Highlights

- Productivity, the rate of output (GDP) per unit of input (capital and labour), is a critical driver of sustainable economic growth and income. The perception that Asia is a low-productivity region is out of date. Since 2000, Asia’s productivity performance has been solid across the board. We think the slowdown in productivity since the global financial crisis (GFC) is more cyclical than structural and expect a recovery in the coming years, helped by urbanisation, reform and productive investment. It is important to separate the China story from the rest of Asia. In Asia excluding Japan and China (AXJC), the contribution of capital to GDP growth has been slowing for many years, while productivity growth has been sustained. Click here for the Scoop, an audiovisual summary of this report.

- Countries with low per-capita capital stocks have strong growth potential. They include China, India, Indonesia, the Philippines and Thailand.

- Headwinds to growth from ageing populations in Northeast Asia, Thailand and Singapore put more of a burden on urbanisation, infrastructure and reforms to boost productivity and growth. We present our estimates of the impact of demographics on Asia’s economic growth.

- We think China's real effective exchange rate (REER) looks overstretched based on its relationship with productivity, while the Korean won (KRW) looks mildly undervalued, suggesting more upside potential.

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Asia’s productivity: The new story

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Executive summary

Economic growth boils down to three factors: capital, labour, and how they are used – i.e., productivity. While economists may have widely differing views on economic growth, they all agree on the importance of productivity. Strong and increasing productivity is vital to drive wealth creation and create a successful and sustainable economy. Capital is vital for any economy, particularly at the early stages of development, supported by a growing and increasingly skilled labour force. However, the ability to get more output from a given set of inputs enables real growth over the longer term and makes a country a more attractive trading partner.

In this report, we examine Asia’s productivity track record and the outlook based on the present quantity and quality of capital and labour. We present our estimates of the impact of urbanisation, our measure of the quality of capital investment, and our estimate of the impact of Asia’s ageing populations.

Key takeaways

1. We see the decline in productivity in recent years as more cyclical than structural, and expect Asia’s growth outperformance to continue and be sustainable.

2. Despite the recent slowdown, Asia’s productivity since 2000 has been better than in the 1980s and 1990s. Asia has moved on from the phase of excessive capital accumulation with no productivity growth to show for it. The reforms of the late 1990s underpinned the productivity boost in the 2000s. Further reforms are needed to boost productivity and growth, a theme we have explored in previous reports (The Super-cycle lives: EM growth is key; Economic reform: The unfinished agenda; SCout, India: Reviving growth, growth brick by brick). It is critical to distinguish between the story in China, where capital intensity has continued to rise, and the rest of Asia, where capital intensity has dropped overall.

3. Urbanisation will be a significant driver of productivity as the share of agricultural workers declines and shifts instead towards manufacturing and services.

4. Shrinking labour forces in Northeast Asia, Thailand and Singapore highlight the urgent need to urbanise where possible and reform to boost productivity.

5. Countries with currently low capital stocks (per worker) have huge future GDP growth potential: the Philippines, Indonesia, India, China and Thailand.

6. The quality of capital growth is what matters. We define productivity-enhancing investment as all investment except that in residential property. This is good news for China, Thailand, South Korea and Indonesia.

7. While the shift from agriculture to manufacturing is a source of increased productivity, there is no specific share of manufacturing versus services that creates optimal total factor productivity (TFP) growth. Boosting productivity requires competitive pressure in the industry.

8. The relationship between REERs and productivity is generally strong, particularly for China. However, China’s REER looks overstretched versus the level suggested by the relationship with productivity levels, compared with that of the US. The KRW looks mildly undervalued. Thailand’s REER appreciation is supported by the economy’s relative productivity performance.
Asia’s productivity story – Better since 2000

- Asia’s productivity growth has outperformed other EM regions in the past decade
- This is a much-needed improvement from the 1990s
- More urbanisation, productive investment and structural reform is needed to build on this track record

It’s not just about perspiration

The common story in the early 2000s that Asia was dependent on excessive capital accumulation, with low or negative productivity growth, has changed. In the 1990s, about half the Asian countries listed in Figure 1 had negative productivity growth; today, none of them do. Asia’s growth does remain heavily skewed towards capital accumulation relative to other emerging-market (EM) regions, as Figure 2 shows. But productivity plays an increasingly important role, a major shift from the pattern of the 1990s. Asia’s productivity gains have also exceeded those of other EM regions.

Within Asia, we see a contrast between China and the rest of the region (see Figures 4 and 5). While capital stock accumulation has slowed and productivity growth has accelerated in Asia ex-Japan and China (AXJC) since the 1990s, China has seen faster capital stock accumulation and a slowdown in productivity growth. This indicates declining returns on investment in China. Excess credit growth is another indication of declining returns: growth in China’s capital and credit increased further in 2009 in reaction to the GFC and recession. In the rest of the region, productivity growth has been positive across the board, helped by the reforms implemented in the aftermath of the Asian financial crisis of 1997-98. In more recent years, however, AXJC productivity growth has slowed. The question now is whether reforms, urbanisation and productive investment growth are sufficient to enable further productivity gains over the next decade.

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We examine both quality and the quantity of capital accumulation, which is vital to any country’s growth outlook; we also consider the importance of urbanisation in counteracting the negative impact of a shrinking workforce in some Asian economies in the coming decades. We are optimistic overall about Asia’s growth outperformance in the coming years.

Figure 1: A better performance in Asia during the 2000s, after a mixed 1980s and 1990s

Percentage contribution to GDP growth from productivity (TFP), by decade (average)
A better productivity experience in the 2000s…

2001-11 was a good decade for productivity growth in Asia, according to the Penn World Tables. Productivity contributed c.10-40% of each economy’s GDP growth during the period. This strong across-the-board performance was a departure from the patchy track record of the 1990s (see Figure 1), and may have been a by-product of the painful reforms implemented in the aftermath of the Asian crisis of 1997-98. Compared with other EM regions, Asia registered higher growth in both productivity and capital investment during this period. Excluding the large economies of Japan, China and India, Asia’s productivity and investment growth still outperformed, though to a lesser degree (see Figure 2).

. . . but recent productivity growth has been softer

After a decade of strong productivity growth in the 2000s, our estimates suggest a more mixed productivity story for Asia in recent years. This may be partly explained by the lack of reforms in the aftermath of the GFC, as market pressure for such reforms was muted by indiscriminate investor inflows to emerging markets. This is now changing. Pressure for reform has returned as markets are again being priced according to each country’s fundamentals.

Weaker global growth may also be curbing Asia’s productivity. Productivity has historically underperformed during periods of weak growth. This pattern is particularly prevalent in China, where rapid credit growth from 2008-13 was mostly used for capital investment. This resulted in a steep rise in the share of GDP growth contributed by physical capital growth rather than productivity. The average contribution of physical capital to growth in the five years from 2009-13 was more than 80%, higher than at any time in the last 30 years.

Other possible causes of the slowdown in productivity growth include the rebalancing of the world economy and the transition in the drivers of Asia’s economic growth from external to domestic.

**Figure 2: Asia’s capital and productivity growth has outperformed other EM**

*Average growth (%, y/y), 2001-11*

Note: For this chart, Asia consists of China, Hong Kong, India, Indonesia, Japan, South Korea, Malaysia, Philippines, Singapore, Taiwan and Thailand

Source: Penn World Tables, Standard Chartered Research
How Asian economies stack up against the US

The US is widely viewed as the global leader in productivity. The world’s largest economy remains at the forefront of research and technology and has the ability to reinvent and adapt. We believe it is important to use the US as a point of reference when evaluating countries’ relative progress on productivity. The productivity index presented in Figures 6 and 7 is a relative index in which the US’ 2005 productivity level = 100. This makes it easier to assess economies’ relative status.

We identify two groups in Figures 6 and 7: emerging and more advanced markets. There is a clear and positive relationship between productivity and income, as reflected in the fact that lower-income groups are still some way behind the US in terms of productivity. Malaysia is the closest to breaking out of this pack, with government policy aimed at moving the economy towards high-income status in the coming years. The Philippines lags the region in terms of both productivity and GDP per capita.

Relative improvements since 2000 have been seen mostly in EM countries. China, Thailand, Malaysia and Indonesia have improved the most over this period. In contrast, Singapore, Hong Kong and South Korea have fallen back the most by this measure. There are many potential explanations for why countries are at the higher or lower end of the range. In Singapore’s case, we think one reason why its per-capita GDP is higher than Taiwan’s is because of the higher growth contribution of residential property investment to Singapore’s economy, which does not feed into productivity but does generate GDP during the construction phase.

Figure 3: Productivity growth has fallen in recent years

Productivity contribution to growth (ppt), multi-year average

Source: Penn World Tables, Standard Chartered Research
Asia’s productivity: The new story

Figure 4: Within Asia, China was more capital-driven…

Growth in each GDP component for China (%, y/y)

Figure 5: …while capital growth elsewhere slowed

Asia ex-China, India, Japan, growth by component (% y/y)

Figure 6: Productivity snapshot across Asia, 2000

Figure 7: Productivity snapshot across Asia, 2013

Those furthest behind have had the most relative catch-up with the US

Source: Penn World Tables, Standard Chartered Research

Source: Penn World Tables, Standard Chartered Research

Source: IMF, Penn World Tables, Standard Chartered Research

Source: IMF, Penn World Tables, Standard Chartered Research
Productivity outlook – Labour

- Productivity trends have improved since 2000, but sustained improvements cannot be taken for granted
- Urbanisation and industrialisation, along with better infrastructure, will help lower-income economies to boost productivity
- Shrinking labour forces may become a major challenge for China, Korea, Hong Kong, Thailand and Singapore by the 2020s

Move from rural areas to cities drives productivity

Asia has significant potential to boost productivity growth as it urbanises and industrialises. As people living a subsistence lifestyle move to cities, they learn new skills on the job, boosting their productivity and income. The extent of productivity gains will depend on the pace of urbanisation and growth in infrastructure (both hard and soft). Figure 8 shows the strong relationship between urbanisation and productivity. While many other factors also need to be in place, the process of moving workers from rural areas to urban centres is a key channel for increasing productivity and incomes. Asian countries still have much room to benefit from this simple yet powerful process.

Increased urbanisation and industrialisation will become more important drivers of growth as demographics – another key growth driver – becomes less supportive or even a drag on growth in some markets. For China, Korea, Hong Kong, Thailand and Singapore, demographics is set to reverse from being a positive growth driver to a drag over the next decade. Smaller and more open economies may be able to counter this by importing labour. This is much harder to do for larger economies, most notably China given that it has the world’s largest population. The good news for China is that despite a contraction in the working-age population, the urbanisation process has a long way to go, which may keep labour productivity growth strong during this period. This could be complemented by improving the quality of human capital. We show the relationship between the quality of human capital and productivity later in this section.

Figure 8: Urbanisation appears be positively correlated with productivity levels

Source: IMF, Penn World Tables, Standard Chartered Research
Urbanisation’s role in growth and productivity

We think that China can sustain its current growth levels just by developing and urbanising its own backyard (see On the Ground, 30 November 2012, ‘China – As the poor catch up with the rich’). This can be done by further developing services industries, which make up a smaller share of China’s GDP than in more developed economies. For instance, China’s services sector accounted for 46.1% of GDP in 2013 (versus 43.9% for manufacturing), smaller than South Korea’s 54% (versus 35% for manufacturing).

Many ASEAN economies remain relatively rural, offering opportunities to shift labour into more productive industries. We categorise Singapore, Brunei and Malaysia as Tier 1 urbanised economies; Indonesia and the Philippines as Tier 2; and Laos, Thailand, Myanmar, Vietnam and Cambodia as Tier 3. Assuming Tier 2 and Tier 3 economies move to the next level of urbanisation, we expect GDP per capita to triple and GDP growth to quicken (see On the Ground, 28 January 2013, ‘ASEAN – Time for take-off’).

Demographics is becoming a drag on growth

Of all of the growth drivers in the coming decades, we have the most clarity on demographics. Japan’s shrinking working-age population has been negative for its growth over the past decade. Unlike China, whose working-age population is also set to decline, Japan’s urbanisation process is complete. Therefore, increasing the productivity of the existing population needs to be achieved through other channels. Rapid growth in Singapore’s working-age population in the mid-2000s has softened and is likely to turn negative by the second half of the 2020s. Hong Kong is likely to reach this stage even sooner, and Korea is not far behind. In ASEAN, while demographics are broadly favourable for Indonesia, Malaysia and the Philippines, Thailand is a major exception.

Figure 9: Asia’s demographic slowdown

Average annual growth in working-age population growth, 2006-30

Source: UN, Standard Chartered Research
Northeast Asia and Thailand face the greatest demographic challenges

Figure 9 shows the expected changes in the working-age population in various Asian economies. In countries with young populations, labour will continue to boost growth. Indonesia and the Philippines are estimated to add a combined 35mn people to their working-age populations between now and 2025, according to the UN. This is equivalent to half of Thailand’s total population.

The story is not all positive, however. Unlike in the US, it is difficult to see immigration significantly changing the demographic destinies of most Asian economies. Many face the challenge of compensating for falling labour supply in the coming years. Singapore, Hong Kong, South Korea, Thailand and China face the greatest challenges. In Figure 10 we show the growth impact (in ppt) of the demographic decline until 2030, broken down into five-year periods. We use UN data for the working-age population; these numbers are unlikely to change until at least 2030, even if major reforms are implemented today. Demographics start to become less positive from the mid-2010s, before turning into a drag on growth. The negative impact increases in the 2020s.

Using this data to project the growth impact of the shrinking labour force illustrates the additional pressure on other sources of growth, including productivity, to compensate (see Figure 10). While smaller economies will be able to import labour to counter this effect, this is unlikely to happen in China or South Korea. This explains the importance of focusing on productivity growth: inspiration over perspiration. From now to 2025, China’s working-age population is set to shrink by 15mn, nearly two-thirds of Australia’s population today. From 2025-30, China’s working-age population will fall by another 20mn, almost the equivalent of Australia’s entire population today. China will likely need to find an extra 1.5ppt of GDP growth from other sources in order to compensate for its shrinking-working age population by 2025.

Human capital as a productivity and growth driver

Having looked at the quantity of labour in the above section, we now look at the quality, by considering the relationship between productivity and human capital in Asia. The more skilled the workforce, the higher productivity is likely to be. We find the positive relationship between human capital development and productivity is clear.
that this relationship holds for most countries, although South Korea and Japan do not seem to get as much productivity out of their human capital as the US, despite having highly skilled workforces (see Figure 11). We use the human capital index from the Penn World Tables, which combines average years of schooling with a measure of the ‘effectiveness of schooling’ (returns on education; see the work of George Psacharopolous). While we hesitate to draw firm conclusions from the exact position of each economy in this chart, we see a clear positive relationship between human capital development and productivity.

Indonesia is an outlier, with higher productivity than its human capital index would suggest. This may be due to problems with measuring productivity, which is difficult in such a large and diverse economy. We have excluded India from this comparison for the same reason, as it is extremely difficult to estimate productivity accurately. This measure puts Singapore’s productivity on par with Hong Kong’s and ahead of Australia’s, despite a lower human capital index reading.

Human capital development has contributed positively to trend growth across Asia. Training and education boosted Asia’s average annual growth by 0.3-0.5ppt from 2001-13. In Thailand, training and skills development contributed particularly strongly to economic growth. The Philippines was the exception to this positive trend, registering only a 0.17ppt contribution in the past decade – comparable to the US but lower than Japan. Since training and development levels are much lower in the Philippines than in the US and Japan, it has room to catch up with the rest of Asia. This is another important way to boost the region’s growth rates to counter the challenge of ageing populations.

Skills development is playing a positive role in boosting Asia’s productivity

Figure 11: US remains in pole position in human capital and productivity

Source: IMF, Penn World Tables, Standard Chartered Research
Productivity outlook – Capital

- Capital investment plays an important role in the early stages of development
- Capital stock per worker is low in China, India, the Philippines and Indonesia, meaning strong growth potential
- The quantity of capital stock is important, but so is the quality

The importance of ‘productive’ investment

In the early stages of economic development, capital investment is the major contributor to GDP growth (see Figure 12). Infrastructure plays a major role in enabling growth; this helps to explain why India’s growth rates have been much lower than China’s. There is a point, however, at which the intensity of capital within GDP starts to fall, even as income per-capita continues to rise; this is represented by the arc-shaped line in Figure 12. This can be seen as the point at which an economy shifts from capital-intensive manufacturing growth to services growth, which is far less capital-intensive. Also, by this stage of development, much of the major infrastructure has typically been built (roads and rail, for instance). China is still a long way from reaching this point, in our view.

A better-equipped workforce will be more productive. There is a clear positive correlation between the capital stock available to each worker and the productivity of the economy (Figure 13). Hence, capital investment is required for an economy to move to the next tier. In this respect, we see much more scope for investment in developing economies such as China, India, the Philippines and Indonesia. This also suggests that talk about over-investment in China may be too simplistic or overlook the country’s long-term needs. While there may be pockets of over-investment and overcapacity, many parts of China still require much more investment (see Figure 13).

Some countries appear to be better than others at utilising the amount of capital stock available. For example, the amount of capital stock available to workers in Taiwan is lower than that in Singapore and Hong Kong, but Taiwan’s productivity is higher than Singapore’s and Hong Kong’s (see Figure 13).

Figure 12: Less reliance on capital-fuelled growth as GDP per capita rises

Source: IMF, Penn World Tables, Standard Chartered Research

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**Capital investment is vital in boosting growth in the early stages of development**

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We believe that the productivity gap between Taiwan and other economies with similar productivity levels is explained by the type of capital stock in place. The quantity of capital stock is important, but so is the quality. Residential property investment may boost GDP in the short term, but longer-term, we believe other types of investment contribute more to productivity. We compare the productive investment-to-GDP ratios of economies in the region in Figure 17. We define investment in transport equipment, machinery, roads and factories as ‘productive’. For the purposes of this exercise, we define productive investment as gross fixed capital formation excluding residential investment.

It is difficult to obtain data showing the amount of productive capital stock available to each worker. GDP data across the countries is also not readily comparable. As such, we compute the ratio of the change in annual productive investment and the annual change in workers (1995=1). In Figure 14, Hong Kong and Singapore spend less on productive investment per year per worker than Korea and Taiwan. This supports the view that despite a lower amount of total capital stock, Taiwan’s productivity is higher partly because of the greater availability of productive capital stock. However, it does not explain the underperformance of South Korea’s productivity relative to other countries. This may be due to the weaker productivity performance of its services sector.

**Figure 13: More capital stock is a key enabler of productivity**

Source: IMF, Penn World Tables, Standard Chartered Research

**Figure 14: Hong Kong and Singapore lag in productive investment per worker**

Annual ratio of change in productive investment to change in workers (1995=1)

Source: CEIC, Standard Chartered Research
If investment in productive assets is a guide to future productivity trends, we see countries such as China, Indonesia, Thailand and Korea benefiting from recent increases in investment (see Figure 17 – a heatmap of the intensity of productive investment). China may have gotten ahead of itself in terms of investment recently, but it will require much more investment over the long term. We also see large scope for further productive investment in Indonesia and Thailand.

There is no exact level of manufacturing versus services that leads to stronger productivity (see Figure 18). This is because of the substantial disparity in productivity between sectors depending on the country. We believe that an industry exposed to competition is ultimately more likely to be more productive than one that is not. Using data from the Groningen Growth and Development Centre, we compute the simple average of labour productivity (latest as of 2005; we remove the top and bottom numbers) across industries (see Figures 15 and 16). While average productivity levels within the services sector appear similar, there are considerable disparities between labour productivity in each individual sector across the countries. For example, Hong Kong’s labour productivity in finance, insurance and real estate is significantly higher than that of South Korea.
We also compute labour productivity growth in each sector and take a simple average across the countries, discarding the top and bottom values. Outside services, manufacturing has the highest productivity growth, while construction has the lowest. We believe that the global nature of the manufacturing sector encourages competition, while construction is a locally oriented activity and typically has low productivity growth. Labour productivity appears to be very high in the utilities sector, but we believe this is due to the capital-intensive nature of the industry.

**Figure 17: Indonesia, Thailand, India and South Korea look more capital-equipped for stronger growth than Malaysia and the Philippines**

Heatmap – Ratio of productive investment to GDP in Asia; darker (lighter) shades indicate stronger (weaker) growth

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<td>17.4</td>
<td>15.7</td>
<td>16.9</td>
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<td>23.8</td>
<td>23.5</td>
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</table>

Source: CEIC, Standard Chartered Research

**Figure 18: Productivity typically rises with higher manufacturing input**

% of GDP by industry (y-axis); ranking of productivity index relative to US (2005=100)(x-axis)

Source: Penn World Tables, Standard Chartered Research
Reform and productivity growth

There is scope for structural reforms to support further productivity growth. We estimate that reforms could raise GDP growth by 1-3ppt, and boost GDP per capita in 2030 by an extra 20-50% (see Special Report, 10 October 2012, Economic reform: The unfinished agenda). Possible reasons for the slower pace of reform in recent years are complacency, the lack of a crisis resulting in heightened pressure to reform, bureaucracy and opposition to market-oriented reforms.

We think that economic reforms are likely to centre on two areas: infrastructure and the labour market. For economies such as India, Indonesia and the Philippines, the onus remains on building up infrastructure and logistics networks. In the Philippines, this will mean implementing energy-market reforms and more private-public partnership projects. The challenge is to create the necessary competitive environment to move these economies up the value chain across the manufacturing and services sectors, as Hong Kong, South Korea, Singapore and Taiwan did from 1970-2000. South Korea today faces the challenge of boosting services-sector productivity growth, which is negative – the majority of the country’s new jobs are being created in services as baby boomers age and shift into the sector.

In economies that already have infrastructure in place and higher productivity levels, labour-market reforms take on greater significance. As Japan’s labour force ages, for instance, it needs to draw increasingly on the female labour force, the ‘silver’ workforce of workers aged 60 and above, and non-regular workers.
FX – Valuation and productivity in EM – A reality check

In the context of our findings on EM productivity and of market volatility over the past 12 months, we take a detailed look at EM currency valuation, both on an absolute basis and relative to total factor productivity (TFP) trends. We acknowledge the limitations of currency valuation, which provides a medium-term reality check rather than short-term trading signals. Moreover, TFP – skills- or knowledge-based productivity – is a residual, depending on the validity of published data on output productivity. Notwithstanding these caveats, we think that comparing medium-term valuation with TFP trends is useful in determining economic competitiveness.

We start this process with the broad REERs for currencies in Asia, Africa and the Middle East (see Figure 19, as provided by the BIS). Relative to their 10-year averages, Asian currencies (including Japan) are around 2.4% overvalued on a REER basis on average. If we exclude Japan, AXJ currencies are around 4.3% overvalued on a REER basis. By comparison, a representative sample of African currencies (South Africa, Algeria) appears undervalued by just under 8%, and a similar representation for Middle East currencies (UAE, Saudi Arabia and Turkey) is roughly fairly valued. Looking at the regions on a Z-score basis suggests valuations are far from stretched. However, within this there are powerful individual currency stories that contradict this overall view.

Within Asia, the Chinese yuan (CNY) and Singapore dollar (SGD) REERs have the highest Z-scores, at +1.82 and +1.54, while the Japanese yen (JPY) and Indian rupee (INR) REERs have the lowest, at -1.93 and -1.65, respectively. On an index basis, the CNY REER (at 117.45) is 26.07% above its average since 1994, while the SGD REER (at 112.00) is 12.63% above its average since 1994. Similarly, the JPY REER is currently -27.72% relative to its average, while the INR REER is -6.16% relative to the average. On the face of it, this suggests that the CNY and SGD are overvalued on a REER basis, while the JPY and INR are similarly undervalued. However, we also take into account productivity – and particularly TFP – trends to determine the true extent of competitiveness losses or gains.

As Figure 20 shows, while the CNY REER looks very stretched, its appreciation continues to be matched by strong TFP gains. Unsurprisingly, the REER appreciated significantly during the GFC – when the CNY nominal effective exchange rate (NEER) appreciated significantly as trading-partner currencies fell against it. However, it continued to appreciate in the GFC’s aftermath to multi-year highs as of 2013. More positively, TFP has also continued to hit new highs, somewhat reducing valuation concerns. To provide context, the CNY NEER (112.64) is 21.90% above its average since 1994. However, it has fallen by 2.57% since the end of January, bringing it back to only just above the average since January 2013 of 112.37.

Elsewhere in AXJ, we see the most compelling stories in Korea, India, Indonesia and Thailand. In Korea, the good news is that the KRW still looks mildly undervalued – as the IMF recently commented. The KRW REER, at 108.00, is 1.26% below the average since 1994. On a purchasing power parity (PPP) basis, the latest OECD data suggests that the KRW is 23.06% undervalued against the US dollar (USD). However, the productivity chart shows that TFP gains have stalled. While this is not an issue for the time being, it would become one if the KRW NEERs and REERs extended significantly above their average rates.
In Indonesia, there appears to be a relatively low correlation between the IDR REER and TFP. On the negative side, TFP gains appear modest. More positively, the IDR REER (88.77) is basically aligned with the average (88.49) since 1994. India’s valuation/productivity story is compelling. For a start, the INR REER (86.45) is 6.16% below its average since 1994 and 8.97% below the 10-year average. Second, TFP continues to increase at the same time as the INR is undervalued. This strongly supports the case for an INR rebound. We also see a positive story in Thailand, where REER gains have been supported by rising TFP.

In the G10, the USD remains undervalued on a REER basis, despite very strong TFP gains. At 98.65, the USD REER (BIS broad) is 8.89% below the average since 1994 and 4.5% below the average since 2004. The strength of TFP in the US economy appears to support a significantly stronger REER, which (in the absence of inflation) would likely be driven by NEER appreciation. Finally, the JPY is now clearly undervalued on a REER basis. At 75.95, the JPY REER is 27.72% below its average since 1994 and 19.50% below its average since 2004. While TFP stalled in the 2000s, it has rebounded sharply since 2012 – a positive effect of ‘Abenomics.’
Asia’s productivity: The new story

Figure 21: USD undervalued despite productivity gains

Figure 22: JPY is now undervalued on a REER basis

Figure 23: Productivity gains have stalled in South Korea

Figure 24: Low correlation between productivity and REER in Indonesia

Figure 25: INR undervalued on a REER basis compared with gains in productivity

Figure 26: Currency gains associated with rise in productivity in Thailand

Source: BIS, Penn World Tables, Standard Chartered Research
Methodology

For this report, we derive most of our data from the Penn World Tables (PWT) version 8.0. PWT 8.0 provides information on relative levels of income, output (including GDP), inputs (such as employed labour and capital stock) and productivity, covering 167 countries between 1950 and 2011. We estimate 2012-13 data by adding country data to PWT 8.0.

The report uses PWT 8.0’s definition and methodology for productivity. Productivity is a “measure of output divided by a measure of input”. We note the difference between the definitions of total factor productivity (TFP) and labour productivity adopted by PWT 8.0. TFP is a variable that accounts for effects in total output not caused by labour and capital inputs, while labour productivity is the amount of goods and services that a unit of labour produces. PWT 8.0 uses the Törnqvist quantity index of factor of inputs to estimate productivity growth, as follows:

\[
GDP \text{ growth} = \text{ Productivity growth} + \text{ Capital stock growth (adjusted by change in capital share)} + \text{ Labour force growth (adjusted by change in labour share)} + \text{ Human capital growth (adjusted by change in labour share)}
\]

We calculate GDP and productivity growth statistics from the following variables:

- Capital stock: Capital stock at constant 2005 national prices (USD mn)
- Labour force growth: Number of persons engaged
- Human capital: Index of human capital per person, based on years of schooling and returns on education
- Productivity: TFP at constant national prices
- Share of labour compensation at current national prices
- GDP: Real GDP at constant 2005 national prices (USD mn)

According to PWT 8.0, capital stocks are estimated based on cumulating and depreciating past investments using the perpetual inventory method. PWT 8.0 provides different geometric depreciation rates for different assets (2% for structures, 18.9% for transport equipment, 11.5% for communication equipment, 12.6% for other machinery and assets, and 31.5% each for computers and software). Methodologies vary across economies due to data quality and availability. Initial capital stocks are traced back to 1950 where possible to estimate current capital stock levels.

Human capital is estimated using years of schooling and returns to education. PWT 8.0 uses the Psacharopoulos (1994) methodology for rates of returns on education, which has a higher return on early years of education than the later years.

For the share of labour, PWT 8.0 provides a ‘best estimate’ by gauging the labour share of self-employed workers in agriculture. In lower-income economies, more people are self-employed, which compensates for the lower labour share in these economies.

We estimate relative productivity levels that are comparable across time and economies (US productivity = 100 in 2005) from the following variables:

- Productivity: TFP level at current PPPs (US=1)
- US TFP at constant national prices (2005=1)

For more information about the detailed methodology, please refer to ‘Capital, labour and TFP in PWT8.0’.
Appendix

Figure 27: China
Ppt contributions to GDP growth

Figure 28: Hong Kong
Ppt contributions to GDP growth

Figure 29: India
Ppt contributions to GDP growth

Figure 30: Indonesia
Ppt contributions to GDP growth

Figure 31: Malaysia
Ppt contributions to GDP growth

Figure 32: The Philippines
Ppt contributions to GDP growth

Source: Penn World Tables, Standard Chartered Research

Source: Penn World Tables, Standard Chartered Research
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Figure 33: Singapore
Ppt contributions to GDP growth

Source: Penn World Tables, Standard Chartered Research

Figure 34: South Korea
Ppt contributions to GDP growth

Source: Penn World Tables, Standard Chartered Research

Figure 35: Taiwan
Ppt contributions to GDP growth

Source: Penn World Tables, Standard Chartered Research

Figure 36: Thailand
Ppt contributions to GDP growth

Source: Penn World Tables, Standard Chartered Research

Figure 37: Australia
Ppt contributions to GDP growth

Source: Penn World Tables, Standard Chartered Research

Figure 38: Japan
Ppt contributions to GDP growth

Source: Penn World Tables, Standard Chartered Research
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Figure 39: Positive productivity growth in Asia since 2000, stronger track record across the board
Average annual ppt contribution to GDP growth from productivity (TFP), by decade

Figure 40: A better performance in Asia during the 2000s, after a mixed 1980s and 1990s
Average percentage contribution to GDP growth from productivity, by decade

Figure 41: Capital growth remains the largest contributor to growth in Asia
Average annual ppt contribution to GDP growth from physical capital, by decade

Source: World Penn Tables, Standard Chartered Research
Figure 42: China and South Korea have been relatively capital-driven
Average percentage contribution to GDP growth from physical capital, by decade

Figure 43: Human capital development remains an important component of GDP growth
Average annual ppt contribution to GDP growth from human capital, by decade

Figure 44: Japan, Thailand and Taiwan rely heavily on human capital growth for GDP growth
Average percentage contribution to GDP growth from human capital, by decade

Source: World Penn Tables, Standard Chartered Research
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**Figure 45:** Asia relies on labour growth to some extent
*Average annual ppt contribution to GDP growth from labour, by decade*

Source: World Penn Tables, Standard Chartered Research

**Figure 46:** Japan’s shrinking labour force has become a major drag on GDP growth
*Average percentage contribution to GDP growth from labour, by decade*

Source: World Penn Tables, Standard Chartered Research
Figure 47: Asia productivity growth

_GDP-weighted, %_

Asia refers to China, Hong Kong, Indonesia, South Korea, Malaysia, Philippines, Singapore, Taiwan, Thailand;
Source: IMF, Penn World Tables, Standard Chartered Research

Figure 48: Asia ex-Japan and China (AXJC) productivity growth

_GDP-weighted, %_

Source: IMF, Penn World Tables, Standard Chartered Research
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Feenstra, Robert C., Robert Inklaar and Marcel P. Timmer (2013), ‘The Next Generation of the Penn World Table’, available for download at www.ggdc.net/pwt

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Groningen Growth and Development Centre – 10-Sector Database
Disclosures Appendix

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