Potential Output in Asia: Some Forward-Looking Scenarios

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This paper presents estimates of potential output growth for a sample of 26 Asian economies and projects potential output growth through 2040 under several scenarios. Results suggest that in the absence of further capital deepening, and assuming continued total factor productivity growth at recent rates, potential output growth across economies could slow from a median of 4.6% during 2010–2015 to 2.7% between 2035 and 2040. Demographic trends and an assumed stabilization in capital–output ratios account for most of the slowing. Much better outcomes are possible if trends are supported by policy. Better total factor productivity growth could raise potential output by between 11% and 24% by 2040, while lower unemployment and higher participation rates could boost potential output by 10% or more in some South Asian economies. An improved investment climate could add between 6% and 10% to potential output in most economies, while accelerating structural convergence (moving labor from lower to higher productivity sectors) could raise potential output by 10% or more in half of the examined countries.

Keywords: cross-economy growth comparisons, potential output, total factor productivity, sectoral change

JEL codes: E17, O11, 047

I. Introduction

Potential output is a key concept in macroeconomics, but one whose measurement is fraught with uncertainty mainly because (like many other economic notions) it is not directly observable. Nor is the concept itself unambiguous. Some authors speak of potential as the level of activity that would be observed if all constraints were removed. In a developing economy context, this could be the level that might be observed if the capital stock, skills of the population, and economic institutions were on the par with the best-performing high-income economies. More commonly, potential is used to reflect a level of activity consistent with the full

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utilization of existing resources given the existing institutions and technology of an economy. Even with this definition, there are many different approaches that can be taken to identify the unobservable true level of potential output. Common identification strategies include

(i) equating potential output as the level of output consistent with a statistically average growth rate of output (e.g., Hodrick–Prescott or Kalman filters, and other frequency or time-domain filters);

(ii) using nonaccelerating inflation as an indicator of potential (see, for example, Lanzafame 2016); and

(iii) using a notion of full utilization of the factors of production at trend levels of factor productivity to identify potential output (as this paper does).

II. Methodology

The estimates of potential output presented here are based on the production function approach similar to that used by, among others, the World Bank in its Macro-Fiscal Model (World Bank 2016b); the United States (US) Congressional Budget Office (Congressional Budget Office 2001); the Organisation for Economic Co-operation and Development (Beffy et al. 2006); the European Commission (Economic Policy Commission 2001, D’Auria et al. 2010, Denis et al. 2006); and the US Federal Reserve in its Federal Reserve Board model (Brayton, Laubach, and Reifschneider 2014). In this approach, the supply side of gross domestic product (GDP) is described by a simple Cobb–Douglas function of the form given below:\(^1\)

\[
GDP_t = TFP_t K_t^\alpha L_t^{1-\alpha}
\]

where GDP is gross domestic product, \(K\) is the capital stock, \(L\) is labor employed, \(TFP\) represents total factor productivity (TFP), \(\alpha\) is the income share of capital (assumed to be 0.3), and the subscript \(t\) denotes time.\(^2\) This paper’s measure of labor differs from that of Burns et al. (2014) by using labor market data (labor force participation, sectoral employment, and unemployment) produced by the

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\(^1\)There exist variants of this form. For example, the Federal Reserve Board model includes trend energy services as an independent factor of production.

\(^2\)Data appear to support the use of the Cobb–Douglas production function. In this paper, an economy-by-economy estimation of a constant elasticity of substitution function yields a mean elasticity of substitution of 0.95. For a sample of 157 developing economies, the mean freely estimated capital share is 0.4, with the modal value lying between 0.23 and 0.34. For the Asian subsample, the mean freely estimated capital share is 0.55.
International Labour Organization to measure labor inputs.\textsuperscript{3} Burns et al. (2014) and other earlier work used the working-age population as an alternative proxy. It is recognized that the labor market data capture labor market behavior imperfectly, especially in economies characterized by a sizable informal labor sector.

Equation (1) can be rewritten by expressing employment $L$ as the product of the working-age population, $P_{1564}$; the labor force participation rate, $Pr$; and 1 minus the unemployment rate, $UNR$, or employment as a percentage of the labor force; which gives

$$GDP_t = TFP_t \cdot K_t^\alpha \cdot (P_{1564,t} \cdot Pr_t \cdot (1 - UNR_t))^{1-\alpha}$$ (2)

The above decomposition is widely used in macroeconomic analysis because it is simple, intuitive, and lends itself to straightforward interpretation. However, its application to developing economies is complicated by data limitations. While the majority of economies publish time series of GDP and the size of the working-age population, data on the capital stock are not widely available and labor market data (labor force participation and unemployment) are often not measured. When measured, labor market data are often ill-defined in economies characterized by widespread informal employment and subsistence agriculture.\textsuperscript{4} The following discussion describes how these limitations have been dealt with in this paper.

\section*{A. Estimating the Capital Stock}

Most developing economies do not have official estimates of their capital stock. This shortcoming is overcome by estimating the capital stock using a highly simplified version of the perpetual inventory method from investment data, dating back to 1960 in many cases, and assuming a depreciation rate of 7\%.\textsuperscript{5} The same basic methodology was employed for estimating capital stocks in developing economies by Nehru and Dhareshwar (1993) and is used by the Organisation for Economic

\textsuperscript{3}The International Labour Organization data set is derived from economy-level sources but data for some years and economies contain gaps (International Labour Organization 2011). Missing data are estimated by various methods. Even when data are derived directly from well-defined surveys, the surveys are not always comparable across economies.

\textsuperscript{4}GDP and investment data are sourced from the World Bank’s Macro-Fiscal Model (World Bank 2016b), which in turn relies on World Development Indicators as a primary source and is supplemented by the International Monetary Fund’s World Economic Outlook database and national source data. Population data are sourced from the World Development Indicators and United Nations (2015) population forecasts are spliced on for the forecast period.

\textsuperscript{5}The Organisation for Economic Co-operation and Development (2001) provides a comprehensive manual of methods for calculating the capital stock, mainly relying on disaggregated sectoral investment data, sectoral differentiation in depreciation rates, and a careful accounting of the cohort structure of the capital stock while also accounting for price changes in the capital stock. The method employed here assumes the same depreciation rate for all forms of capital and abstracts from the obsolescence implied by relative price changes over time. See Wolf (1997) for an exposition of simplified capital stock calculations that are nevertheless much more sophisticated than the procedure employed here.
Co-operation and Development in its Interlink Model for economies where the statistical agency does not produce an independent measure of the capital stock.

Using this methodology, a capital stock series, $K_i$, is generated for each economy using the following capital accumulation equation, where $i$ denotes the initial estimate:

$$K_{i,t} = K_{i,t-1} (1 - \delta) + Inv_t$$

(3)

Because at the starting point ($t = 0$) the capital stock is zero, this method underestimates the capital stock in early years. To get around this problem, a two-step procedure is employed. An initial estimate of an economy’s capital stock is calculated and then divided by GDP to derive a preliminary estimate of the capital–output ratio for each economy. Taking this initial estimate of the capital stock after 15 years, $K_i(15)$, and dividing by GDP in the same year ($t = 15$), gives an estimate of the economy’s steady-state capital–output ratio. In the second step, this estimate of the capital–output ratio in $t = 15$ is multiplied by GDP in $t = 0$ to derive a nonzero starting point for the capital stock of each economy as shown in equation (4). The capital stock for $t = 1 \ldots n$ was then recalculated using equation (3), resulting in a much more accurate estimate of the capital stock:

$$K(0) = GDP(0) \frac{K_i(15)}{GDP_i(15)}$$

(4)

B. Accounting for the Influence of Structural Change

After accounting for labor and capital, the unexplained part of GDP is TFP. An expression for TFP can be obtained after rewriting equation (1) as the product of output per worker and the capital–labor ratio raised to the labor share:

$$GDP = TFPK^\alpha L^{1-\alpha}$$

(1')

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6 Arnaud et al. (2011) cite an alternative method following Kohli (1982) that sets the initial capital stock equal to the level of investment in $t = 0$ and divides by the depreciation rate plus the long-run growth rate of investment.

7 In a steady-state model with a 7% annual depreciation rate, 85% of the initial capital, $Inv(t = 0)$, will have depreciated after 25 years and the initial estimate of the capital stock will be 92% of the actual. After 15 years, the capital stock will have reached 80% of its long-term equilibrium level. Mathematically, the amount of the capital stock that existed at $t = 0$ will equal $K_0 t = K_0 * 0.93^t$ at any given time $t$.

8 To deal with outliers, if the estimated capital–output ratio for an economy fell outside the 25th and 75th percentiles of its income cohort, the estimated capital–output ratio was set equal to either the 25th or 75th percentile level.

9 Assuming a steady-state model with 3% GDP growth per annum, the error in estimation of the capital stock would be 8% in year 0, 3.2% in year 10, and less than 1% in year 25. Of course, in most developing economies, GDP growth and investment rates have accelerated significantly over the past 20 years, suggesting that the actual estimation error is significantly smaller than suggested by the steady-state model.
\[ TFP = \frac{GDP}{K^\alpha L^{1-\alpha}} \]
\[ TFP_t = \frac{GDP_t}{L_t} \left[ \frac{K_t}{L_t} \right]^{-\alpha} \]  
\[ (5) \]

Output per worker can be decomposed as the change in sectoral output per worker \( (w_i) \) and the change in the share of workers in each sector \( (s_i) \):

\[ w_t = \frac{GDP_t}{L_t} \]
\[ w_t = \sum_i^n \frac{GDP_{i,t}}{L_{i,t}} \frac{L_{i,t}}{\sum L_{i,t}} \]
\[ w_t = \sum_i^n w_i * s_i \]

\[ \Delta w_t = \sum_i^n \Delta w_i \left[ \left( \frac{s_i}{L} + \left( \frac{s_i}{L_{t-1}} \right) \right) / 2 \right] + \sum_i^n \Delta s_i \left[ \left( \frac{w_i}{w} + \left( \frac{w_i}{w_{t-1}} \right) \right) / 2 \right] \]

Expressing the two terms in the above expression as \( \Delta w w \) (change in within-sector output per worker) and \( \Delta w b \), the change in the relative size of the sectors gives

\[ \Delta w = \Delta w w + \Delta w b \]

\( w B_t \) can then be defined as the cumulative summation of earlier changes in a sector’s influence on output per worker:

\[ w B_t = \sum_{i=0}^t \Delta w b \]

And equation (5) above can be rewritten as

\[ \frac{GDP}{L_t} - w B_t = TFP_t \left[ \frac{K}{L} \right]^{1-\alpha} \]  
\[ (6) \]

Rewriting (6) gives a new expression for output as a function of TFP net of structural change, labor supply, and structural change:

\[ GDP_t = TFP_t K^\alpha L_t^{1-\alpha} + w B_t * L_t \]  
\[ (7) \]
C. **Estimating Trend Productivity Growth**

After the capital stock and the contribution of structural change to the evolution of output per worker have been estimated, TFP net of structural change over time can be quantified by rearranging the production function shown in equation (6) and solving for $\overline{TFP}_t$ as a residual:

$$\overline{TFP}_t = \frac{GDP_t}{K_t^\alpha (P_{1564,t} \cdot Pr_t \cdot (1 - UNR_t))^{1-\alpha} + w_B * L_t}$$

Trend net TFP, $\overline{TFP}_t^*$, which is necessary to estimate potential output, can be calculated using the Hodrick–Prescott filter through the spot estimate of $\overline{TFP}_t$. The endpoint problem (Mise, Kim, and Newbold 2005) is resolved by assuming that for each economy, TFP growth from the endpoint of actual data through 2040 is equal to the economy’s average rate of growth of $\overline{TFP}_t$ during the period 1995–2015 (or 2014 where 2015 data are not yet available).\(^\text{10}\)

D. **Calculating Potential Output**

Assuming that (i) the labor force is fully employed ($UNR$ and $Pr$ are at their equilibrium values of $UNR^*$ and $Pr^*$ such that $L_t^* = P_{1564,t} Pr_t^* UNR_t^*$), (ii) all of the services of the available capital stock are used, and (iii) TFP net of structural change is at a level consistent with its long-term trend, $\overline{TFP}_t^*$, gives an expression for the growth rate of potential $GDP_t^*$.

Unlike labor, there is no separate estimate of the value of the capital stock at full employment because the relevant input here is capital services, which at full utilization rates are the services from the total capital stock raised to the power $\alpha$:

$$GDP_t^* = \overline{TFP}_t^* K_t^\alpha L_t^{*1-\alpha} + w_B * L_t^*$$

Armed with actual GDP and the estimate of potential GDP, $GDP_t^*$, it is possible to calculate the output gap, $OG_t$, which is defined as the percentage difference between the actual output observed and the estimated potential output:

$$OG_t = \frac{GDP_t - GDP_t^*}{GDP_t^*} * 100$$

\(^\text{10}\)Historical data for GDP in 2015 were not available for all economies. For those economies where such data were unavailable, trend TFP growth was calculated using data for the period 2000–2014.

\(^\text{11}\)The equilibrium unemployment rate and participation rate are estimated using the Hodrick–Prescott filter, assuming that future levels of these variables are equal to their average level in 2000–2015.
If actual output rises above its potential (positive output gap), then capacity constraints begin to bind and one would expect to see inflationary pressures build and also perhaps an increase in the current account deficit. On the other hand, if the output gap is negative, resources are underutilized and inflationary pressures subside. Normally, actual GDP growth will fluctuate around its estimated potential growth path.

III. Baseline Results

Using the methodology described above, Table 1 reports historical growth rates and estimates of potential output growth, TFP growth, the natural rate of unemployment, and the natural labor force participation rate for 23 Asian economies. Due to data limitations, labor’s share of income in output is assumed to be 70% for all economies, the rate of depreciation of capital is 7%, and a relatively tight smoothing parameter (lambda equals 100) is used for the Hodrick–Prescott filter when calculating both the natural rates of unemployment and trend TFP.12 Burns et al. (2014) report sensitivity analysis for alternative assumptions regarding labor’s share of income in output (30%, 50%, and 70%); the capital depreciation rate (6%, 7%, and 8%); and different levels for the TFP smoothing parameter lambda. While historical estimates are impacted by the different assumptions, the extent of the influence is small.

A. Historical Trends

For the region as a whole, potential output growth per annum has accelerated markedly from around 4.1% in the early 1990s to around 5% in the 2000s, before easing somewhat during the first half of the 2010s (Figure 1).13 Excluding the People’s Republic of China (PRC), where potential output growth has been relatively stable until recently, the acceleration is less evident and potential output grows at just under 3% per annum, which is more or less the same rate as just before the 1997/98 Asian financial crisis.

Notwithstanding frequent concerns voiced in the international press about the slowing of developing economy growth after the recent global financial crisis,

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12Ravn and Uhlig (2002) show that a lambda value of 6.25 for annual data is consistent with a value of lambda of 1,600 as first proposed by Hodrick and Prescott for quarterly data. However, they do not show that 1,600 is the appropriate value for quarterly data. That value was proposed originally on the basis of the somewhat arbitrary assumption that “a 5% cyclical component is moderately large, as is a one-eighth of 1% change in the growth rate.” An equally arbitrary but plausible assumption about the influence of the cycle on quarterly growth of 0.5, for example, would result in a quarterly lambda of 25,600, which in the Ravn–Uhlig methodology would give rise to an annual lambda of 100, which is the number used by the European Commission (Economic Policy Commission 2001).

13Most tables and figures presented in this report are focused on the period after 1990 because labor market data necessary for the structural change decomposition are only available in the post-1990 period. However, the TFP (inclusive of structural change) and potential output calculations themselves are not dependent on this decomposition. As a result, calculations of TFP inclusive of structural change and potential output data are available as far back as 1970 for many economies.
potential output grew faster during the postcrisis period (2009–2014) than in the preboom period (1993–1998) in 13 of the 23 Asian economies for which sufficient data exist (Table 1a). Overall, the contribution from capital accumulation and TFP growth on potential output, excluding the PRC, has increased over time, while the contribution of labor to growth has declined in most of the economies covered. The largest accelerations were observed in the economies of the former Soviet Union, many of which underwent profound structural adjustments and reform in the 1990s that set the groundwork for stronger growth in the 2000s.

Table 1a groups the 13 economies in which potential output growth in the most recent 5-year period (2009–2014) was higher than during the 1990s by their most important source of acceleration. Of these economies, only Kazakhstan saw labor force growth as the largest contributor to the acceleration in potential output growth. Although labor was the largest contributor to the acceleration in Kazakhstan, the contribution that labor made to the acceleration of growth in Georgia was actually larger. However, Georgia is not included in this group of economies because the contribution of capital to the acceleration in its potential output growth was even larger. In addition to Georgia, accelerated capital deepening was also the largest driver of improved potential output in Mongolia and Papua New Guinea, likely reflecting a boost in resource-related investment associated with the commodity boom. As global commodity prices have eased and are expected to remain low for some time (World Bank 2016a), it is unlikely that these economies’ strong capital deepening will be sustained over the medium term.

Improved TFP growth (net of structural change) was the largest contributor to accelerating potential output growth in Bangladesh, India, Indonesia, Pakistan, the Philippines, Solomon Islands, and Sri Lanka. Importantly, TFP is growing strongly (close to 2% or more per annum) in all of these economies except Pakistan. Continued TFP growth, and therefore a sustained acceleration of potential output in

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**Figure 1. Asia’s Potential Output Growth**

![Graph showing potential output growth in Asia](image)

PRC = People’s Republic of China.
Source: Author’s calculations.
Table 1a. **Countries with Improved Potential Output Growth between 2009–2014 and 1993–1998**

| Countries where stronger employment growth explains most of the acceleration between the 1993–1998 and 2009–2014 periods |
|---|
| **Kazakhstan** |
| 1993–1998 | −0.7 | −0.7 | −1.4 | 1.8 | −0.4 |
| 1998–2003 | 6.0 | 0.6 | −1.2 | 5.3 | 1.3 |
| 2003–2008 | 7.7 | 1.5 | 0.3 | 4.6 | 1.3 |
| 2009–2014 | 5.2 | 1.0 | 0.9 | 2.5 | 0.8 |
| Change 2009–2014 | 5.9 | 1.6 | 2.3 | 0.8 | 1.2 |
| Countries where stronger capital accumulation explains most of the acceleration between the 1993–1998 and 2009–2014 periods |
|---|
| **Georgia** |
| 1993–1998 | 1.5 | −1.4 | −1.4 | 2.6 | 1.7 |
| 1998–2003 | 3.9 | −0.4 | −0.4 | 6.2 | −1.4 |
| 2003–2008 | 7.4 | 0.5 | 0.3 | 4.9 | 1.7 |
| 2009–2014 | 4.8 | 0.4 | 0.8 | 2.0 | 1.6 |
| Change 2009–2014 | 3.3 | 1.8 | 2.3 | −0.6 | −0.1 |
| **Mongolia** |
| 1993–1998 | 2.6 | 1.4 | 0.2 | 1.8 | −0.9 |
| 1998–2003 | 5.1 | 2.0 | 0.2 | 2.1 | 0.9 |
| 2003–2008 | 8.0 | 1.9 | 1.2 | 3.0 | 1.9 |
| 2009–2014 | 8.6 | 1.3 | 2.4 | 3.7 | 1.2 |
| Change 2009–2014 | 6.0 | −0.1 | 2.1 | 1.9 | 2.0 |
| **Papua New Guinea** |
| 1993–1998 | 2.3 | 2.1 | 0.1 | −0.1 | 0.1 |
| 1998–2003 | 1.2 | 2.0 | 0.6 | −1.4 | 0.0 |
| 2003–2008 | 3.2 | 1.9 | 0.6 | 0.1 | 0.7 |
| 2009–2014 | 9.6 | 1.9 | 3.8 | 2.0 | 1.9 |
| Change 2009–2014 | 7.3 | −0.2 | 3.6 | 2.1 | 1.8 |

Continued.
### Countries where stronger TFP growth explains most of the acceleration between the 1993–1998 and 2009–2014 periods

| Countries          | Contribution to Potential Growth | Structural Change | Contribution to Potential Growth | Structural Change |
|--------------------|----------------------------------|-------------------|----------------------------------|-------------------|
| Bangladesh 1993–1998 | 4.6 1.9 2.2 0.1 0.3              | 1993–1998         | 4.4 1.6 2.8 −0.8 0.8            |
| Bangladesh 1998–2003 | 6.1 1.7 2.3 −0.3 2.4             | 1998–2003         | 2.8 1.2 0.8 0.5 0.2             |
| Bangladesh 2003–2008 | 5.3 1.3 2.4 1.0 0.6              | 2003–2008         | 5.5 1.2 1.5 2.0 0.8             |
| Bangladesh 2009–2014 | 6.2 1.3 2.5 1.9 0.4              | 2009–2014         | 5.8 1.2 1.9 2.2 0.5             |
| Change 2009–2014 | 1.6 −0.6 0.4 1.7 0.1             | Change 2009–2014 | 1.4 −0.4 −0.9 3.0 −0.3         |
| India 1993–1998    | 6.1 1.6 1.9 2.3 0.3              | 1993–1998         | 3.6 2.1 1.2 0.1 0.2             |
| India 1998–2003    | 6.1 1.4 2.0 2.2 0.6              | 1998–2003         | 4.3 2.4 0.7 0.4 0.8             |
| India 2003–2008    | 8.1 1.1 3.1 2.9 1.0              | 2003–2008         | 3.8 2.4 1.0 0.6 −0.2            |
| India 2009–2014    | 7.7 0.9 2.6 3.2 1.0              | 2009–2014         | 3.8 2.1 0.5 0.8 0.4             |
| Change 2009–2014 | 1.6 −0.7 0.7 0.8 0.7             | Change 2009–2014 | 0.2 0.0 −0.7 0.7 0.3           |
| Philippines 1993–1998 | 4.8 1.8 1.2 0.6 1.2           | 1993–1998         | 4.1 1.5 1.6 1.2 −0.2           |
| Philippines 1998–2003 | 3.7 1.7 0.6 1.3 0.1           | 1998–2003         | 4.7 0.8 1.5 1.4 1.1           |
| Philippines 2003–2008 | 4.5 1.7 0.8 2.1 −0.1          | 2003–2008         | 6.0 0.9 2.1 2.9 0.1          |
| Philippines 2009–2014 | 5.9 1.6 1.3 2.3 0.8           | 2009–2014         | 6.4 −0.1 2.4 4.1 0.0          |
| Change 2009–2014 | 1.1 −0.3 0.1 1.7 −0.4           | Change 2009–2014 | 2.3 −1.6 0.8 2.9 0.2         |

Continued.
Table 1a.  
Continued.

| Countries where structural change explains most of the acceleration between the 1993–1998 and 2009–2014 periods | Potential Growth Change 2009–2014 | Contribution to Potential Growth | Structural Change |
|---|---|---|---|
| Countries where structural change explains most of the acceleration between the 1993–1998 and 2009–2014 periods | | | |
| Azerbaijan | 1.1 | 1.0 | 1.6 | −0.7 | −0.8 | 1993–1998 | 6.3 | 1.6 | 3.1 | 0.9 | 0.6 |
| 1998–2003 | 11.3 | 1.4 | 5.2 | 4.0 | 0.7 | 1998–2003 | 6.0 | 1.5 | 4.1 | 0.3 | 0.1 |
| 2003–2008 | 14.5 | 2.1 | 5.3 | 5.9 | 1.2 | 2003–2008 | 8.3 | 1.9 | 5.4 | 0.0 | 1.0 |
| 2009–2014 | 6.6 | 1.5 | 2.1 | 1.3 | 1.6 | 2009–2014 | 7.6 | 1.7 | 3.3 | 0.5 | 2.0 |
| Change 2009–2014 | 5.5 | 0.6 | 0.6 | 2.0 | 2.4 | Change 2009–2014 | 1.3 | 0.1 | 0.2 | −0.4 | 1.4 |
| less 1993–1998 | | | | | | less 1993–1998 | | | | | |
| Lao People's Democratic Republic | 1993–1998 | 3.7 | 1.9 | 0.5 | 1.2 | 0.0 | 1993–1998 | 2.1 | 2.5 | 1.2 | −1.9 | 0.3 |
| 1998–2003 | 4.5 | 1.8 | 0.2 | 3.0 | −0.4 | 1998–2003 | −1.6 | 2.2 | −0.1 | −3.3 | −0.4 |
| 2003–2008 | 5.4 | 1.8 | 1.2 | 3.3 | −0.9 | 2003–2008 | 3.8 | 1.8 | 2.5 | −1.0 | 0.5 |
| 2009–2014 | 6.5 | 1.9 | 1.0 | 1.7 | 1.9 | 2009–2014 | 4.9 | 1.7 | 2.5 | 0.6 | 0.1 |
| Change 2009–2014 | 2.8 | 0.0 | 0.5 | 0.4 | 1.9 | Change 2009–2014 | 2.9 | −0.8 | 1.4 | 2.5 | −0.2 |
| less 1993–1998 | | | | | | less 1993–1998 | | | | | |
| Nigeria | 1993–1998 | 1998–2003 | 2003–2008 | 2009–2014 | Change 2009–2014 |
| 1993–1998 | 3.7 | 1.9 | 0.5 | 1.2 | 0.0 | 1993–1998 | 2.1 | 2.5 | 1.2 | −1.9 | 0.3 |
| 1998–2003 | 4.5 | 1.8 | 0.2 | 3.0 | −0.4 | 1998–2003 | −1.6 | 2.2 | −0.1 | −3.3 | −0.4 |
| 2003–2008 | 5.4 | 1.8 | 1.2 | 3.3 | −0.9 | 2003–2008 | 3.8 | 1.8 | 2.5 | −1.0 | 0.5 |
| 2009–2014 | 6.5 | 1.9 | 1.0 | 1.7 | 1.9 | 2009–2014 | 4.9 | 1.7 | 2.5 | 0.6 | 0.1 |
| Change 2009–2014 | 2.8 | 0.0 | 0.5 | 0.4 | 1.9 | Change 2009–2014 | 2.9 | −0.8 | 1.4 | 2.5 | −0.2 |
| less 1993–1998 | | | | | | less 1993–1998 | | | | | |

TFP = total factor productivity.
Source: Author's calculation.
Table 1b. Countries with Slower Potential Output Growth between 2009–2014 and 1993–1998

| Countries where weaker employment growth explains most of the slowdown between the 1993–1998 and 2009–2014 periods |
|--------------------------------------------------|--------------------------------------------------|
| **New Zealand**                                   |                                                 |
| 1993–1998                                        | 3.4                                              |
| 1998–2003                                        | 3.2                                              |
| 2003–2008                                        | 3.0                                              |
| 2009–2014                                        | 2.1                                              |
| Change 2009–2014 less 1993–1998                  | −1.3                                             |
|                                                 | −0.7                                             |
|                                                 | −0.3                                             |
|                                                 | 0.0                                              |

| Countries where weaker capital accumulation explains most of the slowdown between the 1993–1998 and 2009–2014 periods |
|--------------------------------------------------|--------------------------------------------------|
| **Japan**                                        |                                                 |
| 1993–1998                                        | 1.4                                              |
| 1998–2003                                        | 1.0                                              |
| 2003–2008                                        | 0.8                                              |
| 2009–2014                                        | 0.5                                              |
| Change 2009–2014 less 1993–1998                  | −0.9                                             |
|                                                 | −0.7                                             |
|                                                 | −0.9                                             |
|                                                 | 0.2                                              |

| **Republic of Korea**                            |                                                 |
| 1993–1998                                        | 6.0                                              |
| 1998–2003                                        | 5.1                                              |
| 2003–2008                                        | 3.7                                              |
| 2009–2014                                        | 3.4                                              |
| Change 2009–2014 less 1993–1998                  | −2.7                                             |
|                                                 | −0.4                                             |
|                                                 | −2.0                                             |
|                                                 | −1.7                                             |

| **Malaysia**                                     |                                                 |
| 1993–1998                                        | 7.0                                              |
| 1998–2003                                        | 4.7                                              |
| 2003–2008                                        | 4.7                                              |
| 2009–2014                                        | 5.2                                              |
| Change 2009–2014 less 1993–1998                  | −1.8                                             |
|                                                 | −0.7                                             |
|                                                 | −2.0                                             |
|                                                 | 0.2                                              |

| **Singapore**                                    |                                                 |
| 1993–1998                                        | 7.5                                              |
| 1998–2003                                        | 4.7                                              |
| 2003–2008                                        | 6.1                                              |
| 2009–2014                                        | 4.8                                              |
| Change 2009–2014 less 1993–1998                  | −2.7                                             |
|                                                 | −0.8                                             |
|                                                 | −1.2                                             |
|                                                 | −0.6                                             |

| **Armenia**                                      |                                                 |
| 1993–1998                                        | 7.7                                              |
| 1998–2003                                        | 9.1                                              |
| 2003–2008                                        | 7.8                                              |
| 2009–2014                                        | 3.1                                              |
| Change 2009–2014 less 1993–1998                  | −4.6                                             |
|                                                 | 2.7                                              |
|                                                 | 1.6                                              |
|                                                 | −6.6                                             |
|                                                 | −2.4                                             |

| **Australia**                                    |                                                 |
| 1993–1998                                        | 3.3                                              |
| 1998–2003                                        | 3.4                                              |
| 2003–2008                                        | 3.2                                              |
| 2009–2014                                        | 2.9                                              |
| Change 2009–2014 less 1993–1998                  | −0.4                                             |
|                                                 | 0.0                                              |
|                                                 | 0.4                                              |
|                                                 | −1.0                                             |
|                                                 | 0.2                                              |

Continued.
Table 1b. Continued.

| Countries where weaker productivity growth explains most of the slowdown between the 1993–1998 and 2009–2014 periods |
|---------------------------------------------------------------|
| Potential Growth | Employment | Capital | TFP | Structural Change | Potential Growth | Employment | Capital | TFP | Structural Change |
|------------------|------------|---------|-----|-------------------|------------------|------------|---------|-----|-------------------|
| People’s Republic of China                                 |
| 1993–1998        | 10.0       | 0.8     | 3.9 | 5.5               | −0.2             |
| 1998–2003        | 10.0       | 0.9     | 3.3 | 4.6               | 1.2              |
| 2003–2008        | 10.8       | 0.6     | 3.6 | 4.7               | 1.9              |
| 2009–2014        | 8.2        | 0.0     | 3.6 | 4.6               | 0.0              |
| Change 2009–2014 | −1.7       | −0.8    | −0.3| −0.9              | 0.2              |

Countries where less structural change explains most of the slowdown between the 1993–1998 and 2009–2014 periods

| Countries where less structural change explains most of the slowdown between the 1993–1998 and 2009–2014 periods |
|---------------------------------------------------------------|
| Potential Growth | Employment | Capital | TFP | Structural Change | Potential Growth | Employment | Capital | TFP | Structural Change |
|------------------|------------|---------|-----|-------------------|------------------|------------|---------|-----|-------------------|
| Thailand         |
| 1993–1998        | 4.4        | 1.0     | 2.3 | −0.4              | 1.4              |
| 1998–2003        | 3.3        | 0.9     | 0.1 | 0.6               | 1.7              |
| 2003–2008        | 3.5        | 0.6     | 0.9 | 2.3               | −0.2             |
| 2009–2014        | 2.7        | 0.2     | 0.8 | 2.9               | −1.2             |
| Change 2009–2014 | −1.7       | −0.8    | −1.6| 3.3               | −2.7             |

| Cambodia         |
|------------------|------------|---------|-----|-------------------|------------------|
| 1993–1998        | NA         | 2.6     | 2.2 | 0.7               | NA               |
| 1998–2003        | 9.7        | 3.0     | 3.3 | 0.4               | 2.9              |
| 2003–2008        | 7.9        | 2.2     | 3.8 | 1.3               | 0.7              |
| 2009–2014        | 6.4        | 1.7     | 2.2 | 2.3               | 0.3              |
| Change 2009–2014 | −3.3       | −0.9    | 0.0 | 1.6               | −2.6             |

| Nepal            |
|------------------|------------|---------|-----|-------------------|------------------|
| 1993–1998        | 5.7        | 1.8     | 1.3 | 0.2               | 2.4              |
| 1998–2003        | 3.3        | 1.3     | 1.1 | 0.7               | 0.1              |
| 2003–2008        | 4.2        | 1.0     | 1.1 | 1.3               | 0.7              |
| 2009–2014        | 4.4        | 1.6     | 1.3 | 1.2               | 0.3              |
| Change 2009–2014 | −1.3       | −0.2    | 0.0 | 1.0               | −2.1             |

| Viet Nam         |
|------------------|------------|---------|-----|-------------------|------------------|
| 1993–1998        | 7.6        | 1.7     | 1.5 | 2.0               | 2.4              |
| 1998–2003        | 6.7        | 1.8     | 2.2 | 0.7               | 2.0              |
| 2003–2008        | 7.1        | 1.6     | 2.9 | 0.9               | 1.7              |
| 2009–2014        | 5.3        | 1.0     | 2.2 | 2.6               | −0.4             |
| Change 2009–2014 | −2.3       | −0.7    | 0.7 | 0.6               | −2.8             |

NA = not available, TFP = total factor productivity.
Source: Author's calculations.
these economies, will depend on maintaining the reform process and technological progress. This may be particularly challenging in economies like Sri Lanka where the recent large gains in TFP growth likely reflect a temporary boost following the cessation of hostilities.

In Azerbaijan, the Lao People’s Democratic Republic (Lao PDR), and Nigeria, TFP growth from structural change has been the biggest driver of growth acceleration. The contribution was particularly large in Azerbaijan for both TFP net of structural change and structural change. Partly because of base effects, the contribution of each to potential output growth during 1993–1998 was actually negative.

The contribution of employment to potential output growth weakened in every economy where potential output growth slowed in the latest period relative to 1993–1998, but only in New Zealand was this the largest factor in explaining the slowdown. Weaker capital accumulation was the largest factor in four of the 10 economies—Japan, the Republic of Korea, Malaysia, and Singapore—partly resulting from an end to the rapid capital accumulation that occurred in these economies in the 1990s prior to the 1997/98 Asian financial crisis. Except for Japan, where capital accumulation did not contribute to potential output growth during 2009–2014, capital accumulation continued to be a major factor in explaining growth in each of these economies.

Weaker productivity growth (net of structural change) was the main factor behind the deceleration in potential output growth in Armenia, Australia, and the PRC, although in the cases of Armenia and the PRC, TFP continued to expand relatively quickly. In Cambodia, Nepal, Thailand, and Viet Nam, the largest factor driving the slowdown in potential output appears to have been weaker TFP growth due to structural change, which in the case of Thailand appears to be reflected in the stabilization of the employment share of agriculture in the economy.

IV. Long-Term Projections

The future of potential output in Asian economies will depend on a wide range of factors, including initial conditions, improvements in education policies (human capital), health outcomes, regulatory reforms, industrial policies, and demographics. The identification of the potential impact that individual polices may have on unemployment, labor participation, TFP growth, and investment lie well outside the scope of this paper. However, it is possible to examine the likely impact on potential output from convergence toward best practice along each of these dimensions.

To do so, a two-step procedure is followed. First, a business-as-usual or baseline scenario grounded in specific assumptions as to how each of the principal drivers of potential output is expected to behave over the next 25 years (2016–2040) is generated. In the second step, a series of alternative scenarios are generated to examine the influence that better performances in terms of capital, labor, TFP, and structural change might have on potential output.
For the purposes of constructing the baseline, it is assumed that

(i) demographics proceed in a manner consistent with the baseline assumption of the United Nations’ population projections,

(ii) labor market efficiency is unchanged (constant natural unemployment and participation rates),

(iii) investment continues at a rate consistent with current capital–output ratios (no capital deepening),

(iv) the sectoral transformation of an economy continues along the same path as during the past 15 years, and

(v) TFP growth continues to grow at the same average pace as during the past 15 years.

Table 2 shows potential output growth rates for Asian economies during 2010–2015 and projected potential output growth rates for the period 2035–2040 based on these five assumptions. It presents the change in potential growth between these two periods and breaks down the individual contributions of employment, capital, TFP, and structural change. Figure 2 shows the same changes graphically, with the contributions for each economy sorted from the largest negative contribution to the smallest (or largest positive contribution).

These results are not a forecast but rather a projection of what might occur should the assumptions described above hold. In some cases, the projected change in potential growth and its sources may say more about the 2010–2015 period than it does about the forecast period. For example, in the case of the Lao PDR, where recently there has been rapid capital deepening, the sharp slowdown projected in the business-as-usual scenario mainly reflects the assumption of a stable capital–output ratio, and therefore an end to the rapid capital deepening that has driven recent growth. While probably not a short-term concern, the very slow long-term growth in this scenario highlights the challenge that authorities in the Lao PDR will face in transitioning the economy toward a more sustainable TFP-led growth model. On the other hand, the reduced contribution to potential growth from labor in the baseline scenario reflects a real influence.

With these important caveats in mind, Table 2 shows that average median potential growth among Asian economies is projected to fall by 2 percentage points by the period 2030–2040, with potential output growth in virtually every economy slowing to some degree or another. Slower growth of the working-age population (driven entirely by demographics) and the stabilization of capital–output ratios each account for –0.8 percentage points of the median slowdown. The median decline
from slower TFP growth is a relatively small −0.2 percentage points, while structural change contributes −0.4 percentage points. Almost every economy is likely to see the contribution of labor to potential growth decline during the review period, assuming no further declines in equilibrium unemployment or in the rate of labor participation (Figure 2b). Only Sri Lanka is projected to see the growth rate of its working-age population pick up between 2015 and 2040; therefore, the baseline contribution of employment to output growth rises marginally in Sri Lanka. Elsewhere, working-age population growth slows, with the

Table 2. Baseline Change in Potential Output Growth between 2010–2015 and 2045–2040 and Contributions from Different Sources

| Country | 2010–2015 | 2035–2040 | Delta | Employment | Capital | TFP | Structural Change |
|---------|-----------|-----------|-------|------------|---------|-----|-------------------|
| LAO     | 6.8       | 1.3       | −6.3  | −0.7       | −3.1    | −0.4| −2.0              |
| PNG     | 4.4       | 3.5       | −5.4  | −0.8       | −2.7    | −0.8| −1.2              |
| BAN     | 6.1       | 1.3       | −5.0  | −1.1       | −2.1    | −1.0| −0.8              |
| VIE     | 5.2       | 1.0       | −4.1  | −1.0       | −1.7    | −1.4| 0.0               |
| CAM     | 6.5       | 2.7       | −3.6  | −0.8       | −1.5    | −1.1| −0.2              |
| IND     | 6.7       | 4.1       | −2.6  | −0.4       | −1.2    | −0.4| −1.2              |
| PRC     | 6.8       | 4.9       | −2.9  | −0.7       | −1.9    | 0.0 | −0.2              |
| NEP     | 4.6       | 2.0       | −2.5  | −1.1       | −0.6    | 0.1 | −0.8              |
| INO     | 5.3       | 3.1       | −2.4  | −1.0       | −0.9    | 0.1 | −0.6              |
| SIN     | 4.1       | 2.2       | −2.4  | −1.8       | −1.0    | 0.3 | 0.1               |
| SRI     | 7.2       | 4.0       | −3.2  | 0.0        | −1.3    | −0.9| −0.2              |
| MON     | 5.2       | 5.1       | −2.0  | −0.9       | −0.5    | −0.2| −0.4              |
| AUS     | 2.5       | 1.0       | −2.0  | −0.4       | −1.4    | −0.1| −0.1              |
| PHI     | 5.8       | 3.8       | −1.8  | −0.7       | −0.2    | −0.3| −0.6              |
| PAK     | 4.3       | 2.2       | −1.7  | −1.0       | 0.2     | −0.3| −0.6              |
| KOR     | 2.8       | 1.7       | −1.4  | −1.2       | −0.5    | 0.3 | 0.0               |
| MAL     | 4.7       | 3.7       | −1.2  | −0.9       | −0.5    | 0.3 | 0.0               |
| NZL     | 2.3       | 1.0       | −1.2  | −0.2       | −0.8    | −0.3| 0.0               |
| THA     | 3.8       | 1.8       | −2.0  | −1.0       | −0.2    | −0.4| 0.9               |
| AZE     | 3.3       | 4.4       | −0.5  | −1.5       | −0.7    | 2.5 | −0.9              |
| JPN     | 0.8       | 0.4       | −0.2  | 0.0        | 0.1     | −0.2| −0.1              |
| GEO     | 4.4       | 4.7       | 0.6   | −0.7       | 0.3     | 2.3 | −1.3              |
| KAZ     | 3.5       | 6.5       | 1.9   | −0.4       | 1.1     | 2.1 | −0.9              |
| Median across countries | 4.6 | 2.7 | −2.0 | −0.8 | −0.8 | −0.2 | −0.4 |

| Unweighted average | 4.7 | 2.9 | −2.2 | −0.8 | −0.9 | 0.0 | −0.5 |
| Maximum | 7.2 | 6.5 | 1.9 | 0.0  | 1.1  | 2.5 | 0.9  |
| Minimum | 0.8 | 0.4 | −6.3 | −1.8 | −3.1 | −1.4 | −2.0 |
| Standard deviation | 1.7 | 1.6 | 1.9 | 0.4  | 1.0  | 1.0 | 0.6  |

AUS = Australia, AZE = Azerbaijan, BAN = Bangladesh, CAM = Cambodia, GEO = Georgia, IND = India, INO = Indonesia, JPN = Japan, KAZ = Kazakhstan, KOR = Republic of Korea, LAO = Lao People’s Democratic Republic, MAL = Malaysia, MON = Mongolia, NEP = Nepal, NZL = New Zealand, PAK = Pakistan, PNG = Papua New Guinea, PHI = Philippines, PRC = People’s Republic of China, SIN = Singapore, SRI = Sri Lanka, TFP = total factor productivity, THA = Thailand, VIE = Viet Nam.
Source: Author’s calculations.
Figure 2. Baseline Scenario—Changes in Potential Output Growth and Contributions to Changes in Potential Output Growth

AUS = Australia, AZE = Azerbaijan, BAN = Bangladesh, CAM = Cambodia, GEO = Georgia, IND = India, INO = Indonesia, JPN = Japan, KAZ = Kazakhstan, KOR = Republic of Korea, LAO = Lao People’s Democratic Republic, MAL = Malaysia, MON = Mongolia, NEP = Nepal, NZL = New Zealand, PAK = Pakistan, PNG = Papua New Guinea, PHI = Philippines, PRC = People’s Republic of China, SIN = Singapore, SRI = Sri Lanka, TFP = total factor productivity, THA = Thailand, VIE = Viet Nam.

Notes: The main assumptions of the baseline scenario include constant natural rates of unemployment and labor force participation, constant capital–output ratio, TFP growth equal to an economy’s 2000–2015 average, and sector change equal to an economy’s 2000–2015 average.

Source: Author’s calculations.

contribution of labor to potential output growth declining the most in Azerbaijan, the Republic of Korea, and Singapore.

Capital’s largest contribution to slowing potential growth is observed in economies, such as the Lao PDR and Viet Nam, that have undergone an intense process of capital deepening in recent years. In these and similar economies, the assumption of a stable capital–output ratio implies that the rapid capital deepening
of recent years will end, resulting in a substantial decline in the potential growth rate (e.g., 1.9 percentage points in the case of the PRC). Figure 2c provides a breakdown of which economies are most affected by this assumption.

Insofar as the recent pace of capital deepening is unsustainable, these slowdowns point to a real growth challenge in the medium term. If these economies want to maintain recent potential output growth rates, policies will either have to continue to create conditions that support the very high investment rates of recent years or substitute this investment with faster TFP growth and/or increased labor utilization.

For most economies, the assumption to hold TFP growth at the average rate observed during 2000–2015 has only a small impact on the contribution of TFP growth, with the notable exceptions of Georgia and Kazakhstan, where TFP growth in the postcrisis period (2010–2015) was much lower than in the boom period (2000–2010). As a result, the baseline assumption of average TFP growth implies a substantial boost to potential output growth for these economies. In contrast, TFP growth in Bangladesh, Cambodia, and Viet Nam was higher in the most recent period. As a result, assuming TFP grows at the slower-period average implies a significant decline in potential growth.

Slower structural change, which is largely a function of the assumption to hold the pace of structural change at a constant rate, implies slower growth of 0.4% for the median Asian economy, with impacts in excess of at least 1 percentage point in economies where structural change has picked up in the postcrisis period (2010–2015), including Georgia, India, the Lao PDR, and Papua New Guinea. In contrast, structural change in Thailand slowed sharply in the postcrisis period and a return to more normal rates would imply faster potential output growth.

V. Convergence Scenarios

As discussed above, the baseline scenario is not a forecast but rather a mechanism to help identify potentially untapped sources of growth. In this section, the baseline projection is compared with scenarios employing different assumptions consistent with success in advancing more quickly than under the baseline scenario in one or more aspects of economic convergence. Each of these alternative scenarios assumes that an economy will put in place policies that allow different drivers of potential output growth (e.g., employment to working-age population ratio, capital–output ratio, level of TFP, and economic structure) to converge with the path followed by the Republic of Korea, an economy that made the transition from low- to high-income status relatively rapidly. As such, these alternative scenarios indicate in which area lie the greatest latent possibilities for sustained improvement in economic performance. While the Republic of Korea is a somewhat arbitrary convergence point at which to aim, it has the merit of being concrete and is rooted in one of the more successful Asian development stories of the past 100 years.
A. Employment Convergence

The first alternative scenario examines the impact on potential output if authorities succeed in reducing the unemployment rate and increasing the equilibrium labor participation rate in their respective economies to the levels observed in the Republic of Korea in 2014. This scenario is implemented by reducing the unemployment rate by 0.2 percentage points per annum until it reaches the Republic of Korea’s 2014 level, and by raising the participation rate by the same 0.2 percentage points per annum until it reaches the Republic of Korea’s levels. Figure 3 reports for each economy the impact on potential GDP in 2040 expressed as a percent of baseline potential GDP.

The largest benefits from improved labor market efficiency, with around a 10% increase in potential GDP in 2040, are for India, Pakistan, and Sri Lanka, which are economies with relatively low participation rates due mainly to low rates of female labor force participation. The second-biggest improvements come from economies with high unemployment rates like Georgia, Indonesia, and the Philippines. Bringing more of the working-age population into employment could raise potential output by as much as 5.5% in these economies by 2040.

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14The modeled convergence rate is based on the average reduction or improvement observed in these rates among economies with falling unemployment and rising participation rates over the past 15 years. It implies a maximum improvement in both rates of 5 percentage points between 2015 and 2040.
B. Capital Convergence

In the second alternative scenario, the capital–output ratios in Asian economies slowly converge to the same level currently observed in the Republic of Korea. Figure 4 indicates that the Republic of Korea’s capital stock was 3.2 times potential output in 2014, with the capital-to-potential output ratio among economies in the sample ranging from 1.2 to just under 3 in the case of the PRC.

In this scenario, economies were assumed to grow their capital–output ratios during the projection period until they reached that of the Republic of Korea in 2014, at which point the capital–output ratio would be held constant. The growth rate used was the greater of 2% per year or the average growth rate of an economy’s capital–output ratio during 2000–2015. The 2% growth rate is roughly equal to the mean plus one standard deviation of the rate of growth of the capital–output ratio for all developing economies during the period 1980–2000, implying that the rate of growth of the capital–output ratio exceeded 2% in only roughly 15% of economies during this period.

Figure 5 shows the percentage change in potential output in Asian economies in 2040 resulting from convergence with the Republic of Korea’s 2014 capital–output ratio. For most economies, faster capital deepening adds 6–8 percentage points to potential output by 2040. For economies such as the PRC where the capital–output ratio was already close to the Republic of Korea’s levels in 2014, the gains are minimal. Gains of as much as 13% are captured by economies such as Cambodia and Pakistan where the pace of capital deepening has been particularly rapid in recent years.

Figure 4. Capital–Output Ratios in 2040—Baseline Scenario versus Convergence Scenario

AUS = Australia, AZE = Azerbaijan, BAN = Bangladesh, CAM = Cambodia, GEO = Georgia, IND = India, INO = Indonesia, JPN = Japan, KAZ = Kazakhstan, K−O = capital–output, KOR = Republic of Korea, LAO = Lao People’s Democratic Republic, MAL = Malaysia, MON = Mongolia, NEP = Nepal, NZL = New Zealand, PAK = Pakistan, PNG = Papua New Guinea, PHI = Philippines, PRC = People’s Republic of China, SIN = Singapore, SRI = Sri Lanka, THA = Thailand, VIE = Viet Nam.

Source: Author’s calculations.
C. **TFP Convergence**

The third scenario examines the impact on potential GDP of faster TFP growth (net of restructuring). Here the challenges and potential gains are immense. Figure 6 reports three productivity growth rates for each economy in the sample. The first represents the average growth rate of TFP during 2000–2015, which is used as the baseline projection. The second reports the productivity growth that each economy would need to attain to converge to the PRC’s baseline TFP level in 2040. The third shows the productivity growth rate that each economy would need to attain the Republic of Korea’s baseline TFP level in 2040. Figure 6 confirms that TFP levels in most economies in the region lie well below the Republic of Korea’s levels; even the PRC would need to increase the pace of its TFP growth by 50% if it were to close the gap with the Republic of Korea by 2040.

Figure 6 shows that there is substantial variation in TFP growth across Asian economies, with top performers like the PRC recording TFP growth of 4.5% or more per annum during 2000–2015, while others such as Bangladesh, the Lao PDR, and Pakistan had TFP growth of less than 1% per annum during the same period. Overall, the median and mean TFP growth rates for the sampled economies are about 2.1%, and the standard deviation across economies is about 1.25%. Figure 6 also illustrates that the kind of sustained increases in TFP growth required to converge to the Republic of Korea’s (or even the PRC’s) levels of TFP do not appear attainable for most Asian economies. To reach the Republic of Korea’s or the PRC’s TFP levels...
in 2040, most economies would need to attain TFP growth of more than 5% per annum, and substantially more in some cases, which is more rapid TFP growth than any economy recorded during 2000–2015.

Figure 7 reports the results of two simulations that evaluate the potential gains from exceeding baseline TFP growth, which is no simple task given that 2000–2015 was a period of record growth for most developing economies. This suggests that simply maintaining TFP growth rates from this period would be an achievement. The first scenario estimates the impact on potential output in 2040 of increasing the TFP growth rate of all economies by 0.5 percentage points per annum. The second scenario estimates the effect on potential output in 2040 of increasing TFP growth by the amount needed to match the developing economy mean for TFP growth during 2000–2015 (2.1%), or of raising those economies already above the mean by 0.5 percentage points.

In the first scenario, raising TFP growth by 0.5 percentage points per annum generates end-of-period increases in potential output ranging from 11% to 24% of GDP. In the second scenario, those developing economies where TFP growth during 2000–2015 was well below the median could see potentially huge increases in output of as much as 110% by 2040. The large increases recorded for high-income
Figure 7. **Impact on Potential Output in 2040 under Two Total Factor Productivity Scenarios**

| Country | TFP Growth Impact | TFP Growth Impact |
|---------|-------------------|-------------------|
| AUS     |                   |                   |
| AZE     |                   |                   |
| GEO     |                   |                   |
| KAZ     |                   |                   |
| MAL     |                   |                   |
| SIN     |                   |                   |
| AUS     |                   |                   |
| NZL     |                   |                   |
| KOR     |                   |                   |
| JPN     |                   |                   |
| MON     |                   |                   |
| FRC     |                   |                   |
| INO     |                   |                   |
| PHI     |                   |                   |
| SRI     |                   |                   |
| IND     |                   |                   |
| PAK     |                   |                   |
| THA     |                   |                   |
| NEP     |                   |                   |
| PNG     |                   |                   |
| BAN     |                   |                   |
| LAO     |                   |                   |
| CAM     |                   |                   |
| VIE     |                   |                   |

AUS = Australia, AZE = Azerbaijan, BAN = Bangladesh, CAM = Cambodia, GEO = Georgia, IND = India, INO = Indonesia, JPN = Japan, KAZ = Kazakhstan, KOR = Republic of Korea, LAO = Lao People’s Democratic Republic, MAL = Malaysia, MON = Mongolia, NEP = Nepal, NZL = New Zealand, PAK = Pakistan, PNG = Papua New Guinea, PHI = Philippines, PRC = People’s Republic of China, SIN = Singapore, SRI = Sri Lanka, TFP = total factor productivity, THA = Thailand, VIE = Viet Nam.

Source: Author’s calculations.

Economies like Australia and New Zealand almost certainly overstate their prospects as their TFP levels in 2014 were already higher than the Republic of Korea’s.

The sharp increase in potential GDP among some developing economies in the second scenario reflects how weak TFP growth was during 2000–2015 for these economies, which in turn reflects how reliant GDP growth in these economies was on capital deepening. Switching from a growth model dependent on high investment rates to one more reliant on improved efficiency will not be easy, though even attaining the median TFP growth rate among developing economies could generate huge benefits.

D. **Convergence of Economic Structure**

The final scenario analyzes structural change (Figure 8). An important contributor to income growth in a developing economy is the gradual movement of firms and workers from lower to higher productivity sectors (Lewis 1954). For the baseline, it was assumed that economies maintained the same rate of structural change for the period 2015–2040 as they had during 2000–2015. For the alternative scenario, economic structure was assumed to follow more or less the same pattern.
of structural evolution as occurred in the Republic of Korea. This hypothesis fits the data surprisingly well for many economies. For example, simple regressions of the employment share of the service sectors for the PRC, Indonesia, and Malaysia on the Republic of Korea’s service sector’s employment share generated R-squared values of 0.98, 0.74, and 0.96, respectively.\footnote{The regression is based on a simple model of eserv\textsubscript{x} = α + β eserv\textsubscript{kor, t−lag}, where the lag is determined by the period with the best fit (27 years, 27 years, and 10 years for the PRC, Indonesia, and Malaysia, respectively) and where the lags are selected based on a rolling regression designed to find the lag year with the best fit.}

In the structural change scenario, sectoral employment shares were assumed to follow the pattern of development in the Republic of Korea from that point in time when its agriculture employment share was closest to an individual economy’s.\footnote{More explicitly, a log linear regression of the Republic of Korea’s employment share against time was run and then inverted to solve for the lag to be used by substituting economy x’s agricultural share of employment for the Republic of Korea’s in the equation such that t\textsubscript{x} = e^{(log x − α)/β}.} Using this assumption for structural change, economies such as the Lao PDR and Papua New Guinea, which saw a great deal of structural change during 2000–2015, would see less structural change than under the baseline scenario where it was assumed that structural change would continue at the same rapid pace as the period 2000–2015. For most economies, however, the pace of structural change increases under the alternative scenario, with strong positive impacts on potential output in 2040, including GDP increases of 20% or more in several cases.
Figure 9. Impact on Potential Output in 2040 with Convergence in All Dimensions

AUS = Australia, AZE = Azerbaijan, BAN = Bangladesh, CAM = Cambodia, GEO = Georgia, IND = India, INO = Indonesia, JPN = Japan, KAZ = Kazakhstan, KOR = Republic of Korea, LAO = Lao People’s Democratic Republic, MAL = Malaysia, MON = Mongolia, NEP = Nepal, NZL = New Zealand, PAK = Pakistan, PNG = Papua New Guinea, PHI = Philippines, PRC = People’s Republic of China, SIN = Singapore, SRI = Sri Lanka, TFP = total factor productivity, THA = Thailand, VIE = Viet Nam.
Source: Author’s calculations.

E. Overall Impact

Figure 9 presents the cumulative impacts of the four convergence scenarios examined. The alternative TFP scenario has the most consistently large impact, mainly because in contrast to the labor market scenario or the capital-deepening scenario, the TFP scenario assumes continued improvement every year. In the capital-deepening and labor market scenarios, once convergence with the Republic of Korea’s levels has been achieved, no further improvement occurs and the contribution of convergence to annual potential growth along these dimensions falls to zero. While reforms in earlier years boost the level of potential output, they no longer contribute to raising the rate of growth of potential output in later years. Consistent with the Lewis (1954) turning point, the contribution to potential output growth of structural change is larger in less-developed economies because as income levels and economic structure converge, productivity gains from labor reallocation across sectors decline.

The structural change scenario yields large improvements in those economies where there has been relatively little structural change in recent years as the baseline scenario assumes structural change continuing at the average pace observed during 2000–2015.

VI. Concluding Remarks

In this paper, a relatively simple methodology for estimating potential output is presented and used to project potential output over the next 15 years. The first set
of simulations, which roughly translate into a business-as-usual scenario, employs a set of baseline assumptions consistent with United Nations population projections; stable labor market efficiency; long-term trends of TFP growth; and a constant capital–output ratio, which implies capital growth consistent with the long-term equilibrium properties of the Cobb–Douglas production function and the pace of TFP and labor force growth.

These simulations reveal that, all things being equal, potential output growth across the 26 Asian economies in the sample would fall from a median of 4.6% per annum during 2010–2015 to 2.7% per annum by the period 2035–2040. In the baseline scenario, about 0.8 percentage points of the slowing is due to a decline in working-age population growth, while a stabilization of capital–output ratios at current levels would contribute a similar amount to the slowdown. TFP growth (net of structural change) in the baseline is assumed to stabilize at the average rate observed between 2000 and 2014. As a result, slower TFP growth contributes a relatively modest 0.2 percentage points to the slowdown, while assumed stagnation in the pace of structural change (the movement of labor from lower to higher productivity sectors) cuts 0.4 percentage points from potential output growth between the two periods.

The alternative scenarios presented illustrate the potential to improve on these results by implementing better policies that improve labor market efficiency, prompt more rapid capital deepening, boost structural change, and generate faster TFP growth. The specific policies that could yield these benefits at the economy level lie well outside of the scope of this paper. Nevertheless, the reported scenarios give a sense of the size of potential gains.

In particular, the scenarios suggest that raising TFP growth in economies in which TFP growth has been weak to the developing economy average of 2% per annum, and in all other economies by 0.5 percentage points per annum, could increase potential output in 2040 by between 11% and 24% over the baseline. Reducing unemployment rates and boosting labor force participation rates to the same levels as observed in the Republic of Korea in 2014 would raise end-of-period potential output by less than 6% for two-thirds of economies (as labor utilization rates are already relatively high in many economies), but could boost potential output by 10% or more in some South Asian economies where female labor participation rates are low. Capital deepening—either raising capital–output ratios by 2% per annum over an economy’s average for the period 2000–2014, or attaining the sample’s capital–output ratio average for the period 2000–2014—could add between 6% and 10% to potential output in most economies. In the alternative scenarios, the largest potential benefit comes from a pick-up in structural convergence toward the average rate observed in the Republic of Korea during the last 50 years. The removal of policies that may be restricting structural change, such as rural income support schemes and limits on rural–urban migration, could help boost potential output in 2040 in almost half of all economies by 10% or more above the baseline.
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