of infrastructure, and SOEs often play too large a role giving rise to level playing field issues (competition, pricing and corporate governance). These factors limit efficiency in infrastructure markets and impede competitive neutrality between SOEs and private firms. Product market regulations that constrain competition in infrastructure raise costs across the entire economy and affect the profitability of investments in other sectors.<sup>6</sup>

***Impact on western countries***

The maintenance of undervalued exchange rates, use of capital controls and trade protectionism promotes emerging markets exports limits imports of final goods and damages the traded goods sector in advanced economies as supply chains shift.<sup>7</sup> The supply of consumer goods from emerging markets and pressure on wages in the West<sup>8</sup> acts to keep inflation down and this, together with employment pressures, encourages an easing bias to monetary policy in order to offset the damage to jobs via the traded good sector. The proceeds of dollar foreign exchange interventions in emerging markets are held in US Treasury securities acts to create downward pressure on longer-term interest rates, including via pricing arbitrage mortgages and corporate debt.<sup>9</sup> As more emerging countries adopt and extend this model, more savings, investment and supply enter the global value chains. The emerging markets have grown from 20% of world GDP in 1980 to around 50% by 2013.

***The taxation angle***

Tax distortions also interact with global value chains to affect the location of business investment from advanced countries, and the form of financing that is used. For example, large US companies transfer intellectual property rights to Bermuda or the Cayman Islands with zero tax and create a second company group in Ireland consisting of, say, two subsidiaries: one that supplies the product to customers in the EU, and another which is controlled by the company in Bermuda and receives royalties from yet another subsidiary in the Netherlands which owns the European patent. The Bermuda-Irish grouping is a foreign company from the viewpoint of the USA, avoiding tax treatment there. The Irish supply company gets revenue from the EU, but has to pay a heavy royalty to the Dutch company for use of the patent, and thereby gets a tax deduction wiping out much of the taxable income in Ireland. The Netherlands is used in the chain because it does not levy withholding tax for transfers within the EU: so the Dutch subsidiary transfers the royalty to the other Irish subsidiary controlled from Bermuda. Bermuda has a zero tax rate and receives the cash flow from the Irish company that it controls. In this way the large US tech or pharmaceutical companies (and others) pays no tax from these sources to the USA. Cash is held abroad, while firms borrow domestically to pay dividends and carry out buybacks. The borrowing is of course a tax deduction for the US (and other country) businesses. This structure reduces investment, jobs and tax revenue in the home country and may also shift wealth distribution in favour of shareholders and away from wage earners.

***Buybacks and the uncertainty issue***

There are many possible reasons why companies may be uncertain and reticent to invest in the current environment. Emerging market over-investment may result in downward pressure on margins. The financial re-regulation process is not complete and long-term relationships in banking are subject to change, including via the impact of fragmentation in banking and the reduction of cross-border flows. Rule changes and technology shifts in the operation of stock markets have reduced the use of IPOs, particularly for small and medium-sized businesses (SMEs).<sup>10</sup> Macro policy is not running at normal interest rate levels, and there is a sense that if this is so economic growth is not durable at normal rates. In a low-interest rate environment some investors cheer companies that focus on dividends and buybacks to improve investor (tax effective) yields, in large part because growth of earnings per share is perceived as more uncertain. This works against investment, and where borrowing (encouraged by tax incentives) is used to pay dividends or undertake buybacks debt-equity ratios rise, exposing the firm to greater risk in the future, and this too works against more sustainable long-term investment.<sup>11</sup>

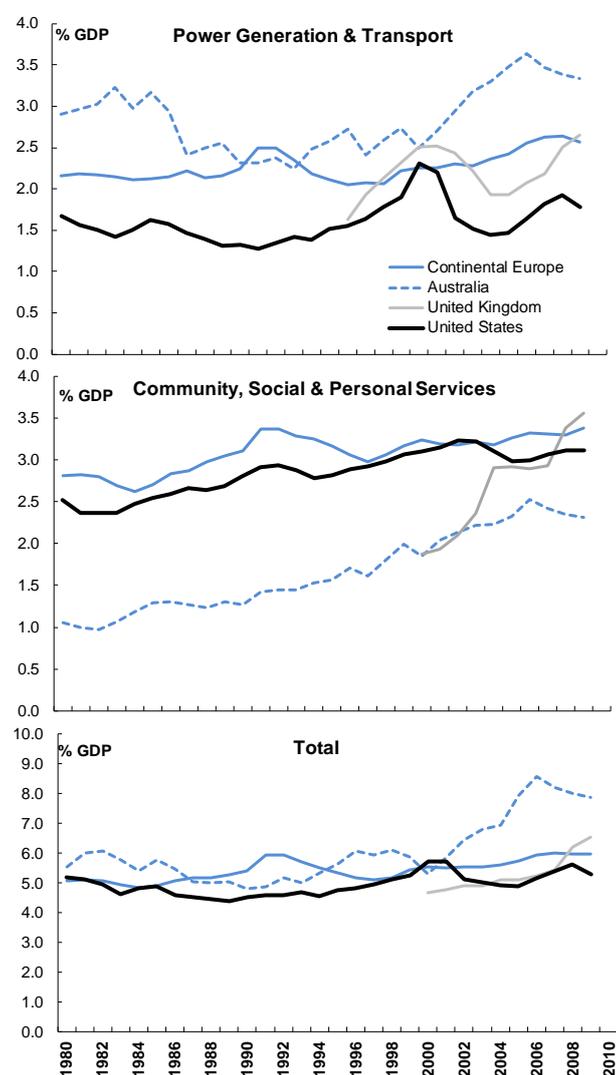
### III. What do company data trends say about investment, stagnation and its possible causes?

#### *National accounts data*

The national accounts are not very helpful in respect to distinguishing some of the above hypotheses. The data for infrastructure investment is available in some OECD countries.<sup>12</sup> It is possible to construct series for gross fixed capital formation in electricity, gas, water, transport, storage and communications (economic infrastructure) and for health and education (social infrastructure). Some of this data is presented in Figure 2. At a first glance there is nothing in these charts to suggest any downward trend in infrastructure investment in recent years in the USA, continental Europe (France, Germany, Italy, and Spain), the United Kingdom and Australia (comparable data for Japan and emerging countries are not available). Indeed, the data suggest the trend in infrastructure investment as a share of GDP is positive, though with a significant interruption after the tech bust in the early 2000s. GDP of course fell in 2008-09 and its growth has been much weaker since then, so the observed slowing in growth of absolute levels of investment cannot easily be separated from the crisis slowdown more generally.

The main features of the data are as follows:

- The US invests less in economic infrastructure (as defined above) than other countries: around 1.5% of GDP prior to the mid-1990s versus more than 2% in continental Europe and 2.5-3% in Australia. From the mid 1990s the communications component of economic infrastructure rose quickly and unsustainably during the tech boom in the USA and the UK. The decline in the early 2000s in both countries was pronounced. Since the financial crisis the share of economic infrastructure investment has risen quickly in the USA, driven by the electricity and gas supply component (the fracking boom for example). The UK recovery has once more been driven by transport, storage and communications.
- In continental Europe economic infrastructure investment began to rise from the late 1990s, from around 2% to 2.6% of GDP by 2010. This was driven by the transport and communication component.
- Australia invests much more in economic infrastructure than the other regions shown due to the capital intensity of requirements for the mining sector. This has accelerated to even higher levels during the more recent mining boom.

**Figure 2. Infrastructure investment in OECD countries**


Source: Authors' calculations based on OECD structural databases.

In community, social and personal services (essentially education and medical) there has been a clear upward trend in most regions. The USA, the UK and continental Europe in the most recent data are in the 3% to 3.5% of GDP range (compared to 2.5% in the early 1980s). Australia appears to have the lowest spending in this area compared to the other regions shown.

Overall, total infrastructure spending in the USA and continental Europe has moved up from the 4-5% range in the early 1980s to the 5-6% range in 2010. While the composition is very different, Australia has moved up from the bottom end of those ranges in the early 1980s to the top end by 2010.

This national accounts data is of limited value however. It does not separate private infrastructure from government investment, the relative extent of which differs between countries, and certainly comparable emerging market data are not available. While the focus of the stagnation discussion is on the falling natural interest rate, this national accounts data cannot be matched with the return on equity

and other financial features of investing firms that would help to distinguish between different hypotheses.

### ***Private company data***

To help provide a picture of what is happening to investment in the private sector in different regions, capital spending by companies in industries associated with infrastructure and for other non-financial sectors is collected for all listed companies from the Bloomberg global equity index consisting of more than 9000 companies.<sup>13</sup> The data are described in Annex 1. It is important to analyse investment associated with infrastructure alongside other industries as the characteristics are very different: infrastructure is more capital intensive, is more associated with state ownership, and is less associated with multi-national enterprise (MNE) activity in global value chains than is the case for non-infrastructure.

The following corporate concepts will be used to explore ideas about which hypotheses seem to find support in the data.

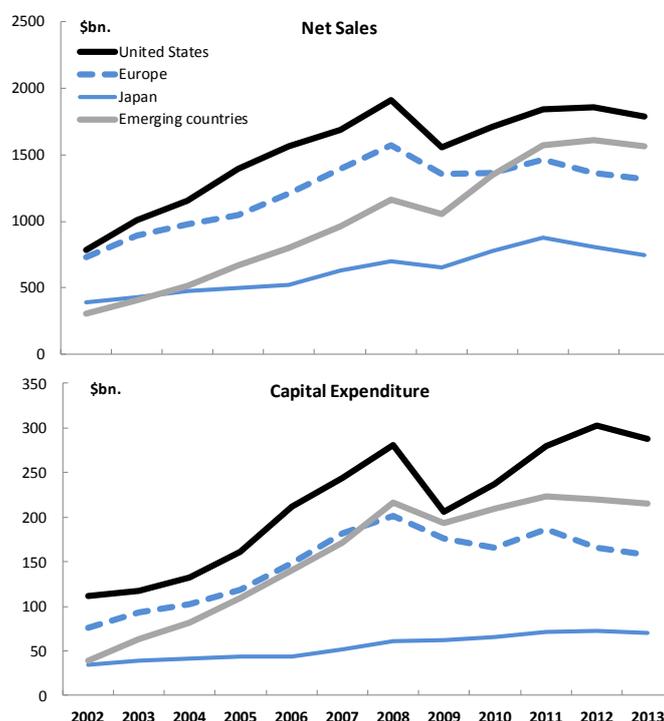
- Financial structure is calculated as the ratio of long-term debt (D) to ‘enterprise value’, or debt plus equity (E), i.e.  $D/(D+E)$ .
- The return on equity (ROE) will be used to proxy the ‘natural interest rate’ (net income/shareholders equity). The cost of equity is the dividend plus buyback yield added to the trend growth in company earnings. The borrowing rate is the AAA corporate bond rate in the country where the company is listed.
- To understand the flow accounting concepts, it will be helpful to keep in-mind a simplified accounting identity:

*Operating Cash Flow + Net Borrowing = Capital Expenditure + Dividends & Buybacks + Net Asset Purchases + Net Cash Accumulation*

Operating cash flow (net income adjusted for receivables, payables and inventory changes) is a key concept that pertains to how much cash companies are generating to maintain and grow their businesses without external financing. They can use internal and external financing: to invest; pay dividends or undertake net share buybacks; buy assets (net) with cash (e.g. buying stakes in other companies); or they may simply accumulate cash balances in the bank. The company data is aggregated up to the USA, Europe (the European Union and Switzerland), Japan and all emerging market countries. The data of course can be disaggregated to any individual country, and all financial concepts are perfectly matched with the companies whose capital spending is being analysed.

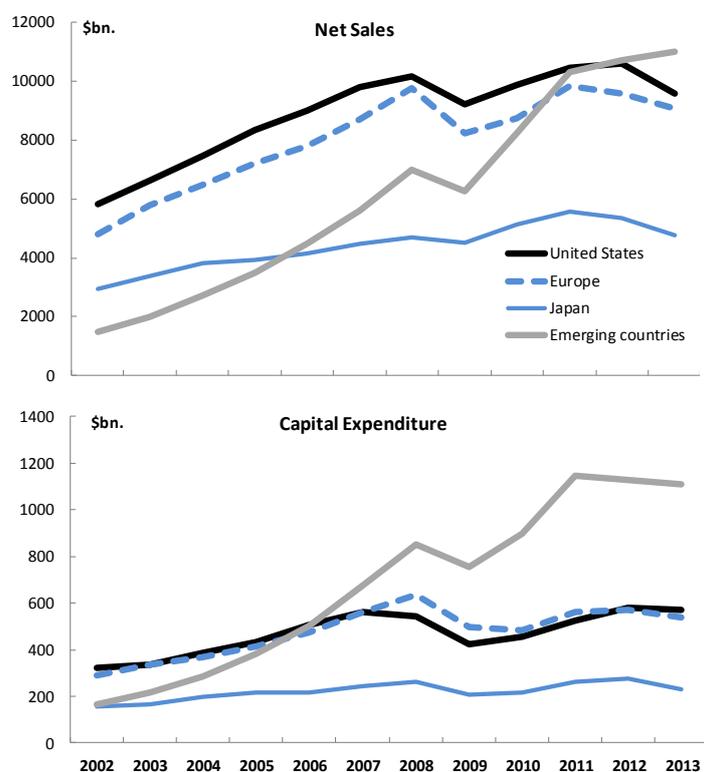
### ***Corporate sales and capital spending***

Sales and capital expenditure by companies for infrastructure and (non-financial) non-infrastructure industries are shown in billions of dollars in Figures 3 and 4, respectively.

**Figure 3. Net sales and capital expenditure: infrastructure (\$bn.)**


Source: Authors' calculations, Bloomberg.

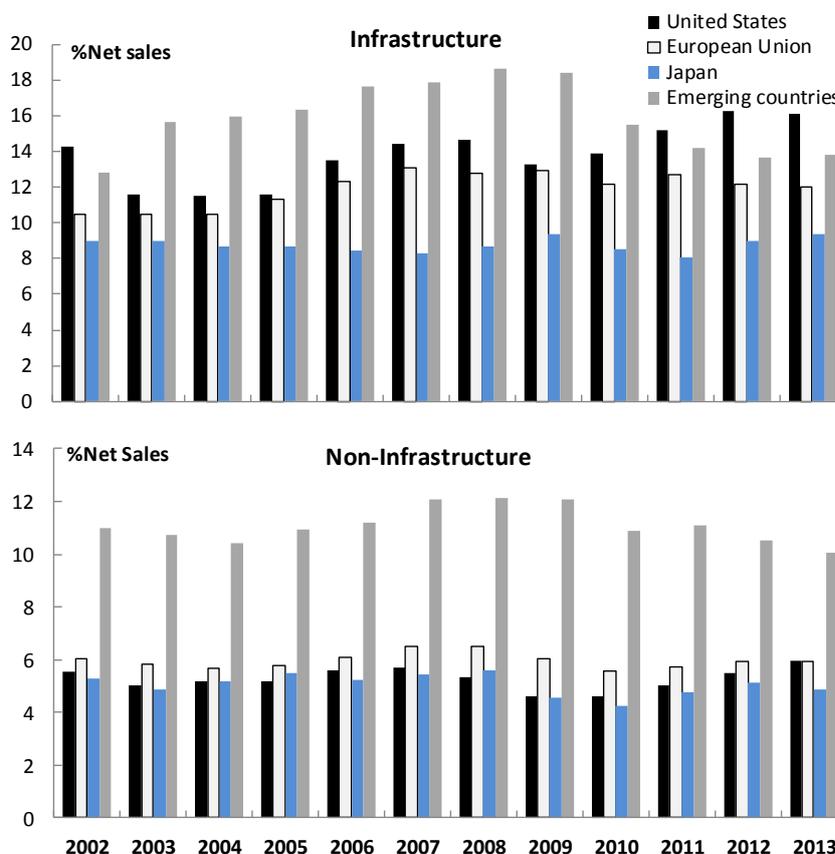
- Infrastructure sales and capital spending (Figure 3)*: in general sales growth appears to exhibit signs of stagnation post the crisis, particularly in Europe. Japan has been falling behind over a much longer period. Emerging market sales have done better, passing Europe in dollar terms (but not the USA). The picture is different for capital spending, however, where the US shows less sign of stagnation post the crisis, while emerging markets and Europe certainly do. Japan has been stagnant for much longer.
- Non-infrastructure sales and capital spending (Figure 4)*: the most striking pattern here is the very strong growth in emerging market sales (though 2013 may be the start of a reversal). From being well below in 2002 emerging company sales are now stronger than all other regions. The US, Europe and Japan, on the other hand, do appear to have slowed since the crisis (Japan for much longer). It would seem reasonable to suppose that there is a connection here: as global supply chains shift towards emerging market locations, the increased sales from there might result in greater stagnation of sales in OECD countries (though not necessarily in their subsidiaries and affiliates abroad). Emerging markets appear to have achieved this growth in sales by very rapid growth of capital expenditure – surpassing anything in OECD countries and in a very short space of time. Commensurately, there has been clear stagnation of capital expenditure in OECD-listed companies.

**Figure 4. Net sales and capital expenditure: non-infrastructure (\$bn.)**


Source: Authors' calculations, Bloomberg.

### *Capital spending as a percentage of sales*

- *Infrastructure (top panel of Figure 5):* the emerging markets witnessed stronger capital spending in relation to sales than elsewhere up to and including the crisis period. Subsequently, these ratios have been declining in complete contrast to the USA where they have been rising. The USA now invests the greatest ratio of infrastructure to sales. Japan's capital spending share is the smallest, and that of Europe is gradually declining. In relation to US sales, there is no sign of 'stagnation' in US infrastructure investment post the crisis, but the reverse appears to be the case in emerging markets. Europe and Japan invest less than the US and emerging markets.
- *Non-infrastructure (bottom panel of Figure 5):* The emerging market capital spending ratio to sales appears to be extremely capital extensive, dwarfing the investment of other regions. Notwithstanding the huge share, the trend for emerging markets is in the downward direction since 2009. The US ratio of investment to sales, while much smaller, has been rising since the crisis (inconsistent with stagnation views).

**Figure 5. Capital spending as a percentage of company sales**


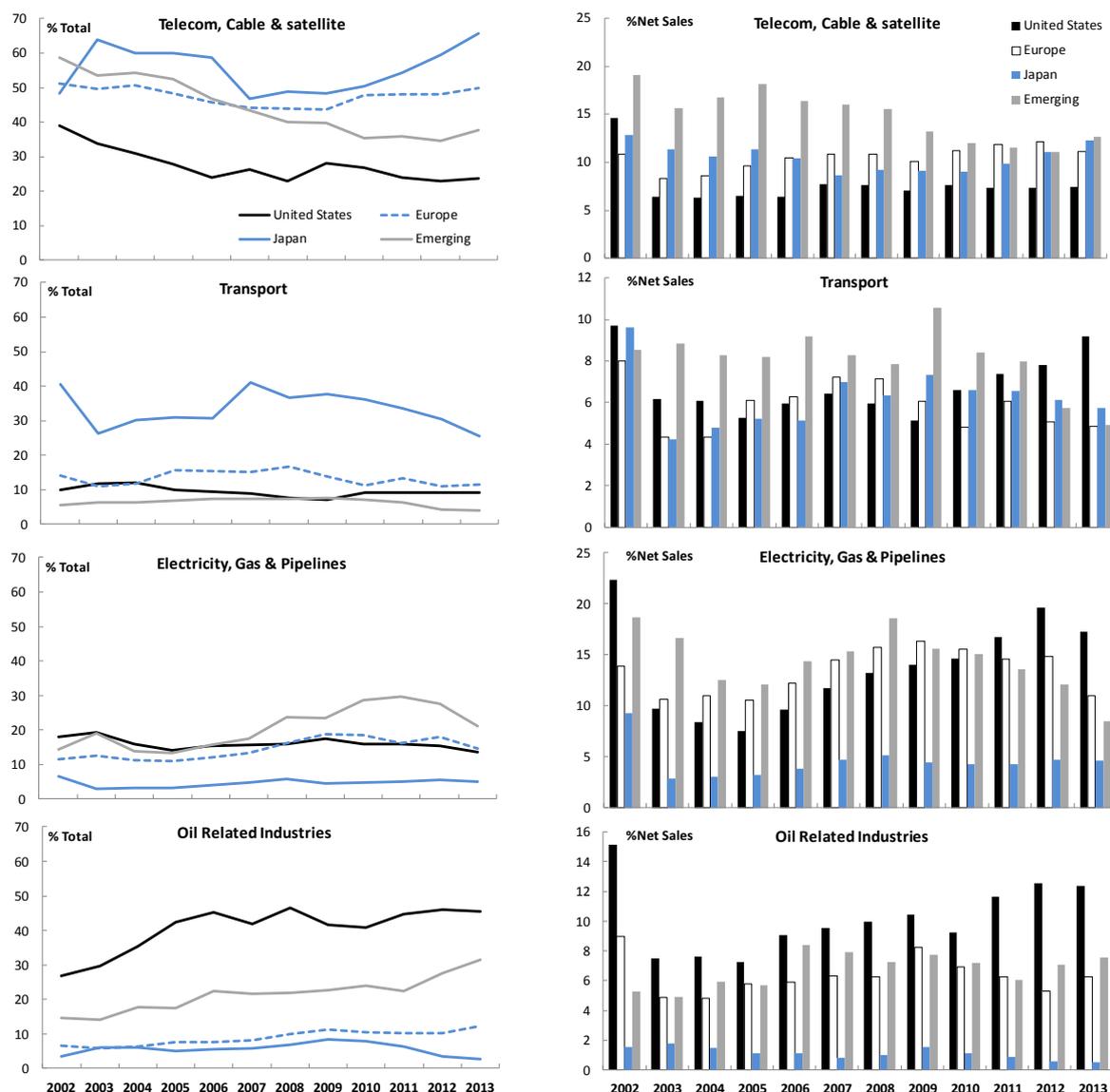
Source: Authors' calculations, Bloomberg.

The company data analysed to this point appear to be broadly consistent with stagnation of sales of companies listed in the US, Europe and Japan. But this is not the case for companies listed in emerging markets (including advanced country subsidiaries and minority stakes), where sales in non-infrastructure (mainly consumer goods) have been booming as has investment. This is broadly consistent with the view that investment and sales are shifting globally in a very meaningful way to emerging markets where local companies, western subsidiaries and minority interests are positioning to take advantage of global supply chains and trade in value added. The investment in emerging markets is also consistent with the heavy savings and investment development strategy described earlier.

### *What sort of infrastructure investment?*

The regional percentage of total infrastructure spending in four different categories: telecommunications, cable and satellite; transport; electricity and pipelines; and oil and related industries are shown in the left panel of Figure 6. Investment as a share of sales by sector and country is shown in the right panel.

**Figure 6. The structure of infrastructure investment: USA, Europe, Japan & emerging economies**



Source: Bloomberg, authors' calculations.

With its natural energy resource availability, the US listed companies devote a huge 45% of capital spending on infrastructure in the oil-related industries: oil exploration, oil refining, and oil and gas drilling. Exploration and production by integrated oil and gas firms have dominated investment in this industry in the USA, rising sharply from the mid-2000s (fracking has been a large part of this). Perhaps related to this has been strong growth in electricity, gas and pipelines and transport in the USA. The US appears to have moved on from the tech boom sector of telecom, cable and satellite.

Some emerging market countries also have huge natural resources, and the share of infrastructure investment in them has been rising continuously, though not as a share of sales (on the right hand side) as in the USA. Electricity gas and pipelines had been rising up until the crisis, but the trend has reversed downwards in recent years. Transport has the smallest share on infrastructure investment, and

it has been very weak since 2009. While the overall share of telecom, mobile and satellite has been falling in EMEs, it is nevertheless still very important at around 40% of the total, and as a share of sales EMEs tend to invest more than other countries.

Japan and Europe, with poor natural resource endowments devote very little to oil-related industries. Instead, both Europe and Japan invest by far the largest proportion in telecommunications, cable- and satellite-related industries. Given its shortage of natural resources and dependence on other regions for gas, Europe's investment in electricity gas and pipelines is substantial, both as a share of the total spend and as a share of net sales within the sector. Japan also devotes a high overall share to transport, almost double anywhere else, which seems odd in a small heavily-populated geography, where diminishing returns may be problematic.

#### IV. What do the company financial data say about stagnation and risk?

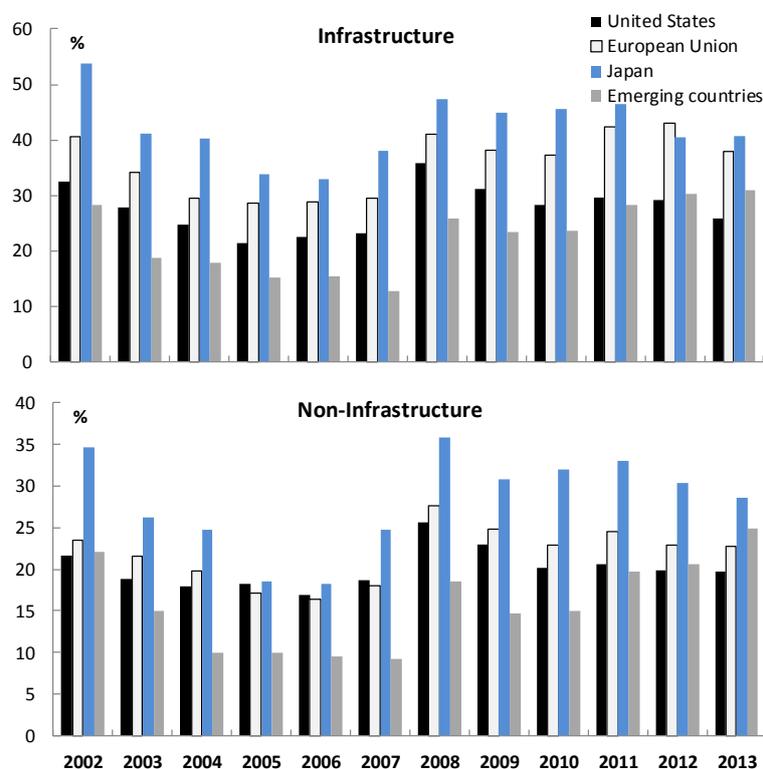
##### *Debt-to-enterprise-value ratios*

Debt-to-enterprise-value percentages are shown in Figure 7 for infrastructure (top panel) and non-infrastructure (bottom panel).

Equity investment via company retained earnings is the prevalent form for investing by companies and is best suited for long-term sustainable growth: any failure of an investment project sees shareholders lose money and vice versa. Debt, on the other hand, while important at different times in the investment process and often useful for tax advantages, remains with the firm when investments fail. Debt-financed over-investment was a key characteristic of the Asia crisis of the late 1990s. Borrowing to pay dividends and buybacks, which is encouraged by the tax system, would also work towards a debt bias and against long-term investment.

A number of observations about debt-to-enterprise-value ratios stand out:

- Investment in infrastructure is associated with higher debt ratios than in other industrial groupings, due to: early stage financing needs; longer horizons for revenue benefits; and/or taking advantage of interest deductibility in the tax structuring of ownership and management rights. In emerging markets SOE banks also play a large role in financing infrastructure and may operate with less-than-commercial terms. For all countries, debt-to-enterprise value is about 30% for infrastructure, and 20% for other industries (on average) over the period shown.
- While there is a lot of press about individual US companies borrowing too much to return capital to shareholders via dividends and buybacks (while foreign subsidiaries hold cash earnings and royalty payments abroad), this is not reflected as a general tendency in the overall data for debt-to-enterprise-value trends. The ratio for US infrastructure companies has been trending down since 2008, and at 25% of enterprise value is below the global average. For non-infrastructure US companies there is no sign of an upward trend.

**Figure 7. Debt-to-enterprise-value ratios**


Source: Bloomberg, authors' calculations.

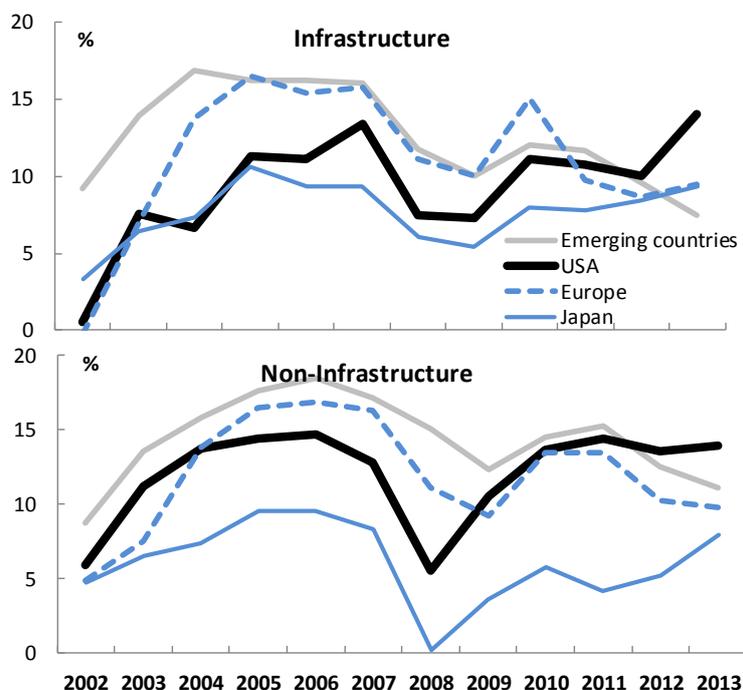
- Japan (a country where stagnation has been at work for a long time) has the highest debt-to-enterprise-value by some margin (42% average for infrastructure and 28% for other industries). For both infrastructure and other industries debt ratios post the crisis are generally higher than mid 2000 levels.
- Europe is closer to Japan in debt structure for infrastructure, and the post-crisis levels appear more challenging than before. Non-infrastructure industries do not appear out of line with US ratios.
- The situation is very different in emerging markets. The debt ratios were low prior to the crisis (13% for infrastructure and 9% for other industries in 2007). Subsequently debt-to-enterprise-value ratios have been rising rapidly. For infrastructure the level has moved up quickly to over 30% of enterprise value, and for other industries to 25%, in both cases now approaching Japanese levels.

Encouraging sustainable long-term investment requires retained earnings to be put to work and initial public offerings (IPOs) for new companies and less reliance on debt. The global patterns are uneven, but it seems that the speed of acceleration of borrowing in emerging markets is much greater than elsewhere and reminiscent of 1990s Asia crisis trends.

### Rates of return on equity

The rate of return on equity for infrastructure and for other industrial companies in the four country groupings are set out in panels one and two of Figure 8, respectively.

Figure 8. ROEs matched to the companies in each grouping



Source: Bloomberg, authors' calculations.

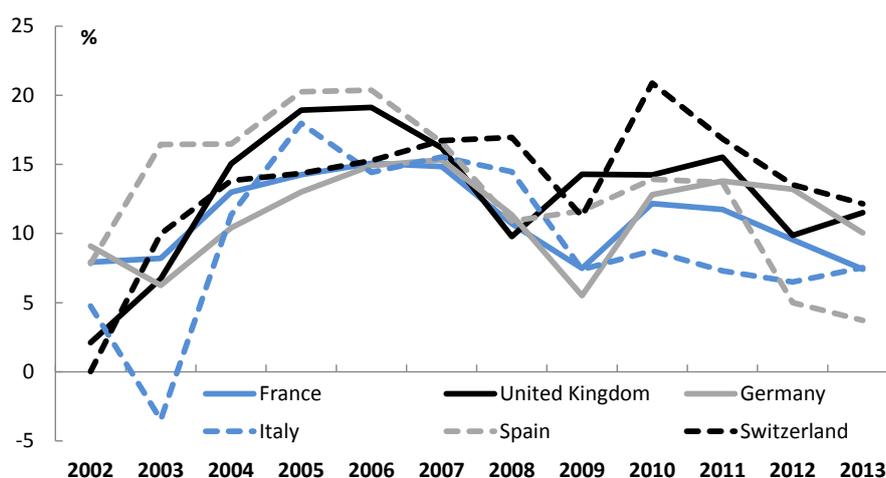
While the averages are around 10%, they vary over time and across regions. The over-investment notion mentioned by Glenn Stevens appears consistent with some of the ROE data. For example, it is immediately apparent that Japan, a country known for over-investment in previous decades, has average ROEs that sit well below that of other countries in non-infrastructure (though it has begun to move up in more recent years).

More generally:

- *The ROE for infrastructure:* is less cyclical compared to other industries. Consistent with the idea of over investment during the tech boom and bust, the ROE is extremely low in the early 2000s in OECD countries, and recovers in 2004. However, in both Europe and emerging countries the ROE appears to begin moving down from even before the crisis of 2008-09. The US ROE, on the other hand, has moved up since the crisis towards the highest level of the period shown (to 14%, very far from the notion of a falling natural rate). In the energy-related infrastructure in the US there appears to be no sign of stagnation.
- *The ROE for non-infrastructure:* is more cyclical, but also shows some broader downward movement in the emerging markets and Europe, whereas the US has fully recovered to pre-crisis levels of around 14%. Japanese ROEs appear to be rising, though it is still the lowest at just under 8%.

- *Some European detail on ROEs:* The above discussion has made reference to the special problems of Europe in running a monetary union in the face of asymmetric real shocks emanating from emerging markets. Two questions arise: do European countries like Switzerland and the UK that have floating exchange rates do better than their euro area counterparts; and do companies in countries in the south of Europe face greater ROE pressures compared to those in the north? Figure 9 shows the ROEs for the non-infrastructure sector of seven European countries. This sector is much larger in size than infrastructure and is more directly in competition with emerging markets.

Figure 9. European ROEs



Source: Bloomberg, authors' calculations.

Since peaking in 2005, following the recovery after the tech bust recession, ROEs have been under downward pressure in the euro-area countries, but particularly so in the case of France, Italy and Spain. Germany, a major exporter of high-technology capital goods, has held up rather well. The Swiss and UK economies with floating exchange rates have had the best overall performance of company ROEs in the face of the crisis and the pressures of globalisation. In 2013 the UK ROE for the companies covered is 11.5% and for Switzerland 12.2%, versus 10% for German companies, 7.5% for France and Italy and 3.7% for Spain.

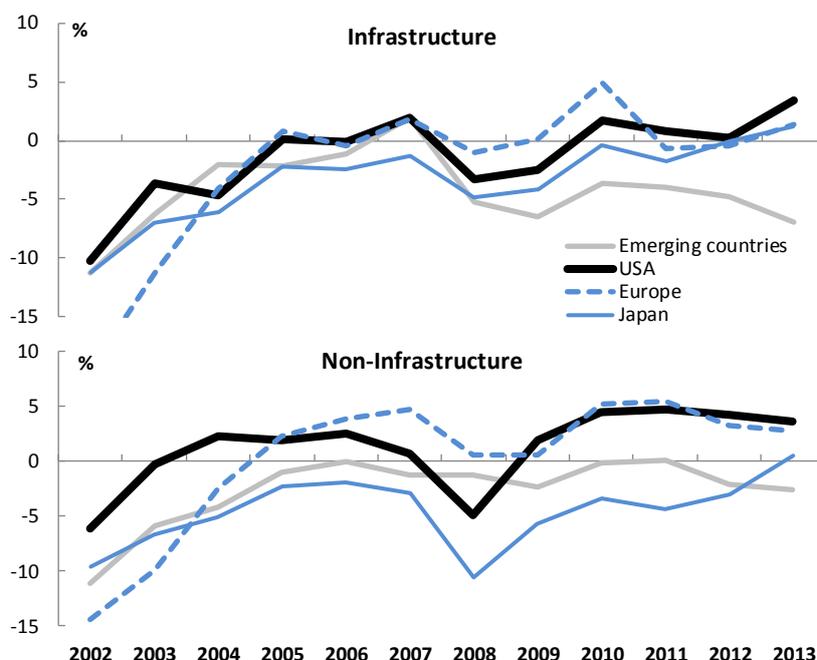
The downward pressure on ROEs outside of the USA are consistent with a number of interpretations, but two hypotheses come to mind: (i) possible over investment in non-infrastructure related to financial repression and the savings glut notion in emerging markets; and (ii) possible governance problems in infrastructure that raise costs and reduce competitiveness (absence of a competitive banking system supported by capital controls, local content requirements, ownership restrictions, role for SOEs, competition restrictions in industry, etc.) in both advanced (particularly Europe<sup>14</sup>) and emerging countries. These problems may be compounded in southern European problems which cannot adjust exchange rates in the face of structural differences with the north, and hence may have a need to adjust governance and competition impediments even more aggressively.

### *ROE minus the cost of equity*

Retained earnings fund most private investment in both infrastructure and other industries. Countries with systems that rely more heavily on borrowing (Europe and Japan) have not had a good

economic record on successful investment to support long-term growth. If the ROE is less than the cost of equity company managers cannot create value, the net present value of investments is negative, and they might be incentivised to return cash to shareholders. The cost of equity<sup>15</sup> matched to the companies in this study is compared to the ROEs in Figure 10.

Figure 10. ROE minus the cost of equity



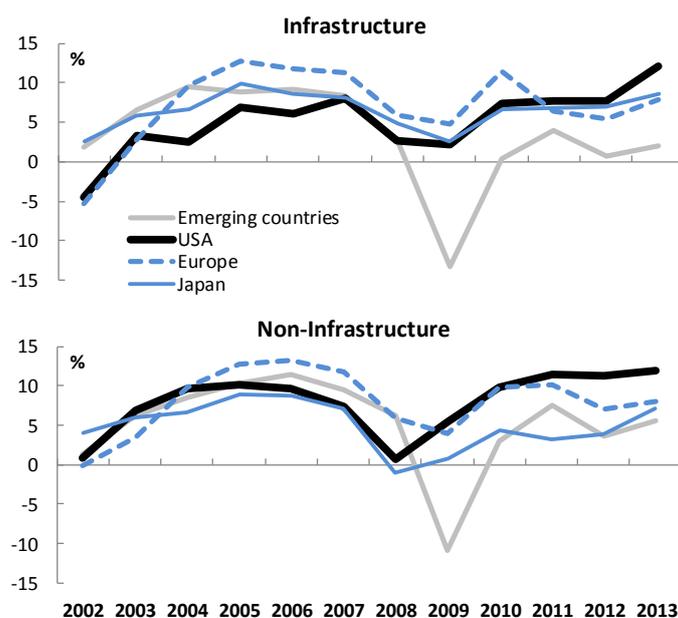
Source: Bloomberg, authors' calculations.

- *Emerging markets*: The ROE minus the cost of equity has recently become negative for both infrastructure and non-infrastructure companies, and noticeably so for the former. This reinforces the notion that there may be serious governance problems related to restrictions on ownership, SOE activity, etc. that make it difficult for private companies to add value in the infrastructure sector. This affects other industries directly. In the non-infrastructure sector (declining) returns are typically just below the cost of equity.
- *Japan*: The ROE is low though improving, but the cost of equity is also very low due to its low dividend yield and weaker earnings-per-share (EPS) growth. Managers in Japan have a greater incentive now to create value by retaining equity to invest than in the prior lost decades.
- *United States*: The data for the US do not seem consistent with stagnation theories. The clearly positive ROE and cost of equity differentials for both infrastructure and other industries are higher than elsewhere and suggest managers can certainly create value.
- *Europe*: lower ROEs matched with a somewhat lower cost-of-equity hurdle is the main cause of the positive differential (lower dividends, buybacks and EPS growth). There is clearly plenty of scope for companies to add value, yet they appear to be holding back.

### *The ROE minus the cost of debt*

Debt overall plays a lesser role in financing investment than retained earnings, but is a relatively more important source of external finance in infrastructure than in other industries. The ROE minus the AAA corporate rate in the jurisdiction concerned is shown in Figure 11 for infrastructure companies in the top panel and for other industries in the bottom panel.

**Figure 11. ROE minus the AAA corporate bond rate**



Source: Bloomberg, authors' calculations.

Once AAA borrowing rates are subtracted from ROEs a similar configuration emerges for the infrastructure companies in the OECD countries, particularly since the crisis. Interest rates appear to have fallen far enough to be consistent with borrowing for an investment cycle. Japan already had low borrowing rates and the rise in the ROE has done most of the work in improving the attractiveness of debt-financed investment. The US and Europe have reduced rates substantially compared to pre-crisis years by around 300 basis points improving the relative attractiveness of borrowing. The US situation looks particularly outstanding in this respect, with the ROE rising and AAA rates falling.

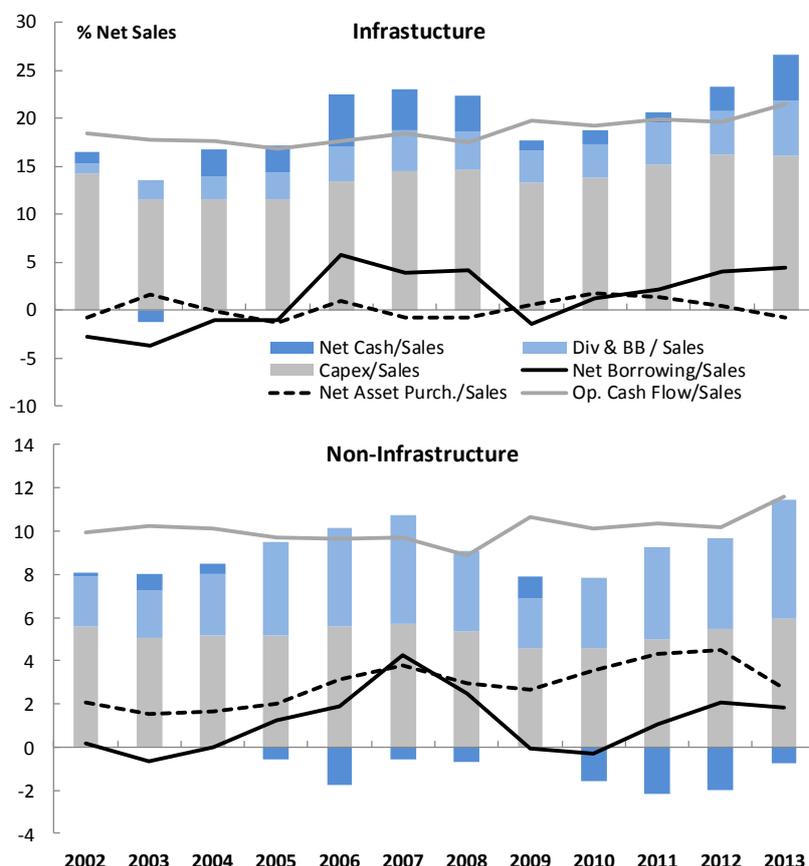
The stagnation hypothesis appears to be more apparent in the case of emerging market infrastructure. Since 2008, the ROE spread to the AAA borrowing rate has remained low, and significantly below OECD countries. Here it has to be borne in mind that most EME corporate debt is in higher risk category than AAA, and for many companies the net present value of such investment projects would be negative. The 'governance' factors discussed earlier reduce the ability of managers to provide value for shareholders. The combined influence of these factors increases risk premiums associated with investment in these countries and add to borrowing costs.<sup>16</sup>

For non-infrastructure companies the broad picture is the same, though the emerging market spread to AAA interest rates looks a little more attractive than is the case for infrastructure, possibly helping to explain the noticeable difference in investment patterns between the two sectors.

### United States company financing flows

The flow financing concepts for companies in infrastructure and non-infrastructure industries in the United States are shown in Figure 12.

Figure 12. Capital spending and related flow financing: USA



Source: Bloomberg, authors' calculations.

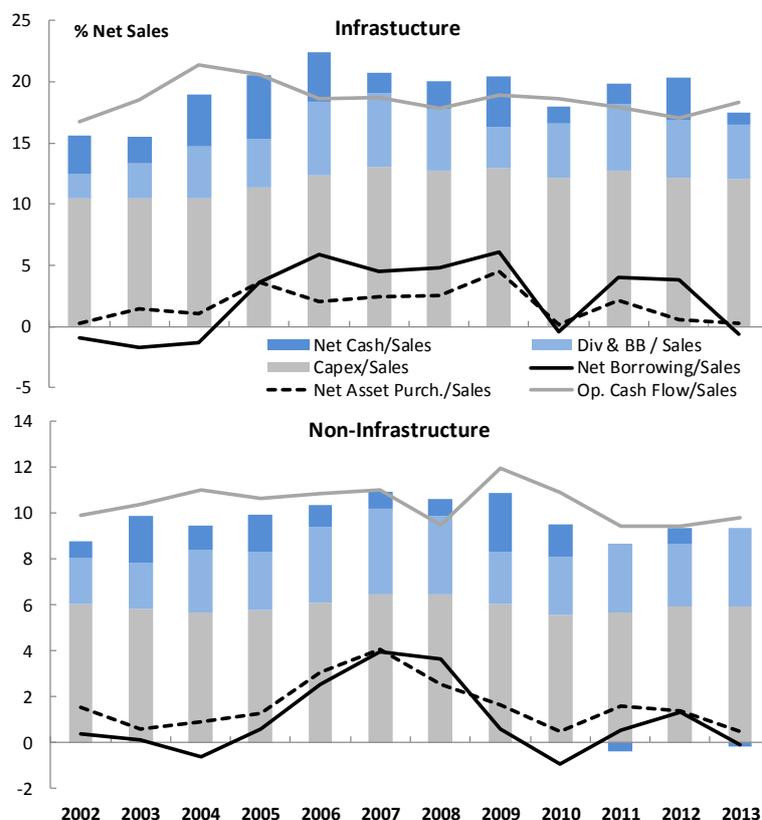
- Operating cash flow as a share of sales is rising for both infrastructure (since 2005) and non-infrastructure industries (since 2008), and is more than sufficient to cover both investment and buybacks.
- Borrowing was strong just prior to the crisis in both sectors and has been picking up again since 2010. This seems to be broadly correlated to the cycle of dividends and buybacks. However, it is worth recalling from Figure 7 that the USA has the lowest debt-to-enterprise-value ratio of all the country groupings here, in both infrastructure and for the non-infrastructure sector, and this borrowing is not likely to create sustainability problems for the future (particularly with foreign cash holding to offset it).
- Capital expenditure as a share of sales has been rising (as noted earlier) in both industry groups, but not to the extent feasible given the funding flows. For infrastructure industries, dividends and buybacks and cash accumulation are growing faster than borrowing and these

could be reduced in favour of investment, but managers choose not to do so. For non-infrastructure industries dividends and buybacks are running at a truly remarkable pace; at about the same pace as capital expenditure itself in recent years. There would be plenty of scope to increase capital spending, but instead firms appear to be adjusting to demands of investors for greater yield (dividends and buybacks). In terms of activity in the USA, the zero interest rate encourages companies to run down cash balances and borrow to finance buybacks and to acquire other assets.

### *European company financing flows*

The flow financing concepts for European companies in infrastructure and non-infrastructure industries are shown in Figure 13.

- Operating cash flows have not been rising like those in the USA. Infrastructure is flat and for non-infrastructure industries there is a clear downward shift after the crisis (following the aid provided via subsidies in 2009), consistent with margin pressures. Borrowing rose for two years in 2011 and 2012, also possibly helped by support measures in some countries in 2009 (including guarantees and interest rate subsidies). But borrowing has fallen back to zero for these companies in 2013.
- Dividends and buybacks are in line with those of the USA in infrastructure, but are only half of what US companies pay (per unit of sales) in non-infrastructure industries. While there is no marked tendency for this component to rise in aggregate in Europe, companies in the UK and Switzerland (not shown) do indeed look very similar to the USA, with very strong growth in buybacks. The accumulation of cash balances has declined, and the net acquisition of assets is much less than in the USA.
- As noted in Figure 7, debt/equity ratios are high for European infrastructure and this, combined with a weak economy, is not conducive to raising even more debt to fund capital expenditure. Debt levels are not especially high in non-infrastructure industries, and new borrowing is weak due to both (banking) supply and also to demand factors.

**Figure 13. Capital spending and related flow financing: Europe**


Source: Bloomberg, authors' calculations.

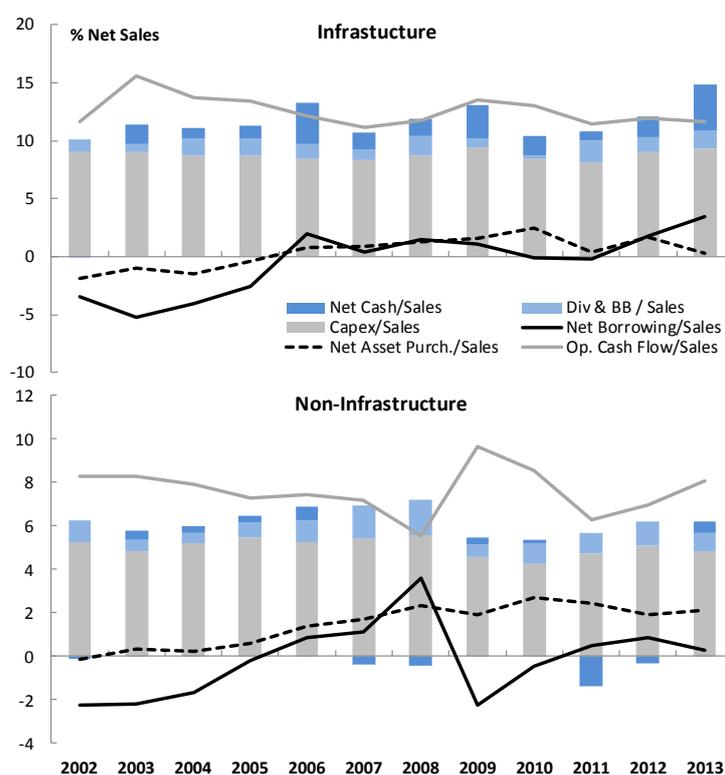
### *Japanese company financing flows*

The flow financing concepts for Japanese companies in infrastructure and non-infrastructure industries are shown in Figure 14.

- Operating cash flow as a ratio to sales for infrastructure (in the top panel) is around 60% higher than for other industries (bottom panel). While this is also the case in other country groups, Japan is unique in that the ROEs are also much lower in non-infrastructure, suggesting that other factors are at work. Borrowing overall is flat in both sectors, as companies try to deal with restructuring from high debt-to-enterprise-value ratios from the past.
- For non-infrastructure companies operating cash flow is well in excess of any capital spending, and dividends and buybacks are miniscule compared to companies in other countries. Non-infrastructure companies appear to prefer acquiring other assets such as shares in other companies. This may reflect in part some effect of vertical kieretsu structures in Japan, as well as participation in global value chains.
- Tax rules appear to have a large impact on dividend repatriation from foreign subsidiaries. For non-infrastructure industries there is a sudden rise in operating earnings in 2009-10, presumably related to the tax reform at the time, which also results in a corresponding drop in borrowing. A greater role for foreign dividends may explain some of the rise in operating

earnings in recent years. The tax reform of 2009-10 has had a big impact on the observed behaviour of multi-national companies (De Mooij and Saito, 2014). In 2009 most of the dividends received by parent companies were exempted from tax if the ownership in the foreign company is at least 25 percent. Foreign subsidiaries as a result began to remit more dividends to Japanese parents.

**Figure 14. Capital spending and related flow financing: Japan**

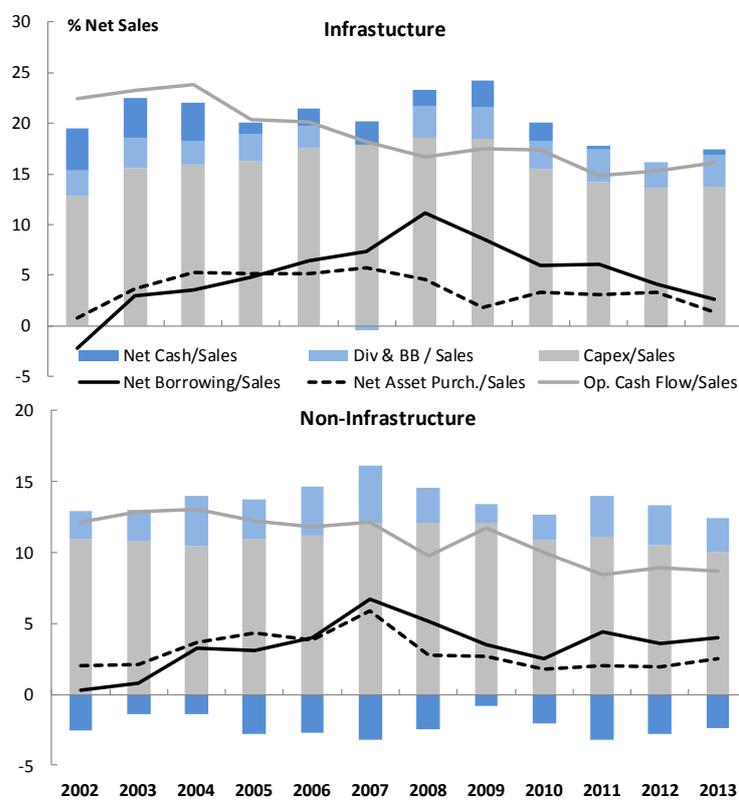


Source: Bloomberg, authors' calculations.

Like Europe, Japan is traditionally more debt financed compared to the USA, and its debt-to-enterprise-value ratios are higher in both infrastructure and other industries (see Figure 7). The Japanese corporate tax rate is often mentioned as a contributor to these high debt ratios compared to other countries (De Mooij and Saito, 2014). Presumably a major objective of policy in Japan would be to use tax reform and other measures reduce debt ratios and to make equity holdings more attractive. As noted earlier, investment in equity is ultimately the best way to fund long-term investment.

### *Emerging market company financing flows*

The situation in emerging markets shown in Figure 15 is quite different to that in advanced countries.

**Figure 15. Capital spending and related financing: emerging countries**


Source: Bloomberg, authors' calculations.

Prior to the mid 2000s operating cash flow as a share of sales was ample to fund capital spending and dividends and buybacks in both sectors. However, from 2004 operating cash flow has been moving down continuously, even ignoring the impact of the crisis. This emerging market experience is consistent with margin compression. Notwithstanding this, capital expenditure continued to rise as a share of net sales until 2008, in both sectors.

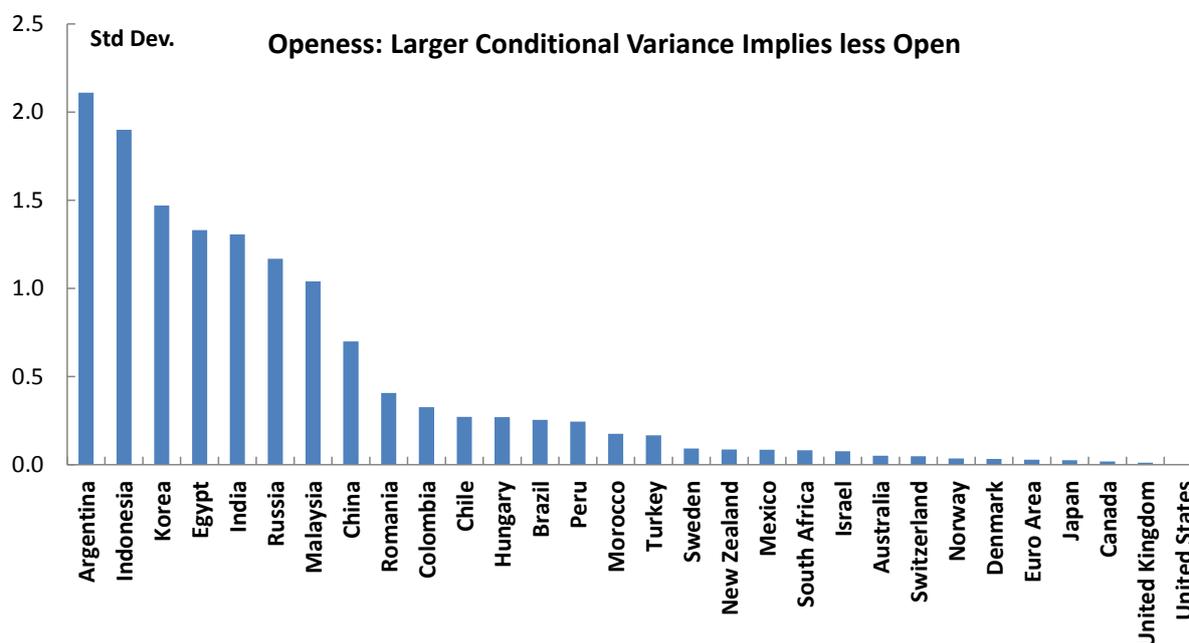
- In the case of infrastructure:* capital spending rose and peaked at 18.6% of net sales in 2008 (compared to 14.7% in the USA) and subsequently has fallen sharply to 13.8% in 2013 (while the USA has moved up to over 16%). Prior to 2006 operating cash flow was sufficient to fund capital expenditure and buybacks and, with a marked rise in borrowing (to 11% of sales), net asset acquisitions also rose. Subsequently, as the downtrend in operating cash flow followed, capital expenditure and acquisitions have been cut back and borrowing has been falling as a share of net sales.
- For non-infrastructure companies:* capital intensity seems to be extraordinary compared to other regions. It peaked at over 12% of sales in 2008 (compared to levels in the range of 5-6% for the USA, Europe and Japan), subsequently moving down to a still high 10% (versus a 4.8 to 5.9% range elsewhere in 2013). Net asset acquisitions following the crisis are lower than for the period before it. Operating cash flow declined, particularly after 2010, and capital expenditure and borrowing to fund it has remained firm (particularly in the past three years).

The debt-to-enterprise value ratio for infrastructure at 31% in Figure 7 is approaching the high levels for Japan and Europe (over 40%). The trend for non-infrastructure emerging market industries is approaching the high debt-versus-equity bias of Japan: this ratio rose from a trough of 9% in 2007 to around 25% in 2013. The apparent sharp upward movement in debt versus equity in emerging markets is a concern. Emerging markets debt ratios appear to be moving exactly in the opposite directions to those in the USA: the US bias towards equity is more conducive to sustainable long-term investment than the emerging markets tendency towards higher debt.

## V. 'Openness' measures to capture potential 'Governance costs' for investors

Government policies of financial repression (to help fund their own expenditures cheaply) and exchange rate targeting to support export market share carry direct cost for companies that use banks and capital markets to fund investment. Financial repression measures include the capping of interest rates, high bank reserve requirements, prescriptive policies for bank holding of government debt, government ownership of domestic banks and restrictions on the transfer of assets abroad via capital controls. Exchange rate targeting includes foreign exchange intervention combined with the use of explicit capital controls as well as the use of bank regulation and currency-based measures (that restrict the free movement of capital without having appeared to impose direct control on cross-border flows). These measures raise transactions costs in the capital markets faced by firms and reduce the breadth and depth of markets that lead to liquidity problems (particularly in crisis periods).

To capture the influence of such governance issues that reduce the openness of economies via their banking systems, the 1-year (average) conditional variance of Covered Interest Parity (CIP) is used (the technical details of which are set out in Annex 2). CIP is chosen as it excludes currency risk and focuses on return differentials between currencies which (apart from low transactions cost and white noise) should not be persistently present in a competitive and open financial system. Movements towards greater openness should see covered differentials diminish and their variance decline over time as arbitrage channels are allowed to operate. The extent of deviations from CIP and the speed with which they can be arbitrated away for the domestic banking system versus open-economy dollar prices can be modelled as an autoregressive structure in both the mean and the variance, and the estimated conditional variance can be used as a measure of openness of the banking system (3-month interbank interest rates and the matching foreign exchange forward and spot rates are used). The average portfolio-flow openness (as opposed to FDI openness) for the period 2010-2013 is shown for a wide range of developed and developing countries in Figure 16.

**Figure 16. Openness measure (2010-2013) based on the conditional variance of CIP**


Source: Bloomberg, authors' calculations.

## VI. A panel study of investment based on the above factors

A panel regression study of the observations of company capital spending discussed in the above analysis provides some interesting insights into the determinants of infrastructure and other-industry investment in advanced versus emerging economies.<sup>17</sup> A vast number of observations are used (i.e., a total of 60,741) and the methodology and results are set out in the Annex 2. The results discussed here may be found in Table A.2.3. The dependent variable is company capital expenditure as a share of net sales, so that it is imposed that capital spending of the company moves in line with its sales, as can be observed in Figures 3 and 4 above. The model is therefore seeking to explain capital spending deviations from company sales with a number of explanatory variables. These include those introduced earlier in the historical discussion: the ROE, the cost of equity, the cost of debt, and the openness measure. For the emerging economies the sample of companies is broken into those with and without a non-deliverable forward (NDF) market. The latter NDF markets normally form when restrictions are so severe that foreign investors cannot participate in foreign exchange derivatives markets in the domestic economy. Instead, they are traded offshore in a dollar-based forward market that allows a shadow hedging market to function. GDP growth of the host country and is included as control variable for the accelerator mechanism to increase the robustness of the results.

### *The infrastructure sector results*

*The advanced economies model* finds that the market-related variables in the cost of equity and measure of openness are supported by the data at the 5% level for infrastructure companies. The AAA bond rate in the domestic market is also significant at the 10% level. The ROE and GDP growth are not supported by the data in advanced economy infrastructure companies. These results are not meaningfully altered whether or not the large number of US companies is included.

*The emerging markets model* (full sample and NDF sample) finds that the ROE is not supported by the data. All of the other variables do find some support, particularly for the NDF sample. These more closed economies appear to have a larger impact on investment from domestic activity (as measured by GDP). The 1-year average conditional volatility of CIP is supported at the 1% for emerging economies. This suggests that emerging markets are not independent of the costs associated with financial repression and capital controls. Emerging market banks frequently rely on foreign funding and liquidity issues are often overwhelming in thin markets during crisis periods. These results are not meaningfully altered if the large number of Chinese companies is excluded from the data.

### The non-infrastructure (general industry) sector results

The results for *the advanced economies model* for general industry are intuitively pleasing. The openness variable is not supported by the data which presumably reflects the greater international orientation of non-infrastructure MNEs listed in advanced economies. Such companies have a broader set of choices as to the location of capital spending and intellectual property, for funding sources and for how earnings are used (for cash accumulation in low tax zones, capital expenditure, buybacks and the matching currency between revenues and liability flows). The openness measure will be less relevant for such companies compared to the more domestic-oriented infrastructure firms. The ROE, the cost of equity, and GDP growth are all strongly supported by the data at the 1% level. A multinational company with foreign subsidiaries and affiliates is first and foremost subject to competition and market metrics are crucial for investment decisions compared to the regulated infrastructure firms and relatively closed emerging markets where rent seeking behaviour is often present.

The results for *the emerging markets model* are also of some interest. The ROE is not supported by the data so market metrics are less evident in decision making. This may reflect the greater role of the state and SOEs in the investment process. Companies in relatively more open emerging countries are similar to the general industrial sector of advanced countries in that the openness variable is not significant. The cost of equity, the AAA bond rate and GDP growth are all supported by the data at the 1% level. For the grouping of companies in countries with NDF markets the openness variable is significant at the 1% level. The cost of debt and GDP growth are correctly signed and significant at the 1% level, while the cost of equity finds no support. Borrowing from state-owned banks may play a bigger role in funding in these more closed economies.

## VII. Drawing together some of the threads

### Summary of trends

Based on an examination of trends in listed companies there appears to be no one generalisation about ‘stagnation’ in the global economy that one can make. Instead, a number of interesting observations can be made based on an examination of the data from many thousands of listed companies.

- Equity is the most prevalent form of funding investment in all industries, but infrastructure companies use more debt financing compared to non-infrastructure companies. Funding infrastructure with debt is most prevalent in the two bank-oriented countries: Japan and Europe as compared to the USA.
- It does appear that infrastructure sales and investment are stagnating in most countries, but not in the United States to 2013, where heavy investment in oil-related companies is 45% of all infrastructure investment.

- Emerging market non-infrastructure company sales and investment are booming while (relatedly) they are stagnating in advanced countries. Advanced country companies also invest in affiliates in emerging markets, as global value chains and the tax-related location of intellectual property, royalties and earnings are used to create shareholder value.
- Emerging markets are seeing a marked decline of operating cash flow (net income adjusted for distorting accruals) per unit of sales, symptomatic of margin pressure. Company ROEs are weakening. These observations are consistent with over-investment and the misallocation argument related to ‘governance’ problems.
- The ROE versus the cost of equity are the lowest in emerging markets. This is an indicator of over-investment. The heavy investment in emerging markets based on a different model of development may be a factor here, particularly in non-infrastructure industries. Capital controls and exchange rate management may also augment the cost of debt and equity.
- Margins and ROEs appear to be rising in the US, improving in Japan but are declining somewhat in Europe (though not to the same extent in all countries). There is a clear difference between European countries with their own floating exchange rates (the UK and Switzerland) and euro-area countries. Southern European countries (which compete more with emerging markets) appear to face more ROE pressure.
- Emerging market operating cash flow is simply not enough to fund investment in non-infrastructure industries. Consequently, investment in infrastructure and other industries has been associated with a very rapid rise of debt at the expense of equity. For non-infrastructure industries debt-to-enterprise-value levels are rapidly approaching Japanese levels of indebtedness that were associated with years of over investment.
- Operating cash flow is not a constraint on investment in the USA or in other advanced countries (as it is in emerging markets). However, buybacks are very strong in the USA and are also firm in parts of Europe (and particularly the UK and Switzerland). These buybacks are at the expense of both investment and the wage gains that are needed for more inclusive growth. Where royalties and earnings are based abroad for tax reasons, tax deductible borrowing can be used to carry out buybacks in the home economy.
- A strong bias of infrastructure investment towards telecommunications and transport areas does not appear to be associated with the avoidance of stagnation trends (Japan and Europe). Lack of natural energy resources in Japan and Europe reduces the scope for diversification of infrastructure investment and may contribute to stagnation pressure.
- Operating cash flow per unit of sales is always larger in infrastructure investment, but this is not matched in respect to ROEs which are generally lower there than for other industries. This could suggest a poor allocation of investment, which is more likely to come about when investment is not based on market mechanisms, and is dominated by subsidies, ownership restrictions, product market regulations, and an excessive role of governments and SOE activity.

There appears then to be a twin paradox in the global economy when examining the detailed data of companies in advanced and emerging economies. Some are investing too much in non-infrastructure industries, which is driving down ROEs and creating margin pressure globally, while others carry out too little long-term investment in favour of buybacks and the accumulation of cash.

Governance problems appear to be associated with the poor performance of the infrastructure sector. A number of thoughts about policy follow the above observations about the data.

### ***Removing obstacles to investment returns and reducing the cost of equity***

Bankable returns that companies achieve (ROEs) and the cost of capital (both debt and equity) were found to be key factors in investment, particularly in the larger general industrial sector, in the econometric results. General industry is much larger than infrastructure and its growth is needed to increase demand for the latter. Easy monetary policy that reduces interest rates and boost share prices can therefore be helpful. However, an excessive reliance on easy monetary policy may become counterproductive. Asset prices and borrowing can go too far, setting up potential future crisis situations. Too low interest rates in advanced economies also lead to poor investment choices (such as excessive investments in real estate) and may also lead to an inter-temporal misallocation of resources. Monetary policy needs to be balanced with policies that improve bankable returns to investment. Greater competition, freer trade and regulatory and tax reforms come to mind.

Market metrics appear to be less powerful in infrastructure generally, and particularly in the more closed emerging economies. There is a need to remove obstacles to competition and market forces. Impediments to efficient profitable investment include: restrictions on foreign ownership; lack of competition that leads to rent-seeking behaviour; poor corporate governance;<sup>18</sup> lack of competitive neutrality with respect to SOE involvement in the economy; corrupt government procurement processes; lack of competitive neutrality between public and private companies; local content requirements (OECD, 2015a); political interference in the pricing of public goods (relevant for infrastructure); legal delays and excessive court costs; costly micro regulations that restrict access to markets; and so on. These distorting factors are present in both advanced and emerging markets. Such conditions complicate efforts to improve productivity and they add to costs for other industries.

### ***The accelerator mechanism***

The results in the panel study also found that the GDP accelerator mechanism was important, particularly for general industry. Policies that enhance stable crisis-free GDP growth and avoid beggar-my-neighbour strategies are essential, including *inter alia*: open world trade, non-distorting supportive economic policy; completing regulatory reform in the financial sector and normalising interest rates, thereby giving companies a better picture of what the exit from the policy responses to the crisis might actually look like.

### ***Financial market openness and avoiding emerging market crises***

While financial repression may be necessary in the early stages of economic development (to harness savings and investment) a closed financial system appears to impose costs that soon become a negative factor for growth. Restrictions affecting financial market openness were found to be a significant negative factor for corporate investment in the above econometric findings. For emerging markets the cost of funding via debt and/or equity is directly affected by financial repression. Furthermore, capital flight is more prevalent in such countries during crisis periods. Ultimately, reducing financial repression and particularly capital controls will have to be an essential element of building a framework for sustainable global growth.<sup>19</sup>

### ***Unsustainable corporate buyback strategies in western countries***

Executives of non-infrastructure companies in the USA, the UK and Switzerland are increasingly rewarding shareholders with short-term share price gains via buybacks at the expense of long-term

investment. With very low interest rates and tax incentives to do so, executives of firms carry out buybacks rather than investing for the long term. By doing so they drive the share price up and reduce the cost of equity (via the reduced dividend yield) in relation to the ROE, raising the scope to create more value in the same way, and often with institutional investors cheering them on. But this is a self-defeating mechanism, as it occurs at the expense of the long-term investment that is necessary to promote higher potential growth and the asset backing needed to support ageing populations (pensions and health care) in the future.

Buybacks benefit company executives and mutual fund managers (whose performance is measured over short periods) both of whom are rewarded with stock options and awards. A typical executive of a large firm has something like 80% of his or her compensation derived from equity participation (Lazonick, 2014). Buybacks enable executives more easily to meet quarterly and or annual EPS targets on which their remuneration is based. Driving up the share price to push stock options ‘into the money’ increases the personal gain of executives, while reducing the scope for investment. Where this is permitted to be carried through by off-market share purchases at fixed price or via a Dutch auction tender process, there is a strong possibility of discrimination amongst shareholders.<sup>20</sup>

Driving down the number of shares outstanding and pushing up the short-term share price in these ways does not benefit the economy in the longer run. The policy options to deal with this include:

- Revisiting corporate law and regulatory rules concerning buybacks, and in the limit to restrain them directly.
- Revisiting executive option and share allocation schemes to align them with long-term investment objectives, as opposed to EPS targets.
- Reducing the attractiveness of borrowing to carry out buybacks. Monetary policy normalisation and the tax treatment of interest costs, capital gains and dividends are most important in this respect.

There are many costs associated with regulations, listing requirements, risk controls and reporting that not all smaller companies can afford – capacity building and simplification in the SME sector can help to reduce these costs. Market rules (such as tick sizes) and the increased use of new technology (electronic and dark exchanges, high frequency trading and passive funds management) have far reaching implications for price discovery and hence for the allocation of investment and the ability of firms to carry out IPOs. These rules need further attention by policy makers.

### ***Avoiding another emerging market crisis and rebalancing the global economy***

A particular concern in the above analysis of corporate data is that investment appears in general to be less efficient in emerging markets. ROEs are declining and have become too low versus the cost of equity and debt. At the same time, borrowing to finance investment appears to be very strong in the general industrial sector of emerging markets. These were ingredients of the Asia crisis.

Addressing problems in the international financial system would aim to allow more scope to normalise interest rates in advanced economies, where low rates have been a response to the damage to the traded goods sector caused by under-valued emerging market exchange rates,<sup>21</sup> and would help to reduce the inefficiency of investment in emerging economies. In short, there may need to be a new

Bretton-Woods-style conference to deal with the damaging incompatibility of very different economic and financial systems and a full reform of the international monetary system.

## NOTES

<sup>1</sup> Amongst many examples see Krugman (2012) and Krugman (2014).

<sup>2</sup> See the OECD-WTO-UNCTAD reports to the G20 on new restrictive measures (2014).

<sup>3</sup> As drawn to make these points in Krugman (2012).

<sup>4</sup> There is no arbitrage to equalise covered returns globally. Strong capital controls that take many direct and hidden forms ensure that these conditions (e.g. covered interest parity) don't hold.

<sup>5</sup> These ideas are developed in Blundell-Wignall and Roulet (2014), and some of the analysis there was used in OECD (2014b).

<sup>6</sup> See OECD (2013a), OECD (2015b) and Della-Croce and Sharma (2014).

<sup>7</sup> See OECD New Approaches to Economic Challenges work, OECD (2014).

<sup>8</sup> Via Heckscher-Ohlin mechanisms.

<sup>9</sup> Bernanke (2005) has referred to the issue of a saving glut. This is estimated to be worth some 300 basis points to the end of 2013 in Blundell-Wignall and Roulet (2014).

<sup>10</sup> See OECD (2014b), and Weild, Kim and Newport (2013).

<sup>11</sup> See Blundell-Wignall and Roulet (2013) where the incentive to buybacks is modelled.

<sup>12</sup> See OECD STAN, the database for structural analysis.  
<http://stats.oecd.org/Index.aspx?DataSetCode=STAN08BIS>

<sup>13</sup> This leaves aside private equity companies, but since there is arbitrage between the listed and unlisted sector this should be quite representative as to what is happening.

<sup>14</sup> This may be a north-south issue in Europe too. Southern countries compete more with emerging markets and are subject to greater margin pressure than the higher technology north. The south seems to have been less able to make structural reforms to improve governance issues and bridge competitiveness gaps.

<sup>15</sup> The cost of equity is the cost to the investor of retaining a dollar of earnings for investment and the ROE would need to be greater in order to create shareholder value. It is measured here as the dividend and buyback yield plus the underlying trend in EPS growth for each company.

- <sup>16</sup> Blundell-Wignall and Roulet (2014) in a panel regression study of global companies show that capital control restrictions, measured by the conditional variance of deviations from covered interest parity, have a significantly negative impact on company investment.
- <sup>17</sup> Annex 1 provides further details about the sample used in the regressions. A co-integration and error correction approach is used. The error correction results imply causal relationships.
- <sup>18</sup> Where mitigating risks requires the public sector to fill gaps via public-private partnerships it is essential to have the right governance structure of boards. The way in which the board is composed, and the role of the governments as providers of capital, needs to be clearly defined. The OECD has developed a useful set of principles to help guide policymakers in these respects. See OECD (2013a), and OECD (2013b).
- <sup>19</sup> See Blundell-Wignall and Roulet (2014). Capital controls are shown to have a highly significant negative effect on investment.
- <sup>20</sup> For example favouring professional versus retail holders, and amongst all shareholders, depending on capital gains and income tax rates where dividend imputation is available.
- <sup>21</sup> This key global issue is not so much about overall current account imbalances which are also affected by saving-investment imbalances in the government and household sectors as opposed to the corporate sector. It is about where investment and jobs are located in the private sector. There is a need for less financial repression and more consumption and open trade in emerging economies so that the gain from trade can be achieved more fruitfully for all players.

## REFERENCES

- Bernanke, B. (2005), “The Global Saving Glut and the U.S. Current Account Deficit”, Remarks at the Sandridge Lecture, Virginia Association of Economists, Richmond; available at <http://www.federalreserve.gov/boarddocs/speeches/2005/200503102/>
- Blundell-Wignall, A. and C. Roulet, (2013), “Long-term Investment and the Buyback Puzzle”, *OECD Journal, Financial Trends*, Vol. 2013/1.
- Blundell-Wignall, A. and C. Roulet, (2014), “*Problems in the International Financial System*”, *OECD Journal, Financial Trends*, Vol. 2014/1.
- Della Croce, R. and Sharma, R. (2014), “Insurers and Pension Funds as Long-Term Investors: An Approach to Infrastructure Investment”, *OECD Working Papers on Finance, Insurance and Private Pensions*, No.38, OECD.
- De Mooij, R. and I. Saito (2014), “Japan’s Corporate Income Tax: Facts, Issues and Reform Options”, *IMF Working Paper* WP/14/138.
- Gordon, R.J. (2014), “The Demise of U.S. Economic Growth: Restatement, Rebuttal, and Reflections”, *NBER Working Paper* No. 19895, February.
- Krugman, P. (2012), “Natural Born Recovery Killers”, *The New York Times*, September 4.

- Krugman, P (2014), “Secular Stagnation, Coalmines, Bubbles, and Larry Summers”, *The New York Times*, November 16.
- Lazonick, W. (2014), “Profits Without Prosperity”, *Harvard Business Review*, September.
- OECD (2013a), *G20/OECD High-Level Principles of Long-term Investment Financing by Institutional Investors*, September.
- OECD (2013b), *Economic Policy Reforms: Going for Growth*. Paris.
- OECD-WTO-UNCTAD (2014), Reports on G20 Trade and Investment Measures; available at [www.oecd.org/daf/inv/investment-policy/g20.htm](http://www.oecd.org/daf/inv/investment-policy/g20.htm).
- OECD (2014), *New Approaches to Economic Challenges (NAEC): The Financial Stream*, OECD, Paris; available at [www.oecd.org/naec/NAEC-Finance-Stream-2014.pdf](http://www.oecd.org/naec/NAEC-Finance-Stream-2014.pdf).
- OECD (2015a), *Overcoming Barriers to International Investment in Clean Energy*, OECD Publishing, Paris (forthcoming).
- OECD (2015b). *Fostering infrastructure investment: lessons learned from OECD Investment Policy Reviews*, OECD Publishing, Paris (forthcoming).
- Stevens, G.R. (2014), “Challenges to Economic Policy”, address to the Anika Foundation Luncheon, 22 July. [www.rba.gov.au/speeches/2014/sp-gov-220714.html](http://www.rba.gov.au/speeches/2014/sp-gov-220714.html)
- Summers, L.H. (2014), “U.S. Economic Prospects: Secular Stagnation, Hysteresis, and the Zero Lower Bound”, *Business Economics* vol. 49, No. 2.
- Weild, D., E. Kim and L. Newport (2013), “Making Stock Markets Work to Support Economic Growth (implications for governments, regulators, stock exchanges, corporate issuers and their investors)”, *OECD Corporate Governance Working Papers* No. 10; <http://dx.doi.org/10.1787/5k43m4p6ccs3-en>.
- White, W. (2012), “Ultra Easy Monetary Policy and the Law of Unintended Consequences”, *Working Paper* No. 126, Federal Reserve Bank of Dallas, Globalization and Monetary Policy Institute; available at <http://www.dallasfed.org/assets/documents/institute/wpapers/2012/0126.pdf>.

## **ANNEX 1.**

### **DATA AND SAMPLE DESCRIPTION**

Two different sets of data are used in this paper to establish the stylised facts: national accounts data for annual real gross fixed capital formation are extracted from the OECD STAN Database for structural analysis over the period 1980-2010; and private company data based on the Bloomberg World Equity Index including 9403 listed companies in 75 countries and 104 sectors over the period 2002-2013. The 44 infrastructure sectors include 1328 companies (i.e., 848 in advanced economies and 480 in emerging economies) and the 60 other sectors excluding financial companies include 8075 companies (i.e., 5 104 in advanced economies and 2 971 in emerging economies). Table A1.1 and Table A1.2 below present the number of companies by sector and country.

Table A1.1. Distribution of companies by sector and country

Advanced Economies	Infrastructure sector	Other sectors (excl. Financials)	Emerging Economies	Infrastructure sector	Other sectors (excl. Financials)
Australia	33	159	Argentina	2	13
Austria	4	32	Bahrain	1	1
Belgium	8	35	Bosnia and Herzegovina	2	35
Canada	60	225	Brazil	32	129
Chinese Taipei	15	211	Bulgaria	1	5
Cyprus*	3	7	Chile	14	38
Czech-Republic	3	5	China (People's Republic of)	142	1222
Denmark	10	38	Colombia	7	11
Estonia	1	1	Croatia	2	19
Finland	4	54	Egypt	5	48
France	35	173	FYR of Macedonia	2	6
Germany	25	176	Gabon	1	0
Greece	13	41	Hungary	1	3
Hong Kong, China	37	210	India	47	209
Ireland	2	30	Indonesia	7	59
Italy	22	82	Israel	7	71
Japan	59	890	Jordan	5	8
Jersey	2	5	Kenya	1	2
Lithuania	1	0	Korea	19	162
Luxembourg	2	13	Kuwait	3	30
Monaco	1	1	Malaysia	22	59
Netherlands	13	71	Mexico	12	59
New Zealand	12	13	Montenegro	1	1
Norway	23	31	Morocco	2	10
Portugal	6	14	Oman	1	4
Singapore	19	83	Pakistan	3	19
Slovenia	2	14	Peru	3	24
Spain	18	83	Philippines	12	31
Sweden	8	99	Poland	9	34
Switzerland	9	111	Qatar	6	10
United Kingdom	65	355	Romania	4	64
United States	333	1842	Russia	51	192
			Saudi Arabia	3	55
			Senegal	1	0
			Serbia	3	67
			South Africa	5	76
			Sudan	1	0
			Thailand	18	71
			Turkey	5	53
			Ukraine	8	38
			United Arab Emirates	5	18
			Venezuela	1	1
			Viet Nam	3	14
<b>TOTAL</b>	<b>848</b>	<b>5104</b>	<b>TOTAL</b>	<b>480</b>	<b>2971</b>

1. Footnote by Turkey

The information in this document with reference to « Cyprus » relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Turkey recognises the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of the United Nations, Turkey shall preserve its position concerning the "Cyprus issue".

2. Footnote by all the European Union Member States of the OECD and the European Union

The Republic of Cyprus is recognised by all members of the United Nations with the exception of Turkey. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus.

Source: Bloomberg, authors' calculations.

Table A1.2. Distribution of companies by sub-sectors

Infrastructure sector	Number of firms	Other sectors (excl. Financials)	Number of firms
Airport Development/Maintenance	26	Advertising	28
Cable/Satellite TV	28	Aerospace/Defense	55
Data Processing	16	Agriculture	58
Electric-Distribution	28	Airlines	60
Electric-Generation	60	Apparel	145
Electric-Transmission	19	Auto Manufacturers	66
Energy-Alternate Sources	83	Auto Parts/Equipment	189
Environ Monitoring	2	Beverages	93
Gas-Distribution	59	Biotechnology	94
Gas-Transportation	2	Building Materials	334
Hazardous Waste Disposal	10	Chemicals	339
Independent Power Producer	14	Coal	79
Internet Infrastructure Software	5	Commercial Services	327
Marine Services	7	Computers	128
Medical-Hospitals	29	Cosmetics/Personal Care	23
Medical-Nursing Homes	6	Distribution/Wholesale	177
Non-Hazardous Waste Disposals	17	Electric	165
Oil Exploration/Production	138	Electrical Components/Equipements	194
Oil Refining/Marketing	49	Electronics	379
Oil-Gas Drilling	15	Engineering/Construction	299
Oil-Field Services	66	Entertainment	142
Pipelines	13	Environmental Control	98
Public Thoroughfares	50	Food	283
Recycling	14	Food Service	44
Research/Development	8	Forest Products/Paper	91
Retirement/Aged Care	3	Hand/Machine Tools	38
Satellite Telecom	3	Healthcare-Products	118
Schools	30	Healthcare-Services	50
Schools-Day Care	2	Holding Companies-Divers	40
Sector Fund-Energy	1	Home Builders	74
Seismic Data Collection	5	Home Furnishings	99
Stevedoring	1	Household Products/Wares	27
Telecom Services	71	Housewares	17
Telecommunication Equip	33	Internet	142
Telephone-Integrated	66	Iron/Steel	180
Television	33	Leisure Time	97
Transport-Equipement/Leasing	7	Lodging	97
Transport-Marine	97	Machinery-Construction/Mining	26
Transport-Rail	42	Machinery-Diversified	269
Transport-Services	62	Media	107
Water	30	Metal Fabricate/Hardware	197
Water Treatment Systems	30	Mining	263
Web Portals/ISP	17	Miscellaneous Manufacturing	117
Whsing-Harbor Transport Services	31	Office Furnishings	12
		Office/Business Equipement	27
		Oil-Gas Services	20
		Packaging/Containers	82
		Pharmaceuticals	184
		Real Estate	632
		REITS	238
		Retail	455
		Semiconductors	121
		Shipbuilding	20
		Software	132
		Storage/Warehousing	24
		Telecommunications	94
		Textiles	155
		Toys/Games/Hobbies	9
		Transportation	22
<b>TOTAL</b>	<b>1328</b>	<b>TOTAL</b>	<b>8075</b>

Source: Bloomberg, authors' calculations.

## ANNEX 2.

### THE DETERMINANTS OF CAPITAL EXPENDITURES: EMPIRICAL EVIDENCE FOR A GLOBAL SAMPLE OF NON-FINANCIAL COMPANIES

To investigate the determinants of firms' (excluding financial firms') capital expenditures, a fairly standard model is postulated, incorporating microeconomic and macroeconomic variables. The dependent variable is company's capital expenditure which is measured as a share of the firm's net sales.

The explanatory variables are:

- The return on equity (ROE) is the ratio of net income to total common equity of the company. It is a measure of a firm's ability to retain earnings for the purpose of capital expenditures. The capital expenditure variable is expected to have a positive relationship with this variable.
- The cost of equity is measured as the dividend yield of the company plus the trend rate of growth of earnings. A higher cost of equity discourages firms to retain earnings for the purpose of capital expenditures. The capital expenditure variable is expected to have a negative relationship with this variable.
- The cost of debt is measured as the AAA-rating corporate bond index of the country location of the company minus the one year government bond yield. A higher AAA bond yield compared to the risk free rate discourages firms from borrowing to increase their capital expenditures. The capital expenditure variable is expected to have a negative relationship with this variable.
- Economic growth is measured by real GDP growth in the home country (GDP). It is the annual per cent change in real gross domestic product of the country location of the firms. The capital expenditures variable is expected to have a positive relationship with this variable.
- The 1-year average conditional volatility of Covered Interest Parity (CIP) is the conditional standard deviation calculated using a GARCH (1,1) model.<sup>1</sup> Along with interest parities, the conditional variance of CIPs might be a measure of dynamic capital mobility. Indeed, with greater capital mobility, not only covered differential rates but also the variance would decline over time. CIP is calculated using deliverable and non-deliverable forward rates.<sup>2</sup> The greater the volatility, the more CIP is deviating from the zero equilibrium. This phenomenon is observed in countries with strong capital control measures. Stronger controls on capital flows discourage firms to retain earnings for the purpose of capital expenditures. The capital expenditures variable is expected to have a negative relationship with this variable.

## Estimation method and data

When economic theory suggests – as in the case of investment models – that there exists an equilibrium relationship between integrated variables, co-integration and vector-error-correction models (VECM) provide an efficient estimator to describe short- run dynamics. Beyond these pure econometric reasons, co-integration techniques and VECM are especially useful in modelling investment. As Hubbard and Hassett (2002) argue, a number of fundamental variables affecting investment move together over the business cycle. This causes simultaneity problems. Shifts in the investment function (often associated with the business cycle) imply a positive relationship between the user cost of capital and investment, while interest rate shocks cause negative correlation between the two. If the first dominates, the user cost elasticity will be small, and accelerator effects (the impact of output on investment) large. This problem could be circumvented by focusing on the long-run relationship instead. In addition, VECM allows a rich dynamic representation of the data, which often turns out to be very useful given the sluggish nature of capital stock adjustment and investment. In this paper Engle and Granger methodology is used.

All annual companies and market data are extracted from Bloomberg and Datastream. Macroeconomic data were also extracted from OECD and IMF Databases. The econometric analysis is run on a global sample of 8774 listed companies from 56 countries and 104 sectors over the period 2002-2013<sup>3</sup>. Table A.2.1 presents some general descriptive statistics of the variables included in the model. Table A.2.2 contains correlation coefficients among all explanatory variables.

**Table A.2.1. Summary descriptive statistics of the sample**

	Mean	Median	Maximum	Minimum	Std. Dev.
<b>Capital expenditures (%Net Sales)</b>	11.52	4.87	199.88	-40.77	19.84
<b>ROE</b>	10.54	10.25	100.00	-99.94	18.65
<b>Cost of equity</b>	10.12	8.63	30.00	0.50	7.32
<b>Cost of debt</b>	1.42	1.17	10.85	-1.61	1.73
<b>Real GDP growth rate</b>	3.66	2.80	28.50	-14.80	3.96
<b>1Y average conditional vol. of CIP</b>	0.27	0.03	2.92	0.00	0.44

Source: Bloomberg, Datastream, authors' calculations, IMF (2002-2013). All variables are expressed in percentage.

## Results

Regressions are run on the global panel of non-financial companies for the years 2002 to 2013, involving some 63,482 observations. This study focuses on the differences which may exist between firms operating in the infrastructure sector and firms operating in other economic sectors in alternately advanced and emerging economies. In addition, regressions are run including countries with only a deliverable forward (DF) market or countries with only a non-deliverable forward (NDF) market.<sup>4</sup> The results are shown in Table A.2.3.

**Table A.2.2. Correlations among the main explanatory variables**

	ROE	Cost of equity	Cost of debt	Real GDP growth rate	1Y average conditional vol. of CIP
ROE	1.00				
Cost of equity	0.10 <i>0.00</i>	1.00			
Cost of debt	0.02 <i>0.00</i>	0.03 <i>0.00</i>	1.00		
Real GDP growth rate	0.08 <i>0.00</i>	0.17 <i>0.00</i>	-0.12 <i>0.00</i>	1.00	
1Y average conditional volatility of CIP	0.03 <i>0.00</i>	0.19 <i>0.00</i>	-0.03 <i>0.00</i>	0.45 <i>0.00</i>	1.00

Note: Correlation coefficients are calculated using a balanced sample. Figures in italics indicate values of the T-statistics that test for null hypothesis of Pearson's coefficients of correlation equal to 0.

**Table A.2.3. The determinants of investment of non-financial companies focusing on the impact of the cost of equity**

Co-integration equation (dependent variable: capital expenditure, % net sales)

Variables	Infrastructure			Non-Infrastructure			
	Advanced economies - DF	Emerging Economies - DF & NDF	Emerging Economies - NDF	Advanced economies - DF	Emerging Economies - DF & NDF	Emerging Economies - DF	Emerging Economies - NDF
<b>ROE:</b> ratio of net income to total common equity of the company	0.004 (0.33)	-0.02 (-0.71)	-0.01 (-0.34)	0.02 *** (3.49)	-0.01 (-1.12)	0.01 (0.63)	-0.02 (-1.51)
<b>Cost of equity:</b> dividend yield of the company plus the trend rate of growth of earnings	-0.14 ** (-2.13)	-0.12 (-1.24)	-0.28 ** (-2.29)	-0.13 *** (-3.19)	-0.15 *** (-3.26)	-0.42 *** (-4.60)	-0.04 (-0.68)
<b>Cost of debt:</b> yield of AAA-rating corporate bond index of the country location of the company minus 1-year government bond yield	-0.23 * (-1.80)	-0.28 *** (-2.66)	-0.34 *** (-2.65)	-0.62 *** (-8.81)	-0.22 *** (-5.58)	-0.30 *** (-4.62)	-0.18 *** (-3.58)
Real GDP growth rate	0.02 (0.31)	0.44 *** (3.16)	0.82 *** (4.98)	0.09 *** (2.71)	0.17 *** (3.77)	0.10 *** (2.40)	0.20 *** (3.49)
<b>1-year average conditional volatility of Covered Interest Parity:</b> conditional standard deviation calculated using a GARCH (1,1) model	-0.06 ** (-2.31)	-0.04 *** (-4.27)	-0.03 *** (-3.17)	-0.01 (-0.85)	-0.01 *** (-4.02)	-0.01 (-0.70)	-0.01 *** (-3.75)
C	0.19 *** (20.82)	0.22 *** (11.45)	0.22 *** (8.93)	0.11 *** (22.46)	0.14 *** (17.14)	0.17 *** (9.84)	0.12 *** (11.86)
R <sup>2</sup>	<b>0.73</b>	<b>0.54</b>	<b>0.53</b>	<b>0.64</b>	<b>0.54</b>	<b>0.63</b>	<b>0.52</b>
F-Stat	19.49	7.04	6.94	14.45	7.95	10.57	7.56
Prob(F)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Durbin-Watson Stat.	1.26	1.27	1.27	1.44	1.44	1.24	1.46
Total Obs.	<b>5416</b>	<b>2726</b>	<b>2319</b>	<b>36533</b>	<b>18721</b>	<b>2672</b>	<b>16049</b>

Error correction equation (dependent variable: change in capital expenditure, % net sales)

Variables	Infrastructure			Non-Infrastructure			
	Advanced economies - DF	Emerging Economies - DF & NDF	Emerging Economies -- NDF	Advanced economies - DF	Emerging Economies - DF & NDF	Emerging Economies -- DF	Emerging Economies -- NDF
<b>1 Year lagged value of VECM residuals</b>	-0.67 *** (-23.32)	-0.66 *** (-21.29)	-0.66 *** (-20.61)	-0.80 *** (-38.49)	-0.73 *** (-30.23)	-0.66 *** (-7.53)	-0.74 *** (-27.34)
<b>Δ ROE: ratio of net income to total common equity of the company</b>	0.05 *** (4.33)	0.09 *** (3.73)	0.09 *** (3.21)	0.03 *** (4.56)	0.07 *** (8.96)	0.04 * (1.69)	0.07 *** (8.09)
<b>Δ Cost of equity: dividend yield of the company plus the trend rate of growth of earnings</b>	0.002 (0.02)	-0.01 (-0.10)	0.09 (0.57)	-0.20 *** (-4.76)	-0.01 (-0.11)	0.03 (0.32)	-0.03 (-0.47)
<b>Δ Cost of debt: yield of AAA-rating corporate bond index of the country location of the company minus 1-year government bond yield</b>	0.04 (0.36)	-0.22 *** (-2.38)	-0.20 * (-1.69)	0.24 *** (3.70)	0.10 *** (2.41)	0.13 * (1.62)	0.10 * (1.78)
<b>Δ Real GDP growth rate</b>	-0.03 (-0.63)	-0.08 (-0.87)	0.02 (0.21)	0.04 * (1.82)	0.01 (0.40)	-0.03 (-0.56)	0.05 (1.14)
<b>Δ 1-year average conditional volatility of Covered Interest Parity: conditional standard deviation calculated using a GARCH (1,1) model</b>	0.02 (1.42)	-0.01 (-1.03)	-0.01 (-1.23)	-0.01 (-0.94)	0.003 (1.52)	0.003 (0.70)	0.004 (1.58)
<b>C</b>	-0.01 (-0.67)	-0.01 (-0.77)	-0.03 (-1.30)	0.02 *** (3.17)	-0.01 (-1.53)	-0.02 (-0.97)	-0.01 (-0.90)
<b>R<sup>2</sup></b>	<b>0.41</b>	<b>0.41</b>	<b>0.41</b>	<b>0.46</b>	<b>0.43</b>	<b>0.42</b>	<b>0.43</b>
<b>F-Stat</b>	4.60	3.70	3.75	5.95	4.33	3.69	4.43
<b>Prob(F)</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Durbin-Watson Stat.</b>	1.74	2.05	2.07	1.94	2.04	2.22	2.02
<b>Total Obs.</b>	<b>4642</b>	<b>2235</b>	<b>1909</b>	<b>31832</b>	<b>15773</b>	<b>2181</b>	<b>13592</b>

Note: This table shows the results of estimating a VECM model for an unbalanced panel of 8774 listed companies from 56 countries and 104 sectors over the period 2002-2013. Cross-section and time fixed effects are used in the regressions as is the White diagonal covariance method. \*, \*\* and \*\*\* indicate statistical significance at the 10%, 5% and 1% levels, respectively.

## NOTES

<sup>1</sup> If we denote  $y$  generically as the CIP, a time-series model that captures the autoregressive (AR) structure in both the mean and the variance can be written as:

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + \dots + \alpha_h y_{t-h} + \xi_t \quad \text{with } \xi_t \sim N(0, \sigma_t^2)$$

$$\sigma_t^2 = \beta_0 + \sum_{t=1}^q \beta_1 \xi_{t-1}^2 + \sum_{t=1}^p \beta_2 \sigma_{t-j}^2$$

where  $\sum \beta_1 \xi_{t-1}^2$  is the ARCH term (the squared error term in the previous time period) of  $q$  order, generally being news about volatility from the previous period;  $\sum \beta_2 \sigma_{t-j}^2$  is the GARCH term (the conditional variance in the previous time period) of  $p$  order. Thus,  $y_t$  follows an AR( $h$ ) process with a conditional variance equation described by a GARCH ( $p, q$ ) process. The GARCH model is implemented via maximum likelihood estimation of the log-likelihood function. The estimated conditional variance  $\sigma_t^2$  will give us an indication of the evolution of capital mobility. In this paper,

GARCH(1,1) model is adopted, which is sufficient to capture the dynamics of the conditional variance of  $y$ . The properties of the dataset are examined before the analysis of the empirical results. The Phillips-Perron (PP) test is employed. It is found that the null hypothesis of one unit root can be rejected in all of the time series. CIP time series are driven by AR(1) processes. It is also identified that the estimated coefficients are significant and all the diagnostic statistics are reasonable.

- <sup>2</sup> CIP is calculated using deliverable forward (DF) rates for countries with only a DF market. For countries with only an NDF market and for countries with both DF and NDF markets, CIP is calculated using the NDF rate.
- <sup>3</sup> The sample presented in Annex 1 is restricted because of data availability to calculate the conditional volatility of conditional volatility of Covered Interest Parity (CIP). The following list details the 56 countries considered for this econometric analysis: Argentina; Australia; Austria; Belgium; Brazil; Bulgaria; Canada; Chile; China (People's Republic of); Chinese Taipei; Colombia; Cyprus; Czech Republic; Denmark; Egypt; Estonia; Finland; France; Germany; Greece; Hong Kong, China; Hungary; India; Indonesia; Ireland; Israel; Italy; Japan; Korea; Lithuania; Luxembourg; Malaysia; Mexico; Monaco; Morocco; Netherlands; New Zealand; Norway; Pakistan; Peru; Philippines; Poland; Portugal; Romania; Russia; Singapore; Slovenia; South Africa; Spain; Sweden; Switzerland; Thailand; Turkey; United Kingdom; United States; Venezuela.
- <sup>4</sup> All advanced economies in the sample have only a deliverable forward market. In addition, because the sample of companies operating in infrastructure sectors located in emerging economies includes a relatively low number of observations, the regression results are not presented in the paper as they might not be reliable enough.