

Staff Analytical Note/Note analytique du personnel 2019-13

# Assessing Global Potential Output Growth: April 2019



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## **Acknowledgements**

We would like to thank Patrick Alexander, Harriet Jackson, Rhys Mendes, Kurt Niquidet, Subrata Sarker and Walter Steingress for their helpful comments and suggestions.

## Abstract

This note presents the updated estimates of potential output growth for the global economy through 2021. Global potential output is expected to grow by 3.3 per cent per year over the projection horizon. Two common themes are weighing on potential output growth across regions: trade disputes, which are reducing total factor productivity growth in the United States and China; and aging, which is having a negative impact on labour force participation in the United States, China, the euro area and Japan. While potential output growth is expected to remain fairly stable in the United States, there are offsetting dynamics across other regions. In emerging-market economies, potential growth is projected to strengthen, mainly due to a recovery of investment as well as structural reforms contributing to total factor productivity growth. Potential output is expected to slow in Japan, China and the euro area, as the effects on growth of population aging and declining labour inputs intensify in these regions over the next three years. A moderation in investment growth will also contribute to slower potential growth in China.

*Bank topics: Potential output; Productivity; International topics*

*JEL codes: E10, E20, O4*

## Résumé

Cette note présente les estimations actualisées de la croissance de la production potentielle pour l'économie mondiale jusqu'en 2021. La production potentielle mondiale devrait croître à un rythme de 3,3 % par année au cours de la période de projection. Deux éléments pèsent sur la croissance de la production potentielle dans l'ensemble des régions : les différends commerciaux, qui entravent la croissance de la productivité totale des facteurs aux États-Unis et en Chine, et le vieillissement démographique, qui influe négativement sur le taux d'activité de la population aux États-Unis, en Chine, dans la zone euro et au Japon. La production potentielle devrait continuer de croître à un rythme assez stable aux États-Unis, mais on observe des dynamiques qui se contrebalancent dans les autres régions. Ainsi, la croissance de la production potentielle devrait se raffermir dans les économies émergentes, notamment grâce à une reprise de l'investissement et à des réformes structurelles contribuant à un accroissement de la productivité totale des facteurs. Au Japon, en Chine et dans la zone euro, en revanche, on s'attend à un ralentissement sous l'effet modérateur croissant du vieillissement de la population et de la diminution du facteur travail au cours des trois prochaines années. Dans le cas de la Chine, une modération du taux de progression des investissements participera aussi au ralentissement de la croissance potentielle.

*Classification de la Banque : Production potentielle; Productivité; Questions internationales*

*Classification JEL : E10, E20, O4*

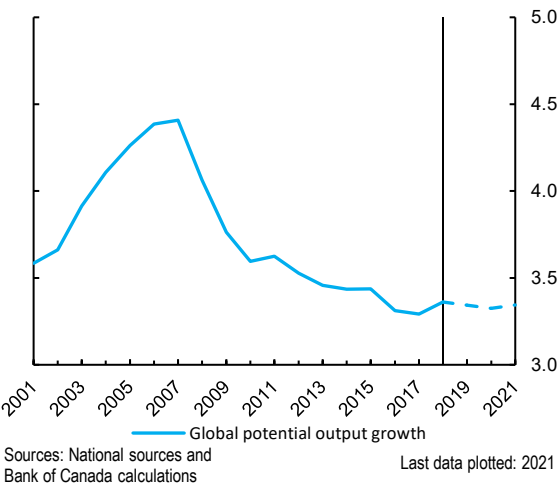
# 1. Introduction

Each year, before the release of the April *Monetary Policy Report* (MPR), Bank of Canada staff reassess potential output growth for Canada and the global economy. This note focuses on the global economy and is a companion piece to Brouillette et al. (2019), which focuses on Canada. Potential output growth for the United States, China, the euro area, Japan and oil-importing emerging markets is estimated using a growth accounting framework that decomposes potential output into trend total factor productivity (TFP), capital deepening and trend labour input (TLI).<sup>1</sup> The latter is further decomposed into working-age population, trend labour force participation rate, trend unemployment rate and trend average hours worked to gain a better understanding of the contribution of labour dynamics to potential growth (see **Appendix** for details). Global potential output growth is obtained by aggregating the regional estimates using an approach consistent with the Bank of Canada’s global projection reported in Table 1 of the April 2019 MPR.

Our analysis suggests that global potential output will grow by 3.3 per cent per year over the projection horizon (**Chart 1**). Global potential growth is primarily driven by TFP growth and capital accumulation in China and other emerging-market economies (EMEs) (**Table 1**). In the United States, potential output growth is expected to average about 1.9 per cent between 2019 and 2021.

In this year’s reassessment, we focus particularly on two common themes weighing on global potential output growth: trade disputes and the aging of the population. The trade dispute and related uncertainty between the United States and China reduces our estimate of potential growth in the United States and China by 0.07 and 0.16 percentage points annually, respectively (**Box 1**). This lowers their respective levels of potential gross domestic product (GDP) by 0.2 and 0.5 per cent by 2021 and global potential GDP by about 0.1 per cent, relative to estimates of what potential output would have been in the absence of trade disputes. Aging is having a direct negative impact on total labour force participation in the United States, China, the euro area and Japan (**Box 2**). In 2018, the resulting drag on potential output growth was similar in all regions, averaging around -0.4 percentage points. Over the next three years, the drag is expected to intensify somewhat in China and the euro area, lessen in Japan and remain roughly unchanged in the United States.

**Chart 1: Global potential output is expected to grow by 3.3 per cent per year in the next three years**



<sup>1</sup> The estimates for the remaining group of countries are obtained using an HP filter methodology. This group of countries, which we call “rest of the world,” consists mostly of oil exporters and other small advanced economies.

The remainder of this note is organized as follows: In Section 2 and Section 3 we discuss the potential output growth estimates for the United States and China, respectively. We focus on these two economies because of their relative size and importance for global dynamics. In Section 4 we briefly discuss the drivers of potential output growth in other regions. In Section 5 we provide an overview of key risks facing our outlook for potential growth in each region.

**Table 1: Global potential output growth mostly driven by TFP and capital accumulation in China and other EMEs**

	US	CH	EA	JA	EMEs	World
<b>Average potential growth, 2019–21</b>	1.9	6.0	1.4	0.8	4.3	3.3
Contribution coming from (ppts):						
<b>Trend labour input</b>	0.5	-0.2	0.4	-0.3	0.7	-
<b>Trend labour productivity</b>	1.4	6.2	1.0	1.1	3.6	-
<i>Total factor productivity</i>	0.7	2.4	0.7	0.7	1.6	-
<i>Capital deepening</i>	0.7	3.8	0.3	0.4	2.1	-
Share of real global GDP <sup>a</sup> (per cent)	15	18	12	4	33	100

<sup>a</sup>GDP shares are based on International Monetary Fund (IMF) estimates of the purchasing-power-parity valuation of country GDPs for 2017 from the IMF's October 2018 World Economic Outlook.

Note: TFP is total factor productivity, ppts is percentage points, US is the United States, CH is China, EA is the euro area, JA is Japan, and EMEs is emerging-market economies.

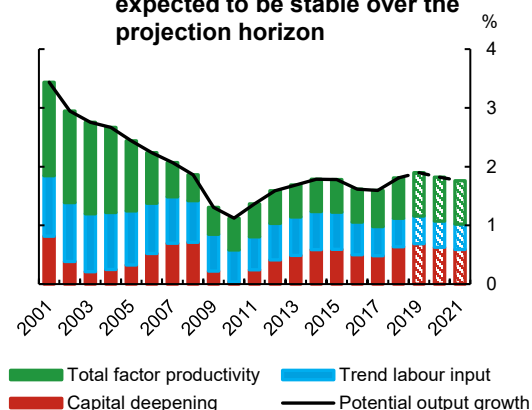
## 2. United States

US potential output growth is expected to be fairly stable around 1.9 per cent over the projection horizon (**Chart 2**). The contributions to growth of TLI, capital deepening and trend TFP are also expected to be relatively constant.

### a) US trend labour input

TLI growth is expected to contribute about 0.5 percentage points to potential output growth each year over the projection horizon (**Chart 3**). The main driver of TLI is population growth, which should average about 0.9 per cent over the projection horizon. This is partly offset by the ongoing decline in the trend labour force participation rate (**Chart 4**), as population aging increasingly weighs on labour force participation (**Box 2**). The non-accelerating inflation rate of unemployment (NAIRU)<sup>2</sup> and average weekly hours worked are expected to be stable over the projection horizon and therefore have a minimal impact on TLI growth.

**Chart 2: US potential output growth is expected to be stable over the projection horizon**

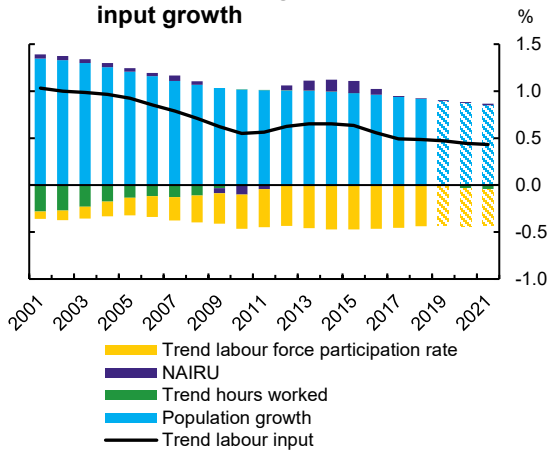


Sources: National sources and Bank of Canada calculations

Last data plotted: 2021

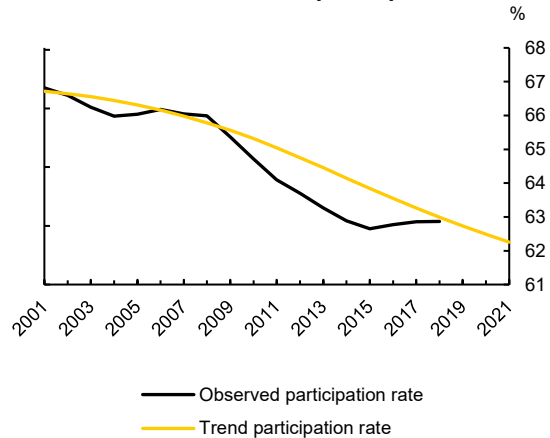
<sup>2</sup> The NAIRU is the rate of unemployment that is consistent with a stable inflation rate. Our projections use the US Congressional Budget Office's January 2019 estimate of the natural rate of unemployment.

**Chart 3: Factors affecting US trend labour input growth**



Note: NAIRU is non-accelerating inflation rate of unemployment.  
Sources: National sources and Bank of Canada calculations Last data plotted: 2021

**Chart 4: US labour force participation rates**

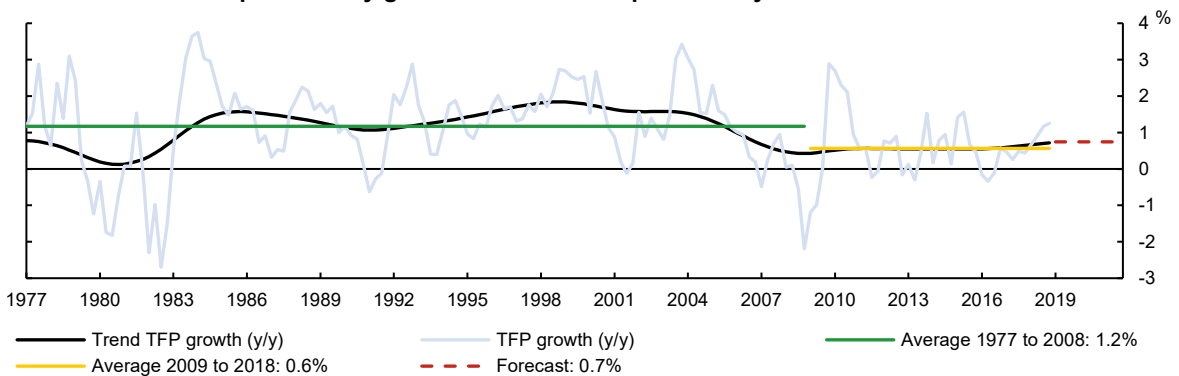


Sources: Current Population Survey and Bank of Canada calculations Last data plotted: Data - 2018; Trends - 2021

## b) US trend labour productivity growth

TFP and capital deepening are expected to contribute equally to trend labour productivity over the projection horizon. TFP growth has been weak over the past decade, averaging only 0.6 per cent per year from 2009 to 2018, down from an average of 1.2 per cent over the previous three decades (**Chart 5**). We anticipate that trend TFP growth over the projection will be only marginally higher at 0.7 per cent per year, reflecting our judgment that offsetting factors will impact the rate of TFP growth. On the one hand, firm entry and business investment should support stronger TFP growth in an economy at full employment with high rates of capacity utilization. On the other hand, trade tensions that have escalated between the United States and China over 2018 are expected to weigh on TFP growth in the coming years (**Box 1**). Capital deepening is expected to be relatively stable over the projection horizon. Growth in capital stock continues to reflect increased investment by firms due to an ongoing rise in capacity utilization as well as the positive effect of last year's tax reforms.

**Chart 5: Total factor productivity growth has remained persistently weak since the onset of the crisis**



Note: TFP is total factor productivity and is calculated assuming a labour share of 62 per cent. Averages calculated based on TFP growth (not trend TFP growth). y/y is year-over-year.

Sources: National sources and Bank of Canada calculations

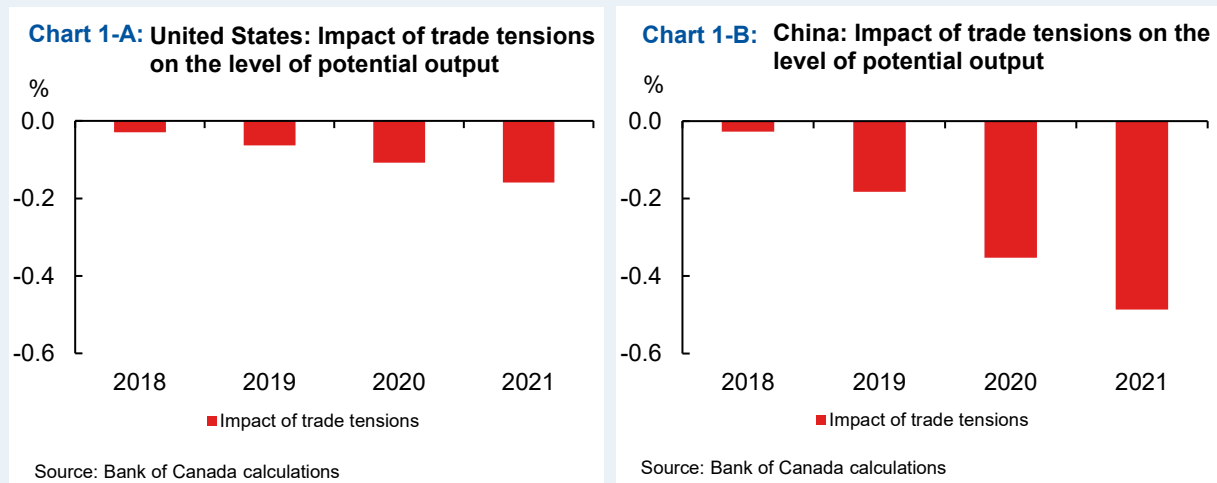
Last data plotted: data, 2018Q4; forecast, 2021Q4

## Box 1: Trade dispute is weighing on global potential growth

Protectionist measures as part of the ongoing trade dispute between the United States and its trading partners are expected to lower potential output. Tariffs and related trade uncertainty negatively affect capital growth and lower total factor productivity (TFP) because they lead to a less efficient allocation of resources. There are many channels through which this occurs, including higher imported input prices and production costs for domestic firms, slower firm creation and expansion for export-oriented firms due to loss of market access, and reduced competition and innovation for importing firms.

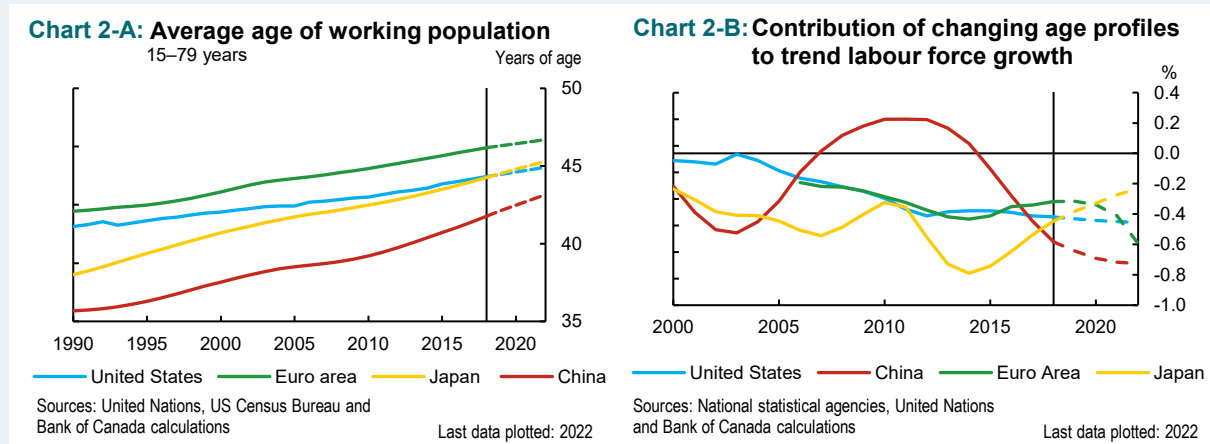
A growing body of analysis suggests that the increase in protectionism is already affecting international trade and inflation. For example, work from Fajgelbaum et al. (2019) and Amiti et al. (2019) examines the impact of recent trade tensions. They find that the US tariff increases over the past two years and the related retaliatory measures have led to a decline in welfare in the United States and for some of its trading partners.

In keeping with these observations, our estimates of the level of potential gross domestic product (GDP) in both the United States and China are 0.2 and 0.5 per cent lower, respectively, by 2021 relative to what our estimates would have been in the absence of trade tensions (**Chart 1-A** and **Chart 1-B**). These revisions are in line with our model-based estimates of the tariffs' impact on investment and GDP presented in the October 2018 *Monetary Policy Report* and are reflected in combined reductions in TFP growth and the rate of capital accumulation. Overall, the tariff effects lower labour productivity growth by 0.07 percentage points per year in the United States and 0.16 percentage points per year in China, over the next three years.



## Box 2: Aging is negatively affecting labour input in all the major regions

Most major economies are experiencing slower population growth and an aging population (**Chart 2-A**). Aging is having a direct negative impact on total labour force participation in all regions (**Chart 2-B**) and therefore contributes to lower potential output growth in all major economies.<sup>3</sup> In 2018, the drag was similar in all regions, averaging around -0.4 percentage points. Over the projection horizon (2019–21), the drag is expected to intensify somewhat in China and the euro area, lessen in Japan and remain roughly unchanged in the United States.



Population aging can also influence potential output through labour productivity (i.e., skill-augmented labour input). Evidence indicates that cognitive and physical abilities generally fall during the latter part of a person’s life, which may offset some of the gains (human capital, experience and wisdom) acquired over a person’s life (see Agarwal et al. 2009). Thus, aging tends to increase worker effectiveness but with diminishing returns—a hypothesis that is consistent with age-earning profiles (see Lagakos et al. 2018; Lemieux 2006).

It is also plausible that aging could affect the rate of technological change. Evidence suggests that most important innovations and inventions are made by people between 25 and 45 years of age (Jones 2010). Thus, the pace of technological change could slow as the population ages.

The effects of aging on labour productivity are difficult to measure. The empirical literature on the topic either finds no significant effects of aging on labour productivity (National Research Council 2012) or small negative effects (Maestas et al. 2016). We therefore do not quantify the degree to which our latest estimates of labour productivity are affected by aging but do acknowledge that this phenomenon may be weighing on the data used to generate our results. Further analysis of this impact could be a topic for future research.

<sup>3</sup> To isolate the impact of population aging depicted in **Chart 2-B**, we estimate the counterfactual trend labour input growth implied by the historical and forecasted change in the age distribution of the working-age population, holding constant age-specific participation rates and population growth rates at their current levels.



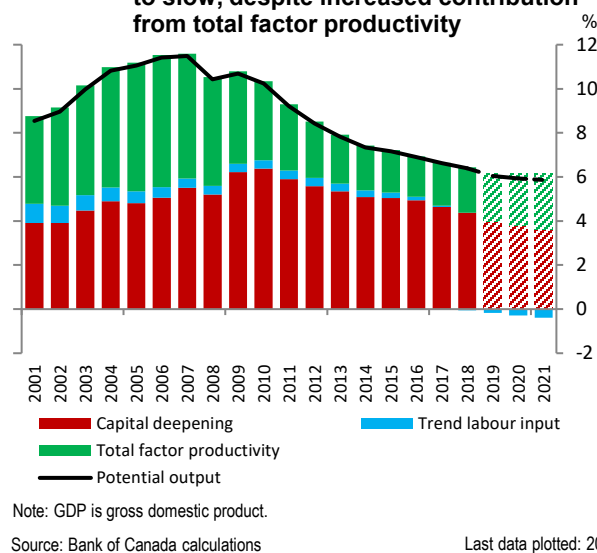
### 3. China

Potential output growth in China continues to slow as the Chinese economy transitions to more sustainable, higher-quality growth (Chart 6).<sup>4</sup> The slowdown in potential growth since 2010 is largely due to the declining pace of capital accumulation. Population aging has also slowed trend labour input growth.

We project potential growth in China to slow from 6.4 per cent in 2018 to 5.9 per cent in 2021, driven primarily by the anticipated effects of population aging and a continued slowdown in capital accumulation. China’s aging labour force is expected to reduce potential output growth by 0.4 percentage points by 2021 (Box 2).

At the same time, growth in capital stock is expected to slow further as the industrialization process matures and as ongoing supply-side reforms encourage the reallocation of investment from excess-capacity industries to relatively high-tech, R&D-intensive sectors. These reforms also support the anticipated pickup in TFP growth, providing a partial offset to the decreasing contributions from capital and labour. However, the structural impact of China–US trade tensions is expected to be a modest drag on both investment and TFP growth over 2019–21 (Box 1).

**Chart 6: China's potential GDP growth is expected to slow, despite increased contribution from total factor productivity**



### 4. Other regions

**In the euro area**, potential output growth is expected to decrease slightly over the projection horizon. TLI growth should slow, reflecting the lessened contribution from migrants integrating into the labour force, population aging and a slowing in the pace of economic reform. Labour productivity growth is expected to be roughly stable over the projection; TFP growth should slow as the positive impacts from past structural reforms to product and service markets diminish, offsetting capital deepening dynamics.

**In Japan**, potential output growth is expected to slow over the projection, as the impact of past reforms that helped boost the labour market participation of women in recent years gives way to the effect of population aging on total labour input growth. Labour productivity growth is expected to remain healthy, reflecting the importance of business investment, notably in intellectual property.

<sup>4</sup> Most notably, Chinese authorities are implementing their “Made in China 2025” strategy, which aims to upgrade the country’s manufacturing sector, particularly in high-priority industries, including robotics, aerospace, electric vehicles and bio-pharmaceutical and medical products.

**In oil-importing EMEs,**<sup>5</sup> the recent upward momentum in potential output growth is expected to continue over 2019–21. The increase reflects ongoing structural reforms that lift investment and TFP growth in several large EMEs.<sup>6</sup> Growth of trend labour input is expected to slow, reflecting the projected declines in working-age population for several large EMEs.

**In the rest of the world (RoW),**<sup>7</sup> potential output growth is also expected to increase as labour productivity in several large oil-exporting EMEs begins to rebound following the 2014–15 oil price shock. The sharp estimated contraction in potential output growth over 2015–17 is in line with the GDP-weighted impacts of large commodity price fluctuations in aggregate investment and TFP among commodity exporters implied by International Monetary Fund (IMF) (2015) estimates. A complete adjustment in these economies to lower oil prices is expected to occur gradually, resulting in a modest pickup in annual potential output growth over 2019–21.

## 5. Risks to the outlook

Our outlook for potential GDP growth is subject to both upside and downside risks from a variety of sources. Some of these risks are common across regions. For example, different possible outcomes of recent trade disputes represent risks to both China and the United States. On the upside, the possibility of reaching a trade deal that relaxes recent tariff measures could boost TFP growth in both regions. On the downside, a further escalation of trade tensions could result in weaker TFP growth. For all regions, there is also an upside risk that digitalization may increase trend TFP more than expected through efficiency gains, automation and new business models (Charbonneau et al. 2017).

In addition to these common risks, our outlook for potential output is subject to several country-specific risks:

- In the **United States**, persistently strong aggregate domestic demand may generate a sustained increase in US potential output growth. A downside risk is that trend TFP growth may not strengthen as assumed if structural factors (e.g., lower business dynamism, greater market power) restrain growth. In addition, potentially restrictive immigration policies may imply lower growth in trend labour input.
- In **China and other oil-importing EMEs**, the pace and impact of ongoing reforms are inherently uncertain and may entail both upside and downside risks to our projected potential growth rates. For China in particular, delays in its campaign to rebalance the economy toward more sustainable growth could result in higher investment and potential output growth than expected.

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<sup>5</sup> This grouping is composed of large emerging markets from Asia, Latin America, the Middle East and Africa (such as India, Brazil and South Africa) as well as newly industrialized economies, such as South Korea.

<sup>6</sup> See Bailliu and Hajzler (2016) for a detailed discussion of structural reforms over 2014–16 and their impact on potential output in large EMEs. More recently, India also adopted a goods and services tax, reformed its bankruptcy laws and launched other banking sector reforms. Brazil reformed its national development bank to improve credit allocation and promote competition and enacted labour market reforms to reduce termination costs and raise part-time employment.

<sup>7</sup> This grouping includes several large oil exporters, such as Russia, Nigeria, Saudi Arabia and Qatar.

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## Appendix: Overview of methodology for estimating potential output

We estimate potential output growth for every region—except for countries in the rest of the world (RoW) block—using a growth accounting framework centred on a Cobb-Douglas aggregate production function. This framework assumes the following relationship between a country’s aggregate output and each factor of production (where  $\% \Delta x$  denotes the percentage change in variable  $x$ ):

$$\% \Delta Y_t = \alpha \% \Delta \left( \frac{K_t}{L_t} \right) + \% \Delta L_t + \% \Delta TFP_t, \quad (1)$$

where  $Y$  is real gross domestic product (GDP),  $K/L$  is real capital stock per worker,  $L$  is labour input,  $TFP$  is total factor productivity and  $\alpha$  is the share of capital income in output.

Country-level capital stocks are constructed using the perpetual inventory method (PIM) based either on national accounts data on gross fixed capital formation or on detailed asset-level investment data, as well as data on average depreciation rates and prices of various asset types.<sup>8</sup> Potential is evaluated based on actual capital stocks because it determines the limits on an economy’s productive capacity today. Labour input is the total number of hours worked in the economy and equals the product of average work hours per person employed, the working-age population, the labour force participation rate and one less the unemployment rate. Finally, TFP growth is calculated as the Solow residual in equation (1) using national accounts data on real GDP growth. Thus, TFP growth captures contributions to productivity from many factors, including global improvements in technology, efficiency gains resulting from domestic innovation, structural reforms, terms-of-trade shocks, financial and geopolitical crises and human capital accumulation.<sup>9</sup>

To abstract from the business cycle, trend levels of labour input and TFP are used to construct potential GDP growth as the sum of the respective input contributions according to the decomposition in equation (1). This notion of potential output coincides with production at full capacity, i.e., the level consistent with full employment and long-run TFP.

Estimates based on the above growth accounting approach appear to understate the impact from the pronounced 2014–15 oil price shock on potential output growth in oil-exporting emerging-market economies (EMEs), resulting in highly persistent negative output gap estimates for the RoW block since 2015. We therefore adopt an alternative approach to estimating potential growth, which now consists of applying an HP-filter to block-level GDP. This methodology yields estimates more in line with the International Monetary Fund (2015) estimated average TFP responses in commodity-exporting EMEs to large commodity price movements.

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<sup>8</sup> Where national accounts investment data are used, geometric depreciation rates for the total capital stock are calculated as the weighted average of depreciation rates across underlying asset classes.

<sup>9</sup> For those regions in which human capital is estimated separately from the Solow residual, the reported potential TFP estimates include contributions from human accumulation.