OECD publishing

THE LONG VIEW: SCENARIOS FOR THE WORLD ECONOMY TO 2060

OECD ECONOMIC POLICY PAPER

July 2018 No. 22

© Victoria Kalinina/shutterstock.com

OECD

BETTER POLICIES FOR BETTER LIVES

Economic Policy Paper No. 22

THE LONG VIEW: SCENARIOS FOR THE WORLD ECONOMY TO 2060

This paper was prepared by:

Yvan Guillemette
David Turner

Authorised for publication by Luiz de Mello

Director, Policy Studies Branch, Economics Department

The OECD Economic Policy Paper Series is published on the responsibility of the Secretary General of the OECD. The opinions expressed and arguments employed herein do not necessarily reflect the official views of the Organisation or of the governments of its member countries.

Series: *OECD Economic Policy Papers*
ISNN:2226583X

On 3 May 2018, the OECD Council invited Lithuania to become a Member. At the time of preparation, the deposit of Lithuania's instrument of accession to the OECD Convention was pending and therefore Lithuania does not appear in the list of OECD Members and is not included in the OECD zone aggregates.

On 25 May 2018, the OECD Council invited Colombia to become a Member. At the time of preparation, the deposit of Colombia's instrument of accession to the OECD Convention was pending and therefore Colombia does not appear in the list of OECD Members and is not included in the OECD zone aggregates.

This document and any map included herein are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area

© OECD 2018

You can copy, download or print OECD content for your own use, and you can include excerpts from OECD publications, databases and multimedia products in your own documents, presentations, blogs, websites and teaching materials, provided that suitable acknowledgment of OECD as source and copyright owner is given. All requests for public or commercial use and translation rights should be submitted to *rights@oecd.org*. Requests for permission to photocopy portions of this material for public or commercial use shall be addressed directly to the Copyright Clearance Center (CCC) at *info@copyright*.com or the Centre français d'exploitation du droit de copie *(CFC) at contact@cfcopies.com*

This paper was written by Yvan Guillemette and David Turner. It draws on the previous work on long-term scenarios referenced below, and on statistical work by Thomas Chalaux and Sylvie Toly. An earlier version of this paper was discussed at meetings of Working Party No.1 (WP1) of the OECD Economic Policy Committee and the OECD Economic Policy Committee. The authors would like to thank the meeting participants, as well as Sebastian Barnes, Luiz de Mello, Åsa Johansson and Zuzana Smidova for comments on earlier versions of the paper. The authors would also like to thank Veronica Humi for editorial assistance and Jeroen Meyer for database assistance. Selected series from the baseline scenario presented herein are available at http://stats.oecd.org/Index.aspx?DataSetCode=EO103_LTB. Other series, as well as data for the alternative scenarios, are available upon request by writing to EcoOutlook@oecd.org.

The following papers contain more methodological details on the long-run projections:

Cavalleri, M. and Y. Guillemette (2017), "A revised approach to trend employment projections in long-term scenarios", *OECD Economics Department Working Papers*, No. 1384, OECD Publishing, Paris, http://dx.doi.org/10.1787/075f0153-en.

Guillemette, Y., A. de Mauro and D. Turner (2018), "Saving, Investment, Capital Stock and Current Account Projections in Long-Term Scenarios", *OECD Economics Department Working Papers*, No. 1461, OECD Publishing, Paris, http://dx.doi.org/10.1787/aa519fc9-en.

Guillemette, Y. and D. Turner (2017), "The fiscal projection framework in long-term scenarios", *OECD Economics Department Working Papers*, No. 1440, OECD Publishing, Paris, http://dx.doi.org/10.1787/8eddfa18-en.

Guillemette, Y. et al. (2017), "A revised approach to productivity convergence in long-term scenarios", *OECD Economics Department Working Papers*, No. 1385, OECD Publishing, Paris, http://dx.doi.org/10.1787/0b8947e3-en.

The following papers present previous versions of long-run scenarios:

Johansson Å. et al. (2013), "Long-Term Growth Scenarios", *OECD Economics Department Working Papers*, No. 1000, OECD Publishing, Paris, http://dx.doi.org/10.1787/5k4ddxpr2fmr-en.

OECD (2014), "Growth Prospects and Fiscal Requirements over the Long Term", in *OECD Economic Outlook, Volume 2014 Issue 1*, OECD Publishing, Paris, http://dx.doi.org/10.1787/eco_outlook-v2014-1-44-en.

Table of contents

THE LONG VIEW: SCENARIOS FOR THE WORLD ECONOMY TO 2060 6

1. Introduction 6
2. The baseline scenario: a continuation of current trends 7
   2.1. World growth slows and the weight of emerging market economies rises 8
   2.2. The world's economic centre of gravity continues to shift towards Asia 12
   2.3. Living standards (real GDP per capita) continue to improve 13
3. Institutional reforms would speed up the convergence of emerging market economies 20
4. The evolution of living standards in the OECD and the potential gains from structural reforms . 24
   4.1. Population ageing will drag down growth in living standards 24
   4.2. Policy reforms have the potential to counteract the negative pressures 25
   4.3. The importance of innovation 32
   4.4. The impact of raising public investment 34
5. Fiscal sustainability in OECD countries 36
   5.1. Low interest rates have eased fiscal pressures, but may not last 36
   5.2. Population ageing will place substantial pressure on OECD public finances 39
   5.3. Structural reforms could alleviate fiscal pressures 43
6. The importance of keeping an open trade regime 44

References 47

Boxes

Box 1. The growth projection and accounting framework 9
Box 2. The determination of saving rates, current account balances and interest rates 38
Box 3. The determination of the main fiscal indicators 40

Main findings

Baseline scenario with no institutional or policy changes

- World trend real GDP growth declines from about 3½ per cent now to 2% in 2060, mainly due to a deceleration of large emerging economies as these continue to account for the bulk of world growth. India and China take up a rising share of world output as the world's economic centre of gravity shifts toward Asia.
- Living standards (real GDP per capita) continue to advance in all countries through 2060 and gradually converge toward those of the most advanced countries, but to varying degrees. Living standards in high-growth emerging market and Eastern European economies converge most, driven by catch-up in trend labour efficiency, but GDP per capita in the BRIICS and some low-income OECD countries remains below half that of the United States in 2060. Demographic change weighs on growth in OECD living standards through 2060.
- Stabilising public debt ratios at current levels while meeting fiscal pressures from higher health spending and demographic change requires the median OECD government to raise primary revenue by 6½ percentage points of GDP by 2060.
- A global saving glut has been putting downward pressure on real interest rates in recent years, a trend that may persist.

Alternative scenarios with institutional or policy reforms

- Relative to OECD countries, the BRIICS have substantial room to improve the quality of governance and raise educational attainment. In a scenario where both factors catch up with average OECD levels by 2060, living standards in the BRIICS are 30% to 50% higher in 2060 than in the baseline scenario.
- Reforms through 2030 to make product market regulation in OECD countries as friendly to competition as in the five leading countries raise living standards by over 8% in aggregate (as much as 15-20% in the countries furthest away from best practices).
- A reform package to improve labour market policy settings in OECD countries up to those of leading countries raises the aggregate employment rate by 6½ percentage points by 2040, mostly via higher youth and female employment. The package raises living standards by 10% by 2060 and helps alleviate future fiscal pressures related to ageing.
- Tying future increases in pensionable ages to life expectancy, as some countries have done, raises the aggregate employment rate of older people in the OECD by more than 5 percentage points by 2060 and living standards by about 2½ per cent by 2060 (as much as 5-7% in countries with currently no explicit plans to change pensionable ages).
- Boosting R&D intensity in all OECD countries to the level of the five leading countries raises aggregate living standards by 6% by 2060 (as much as 10-18% in countries currently spending little on R&D).
- Permanently raising public investment in all OECD countries to 6% of GDP raises aggregate living standards by over 4% by 2060 (as much as 6-9% in some countries). Fiscal burdens rise by much less than the cost of the additional investment and the policy is even self-financing in some countries.
- Slipping back on trade liberalisation – returning to 1990 average tariff rates – depresses long-run living standards by 14% for the world as a whole and as much as 15-25% in the most affected countries.

THE LONG VIEW: SCENARIOS FOR THE WORLD ECONOMY TO 2060

1. Introduction

The OECD Economics Department periodically publishes economic scenarios that extend the normal two-year horizon of the *OECD Economic Outlook* to study medium and longer-term issues.[1] These long-run scenarios have become popular products, perhaps because few scholars or institutions have the temerity to attach numbers to a distant future. This state of affairs was recently decried by Nordhaus (2017[1]) in the context of his work on climate change modelling. He writes that "…economic projections are the least precise parts of [integrated assessment models] and deserve much greater study than has been the case up to now, especially careful studies of long-run economic growth". Indeed, for many economic issues – including the environment, but also population ageing, fiscal sustainability, the catch-up of emerging economies and the effects of structural reforms – a long-term perspective is essential.

This paper presents the first update to the OECD long-term scenarios since 2014, coming after substantial revisions to the methodology. The revisions primarily sought to add channels to the model through which policies and institutions could affect long-run outcomes and, wherever possible, to incorporate recent OECD work quantifying the effects of policy reforms.[2] Hence, besides the baseline scenario, the paper emphasises alternative scenarios which illustrate the potential medium and long-term impact of policy changes.

A few points should be kept in mind from the outset. First, the poor accuracy of short-run economic forecasts, including those of the OECD, should not be invoked to discount the usefulness of long-run scenarios. The difference between a short-run and a long-run economic outlook is akin to the difference between a weather forecast and a climate scenario. High-frequency fluctuations can largely be ignored in an exercise focused instead on identifying and projecting slow-moving trends. Second, the scenarios are not meant to provide a realistic forecast of the future. They are conditional on a number of hypotheses and omit some important factors, such as the environment (see Box 1). Instead, they are meant to illustrate some of the forces that could shape the medium and long-term outlook for the world economy, in particular policies, so as to inform discussion. Third, long-run scenarios are useful, but not always sufficient, to provide country-specific policy recommendations, which must take account of particular economic and policy contexts that cannot be fully incorporated into such a stylised exercise. Fourth, differences in economic outcomes between the baseline and alternative scenarios incorporating policy changes should not be interpreted as reflecting pure one-

1. The last instance is OECD (2014[47]), which was also used in the context of the broader OECD@100 project (Braconier, Nicoletti and Westmore, 2014[45]).

2. See the schematic figure in Box 1 for a summary of the policy channels that have been introduced since the last vintage of the long-term model described in Johansson et al. (2013[52]).

way causation from policies to outcomes. In reality, causation typically runs both ways, so the coefficients linking policies and outcomes incorporated in the long-term model should be understood as adding realism to the scenarios, in the sense of respecting estimated historical correlations. Fifth and finally, the long-run scenarios focus on GDP per capita as a measure of living standards and leave out many other aspects of well-being. Measures of education and health are important inputs to the long-term scenarios, but they are not endogenous to economic outcomes and many other quality of life determinants are, at least for now, left out of the analysis. The long-term model must be used, as it has been in the past, in conjunction with other projection modules – for the environment, income inequality, trade specialisation, etc. – to get a full picture of the likely evolution of well-being.

The paper is structured as follows. Section 2 first presents the most salient features of the no-policy change baseline scenario. One is a slowdown in headline growth for the world as a whole, and a more modest slowdown in GDP per capita growth. Another is the continued catch-up of large emerging market economies and their rising share of the world's economic pie. Section 3 illustrates how catch-up in emerging market economies could be even quicker with better governance and larger gains in educational attainment. Section 4 looks at the evolution of living standards in OECD countries in the baseline scenario, and then illustrates with alternative scenarios the potential for policy reforms to brighten the outlook. Section 5 takes up the question of fiscal sustainability in OECD countries, illustrating the substantial increase in tax burdens likely to be required to stabilise public debt ratios in the context of population ageing, and the potential for policy reforms to alleviate fiscal pressures. Finally, section 6 illustrates the negative impact on worldwide prosperity that rising trade protectionism could have.

2. The baseline scenario: a continuation of current trends

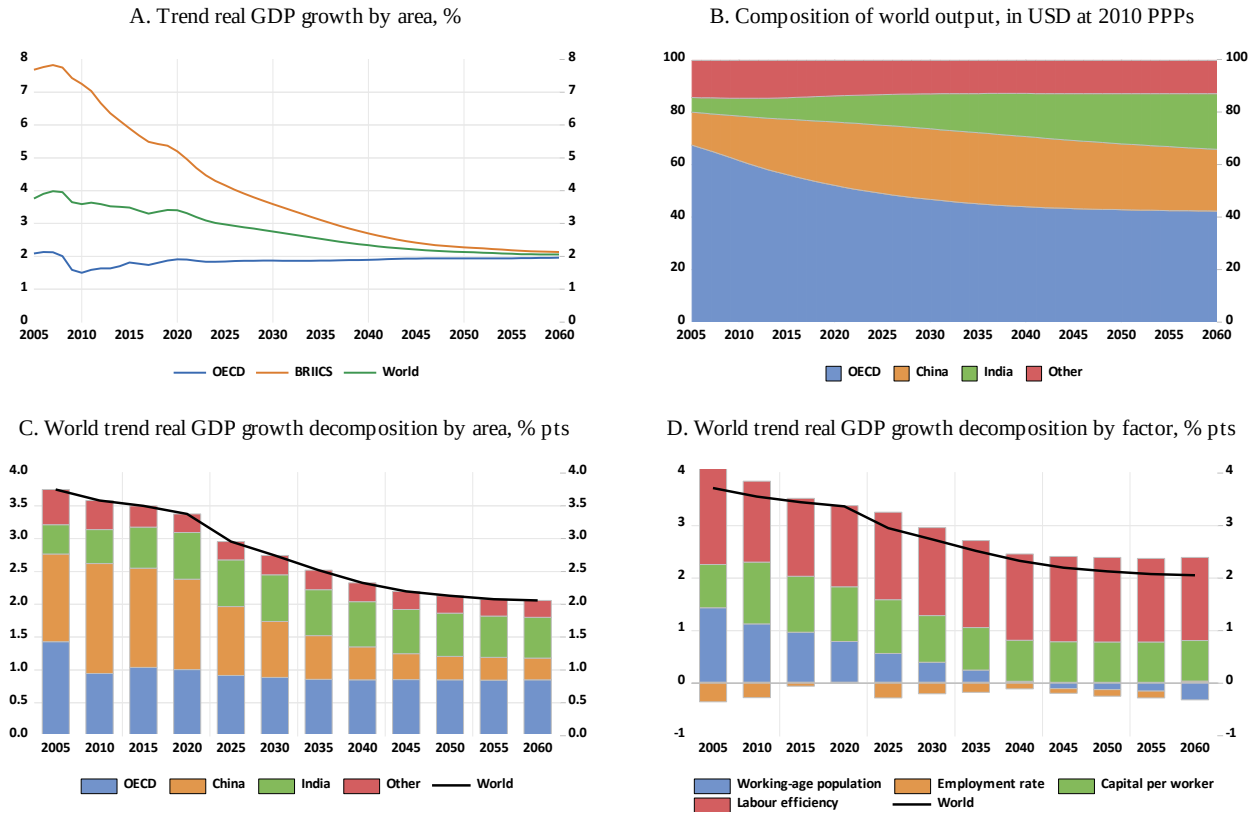
Because it is intended to provide a point of reference for the discussion of other scenarios involving various reforms, the baseline scenario assumes essentially no change to initial institutional and policy settings over the projection period. This approach may be said to lack realism in that tensions are allowed to accumulate (in particular fiscal pressures) or obvious reform opportunities are not seized upon. It does, however, make it easier to illustrate the impact of reform packages than with a baseline incorporating speculation about likely reforms. The two exceptions to the no policy-change rule are for rising average educational attainment – because younger generations acquire more education and gradually replace older ones[3] – and rising social protection spending by emerging market governments – considered to be the flipside of the fall in investment and private saving rates that are bound to accompany these countries' development. Boxes 1 to 3 summarise the main features of the long-term model and provide references where more details can be found.

3. The source for educational attainment projections is the SSP2 scenario of Lutz, Butz and KC (2014[2]), which combines medium fertility, mortality and migration assumptions (similar to the population projections used in the long-term model) with their Global Education Trend (GET) scenario. The GET is a moderately optimistic scenario, considered most likely, which assumes that countries will follow the average path of educational expansion that other countries already further advanced in this process have experienced.

2.1. World growth slows and the weight of emerging market economies rises

Perhaps the most salient feature of the baseline scenario is the continued slowdown in world trend real GDP growth (Figure 1, Panel A).[4] From a rate of 3.4% at the start of the projection period in 2019, it decelerates for the next four decades, driven by slowing growth in the large emerging market economies (Brazil, Russia, India, Indonesia, China and South Africa, henceforth BRIICS). Growth in the BRIICS nevertheless remains well above that of the OECD area until the end of the projection period. As a consequence, the share of OECD output in world output, which has already fallen from 72% in 2000 to just below 54% now when valued at 2010 Purchasing Power Parities, declines to 43% by 2060 (Figure 1, Panel B). China's share of world output peaks during the 2030s at about 27% and declines slowly thereafter, while India's share keeps rising. Each accounts for a fifth to a quarter of the world economy in 2060.

Figure 1. The baseline scenario in a snapshot



StatLink http://dx.doi.org/10.1787/888933776122

Note: 'World' refers to an aggregate of the 46 countries included in the long-term model, which today account for about 82% of world output measured at purchasing power parities (see Box 1 for the list).

4. 'World' in this paper refers to an aggregate of the 46 countries included in the long-term model, which today account for about 82% of world output measured at purchasing power parities (see Box 1 for the list).

Box 1. The growth projection and accounting framework

Model coverage

The long-term model includes 46 countries: the 35 OECD member countries, eight non-OECD G20 countries (Argentina, Brazil, China, India, Indonesia, Russia, Saudi Arabia and South Africa) and three other accession or partner countries (Colombia, Costa Rica and Lithuania). For the purpose of balancing global saving and investment, the model also includes the current account balance of the *OECD Economic Outlook*'s OIL region.

Potential output projection

The backbone of the model is a consistent set of long-run projections for potential output which are extensions of the short-term potential output estimates prepared for the twice-yearly *OECD Economic Outlook*. Potential output (*Y*) is based on a Cobb-Douglas production function with constant returns to scale featuring physical capital (*K*) and trend employment (*N*) as production factors plus labour-augmenting trend technological progress (*E*, hereafter referred to as trend labour efficiency[1]), so that:

$$y = \alpha(n + e) + (1 - \alpha)k$$

where lower case letters denote logarithms and α is the wage share, assumed to be 0.67 for all countries.[2] Potential output is projected out to 2060 by modelling the trend input components as follows:

- Trend labour efficiency growth is determined in a conditional convergence framework. In the long-run it converges to an assumed exogenous rate of global technological progress (1½ per cent per annum). In steady state, the equilibrium level of labour efficiency depends on the particular institutional and policy environment of each country represented by: a broad governance indicator (the World Bank's rule of law indicator); the stock of human capital (mean years of schooling in the population aged 15 and over adjusted for decreasing marginal returns to education); the extent to which product market regulation promotes competition (the OECD's PMR index); stability of the macroeconomic environment (based on the level and volatility of inflation); trade openness (adjusted for population size); domestic and global R&D stocks; and income inequality (the GINI coefficient). Two of these indicators – governance and trade openness – affect not only the equilibrium labour efficiency level but also the speed at which countries converge to this level. For average values of both indicators, the speed of convergence is about 2.3%, meaning that this proportion of the distance between the current labour efficiency level and the equilibrium is eliminated each year. Convergence is also influenced by momentum given current estimates of trend labour efficiency growth specific to each country. The baseline scenario assumes no change to explanatory variables, except for educational attainment, as projected by Lutz, Butz and KC (2014[2]), and trade openness, which evolves endogenously over the projection period. For more details on the productivity convergence framework see Guillemette et al. (2017[3]).
- The evolution of trend employment is primarily the result of three sets of dynamics: the evolving size of the working-age population; its age composition; and trends in the employment rates of different age/sex groups. The size and composition of the working age population (15-to-74 year-olds) follows the

population projections of Eurostat (for most European countries) and the United Nations (for all other countries) and are considered exogenous for this exercise. Trends in the employment rates of different age/sex groups are obtained by applying a cohort approach to cyclically-adjusted historical employment rates. These generational trends reflect societal changes such as rising female employment rates, but also structural changes such as higher educational attainment. Projected changes in potential employment arise from differences in the employment propensities of different cohorts combined with shifts in the demographic structure of the population. To take into account the impact of recent and future policy changes on trend employment rates, the approach also integrates recent OECD empirical work on the impacts of structural reforms (Égert and Gal, 2017[4]; Gal and Theising, 2015[5]). For the baseline scenario, only already-legislated future changes in legal retirement ages are considered, but alternative scenarios can incorporate a number of policy shocks. For more on the trend employment projection framework, see Cavalleri and Guillemette (2017[6]).

- The productive capital stock is notionally split between private and public sector capital stocks. The public sector capital stock-to-output ratio is assumed to be constant in the baseline scenario and thus does not affect the projection, but public investment shocks can be simulated in alternative scenarios. The evolution of the business sector capital stock depends on the economy's cyclical position, incorporates a measure of inertia, and may be constrained by current account deficits depending on the degree of capital account openness. The projection equation also ensures that in steady state, the capital-to-output ratio is stable, so that the growth contribution from changing capital intensity is usually modest, in line with a stylised fact from growth decompositions (Jones, 2015[7]). The projection also incorporates influences from product market regulation, employment protection legislation and the user cost of capital, the latter changing somewhat in the baseline scenario following the path of interest rates, while the two other variables are assumed fixed. Business sector investment is derived from the capital stock projection via the stock-flow identity using a simple projection rule for the depreciation rate. Housing is excluded from the definition of the productive capital stock, and the housing investment share in GDP is assumed to gradually converge to a long-run historical average. For more on the capital stock projection framework, see Guillemette, de Mauro and Turner (2018[8]).

Decomposition of per capita GDP growth

A convenient expository decomposition (used in Table 1 in the main text) is to divide changes in GDP per capita, a crude metric for living standards, into productivity, capital intensity and labour utilisation components:

$$\Delta(y-p) = \alpha\Delta e + \{1-\alpha\}\Delta(k-n) + \Delta(n-pwa) + \Delta(pwa-p)$$

where P is total population, PWA is population of working age, taken to be those aged 15 to 74, and lower-case letters again denote logarithms. The first term on the right-hand side of this equation measures the contribution of labour efficiency growth to GDP per capita growth, the second term measures the contribution of capital intensity (capital per worker), the third picks up the contribution of the employment rate and the last term indicates the contribution of the share of the population that is of working-age, a summary indicator of the demographic structure of the population.

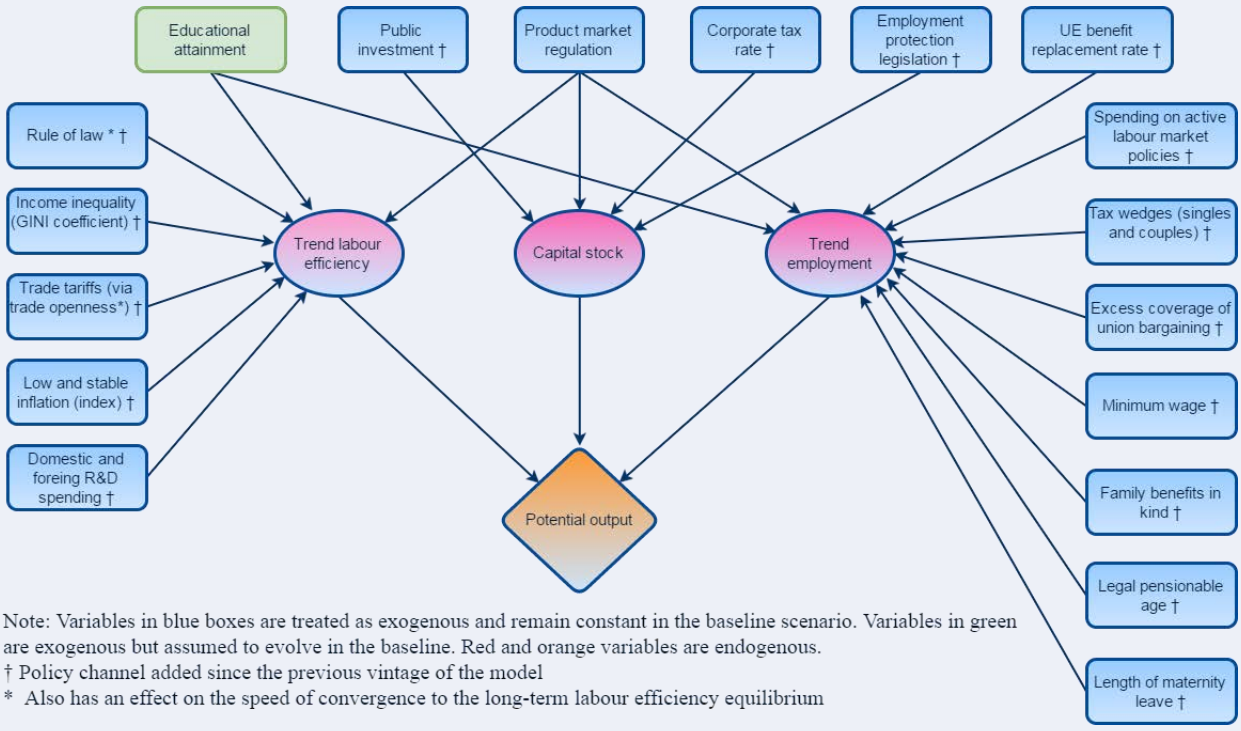
Exchange rate for currency conversion

When comparing levels across countries, GDP and GDP per capita are expressed in United States dollars (USD) at fixed 2010 Purchasing Power Parity (PPP) exchange rates.

Main policy channels in the model

This diagram illustrates the policy channels incorporated in the long-term model:

Policy channels in the long-term model



Note: Variables in blue boxes are treated as exogenous and remain constant in the baseline scenario. Variables in green are exogenous but assumed to evolve in the baseline. Red and orange variables are endogenous.
† Policy channel added since the previous vintage of the model
* Also has an effect on the speed of convergence to the long-term labour efficiency equilibrium

Missing features

Despite the progress made on the model since the last vintage of the long-run scenarios in 2014, it should be noted that important aspects are still missing, particularly in the context of a projection over several decades. Perhaps the most important omission is that of the natural environment, including natural resources, air and water quality, the climate, sea levels and so on. Continued warming of the earth's climate, to take one example, could have profound economic effects that vary by region. Another omission is financial markets, which are a source of important vulnerabilities for the world economy. As regards such missing elements, the projections should be seen as incorporating the implicit assumption that they remain unchanged from their current states.

---

1. In this framework, labour efficiency (E) and total factor productivity (TFP) – that part of output not explained by factor inputs – are closely related but distinct concepts: $TFP = E^{\alpha}$.
2. This parameter value roughly corresponds to the wage share in advanced economies and has proven to be quite stable in time. This is less true of emerging market economies, however, and future work could consider the consequences of allowing the wage share to vary across country, through time, or both.

Together, China and India already account for the bulk of the world's economic expansion (Figure 1, Panel C). With a contribution of 1.4 percentage points to world trend real GDP growth, China currently makes a bigger contribution to world growth than the OECD area, a situation that persists until the early 2030s. By the mid-2030s, India's growth contribution surpasses that of China, so India makes the largest growth contribution of any individual country. By the end of the projection period, China and India's gradual slowdown brings their combined growth contribution roughly in line with that of the OECD area.

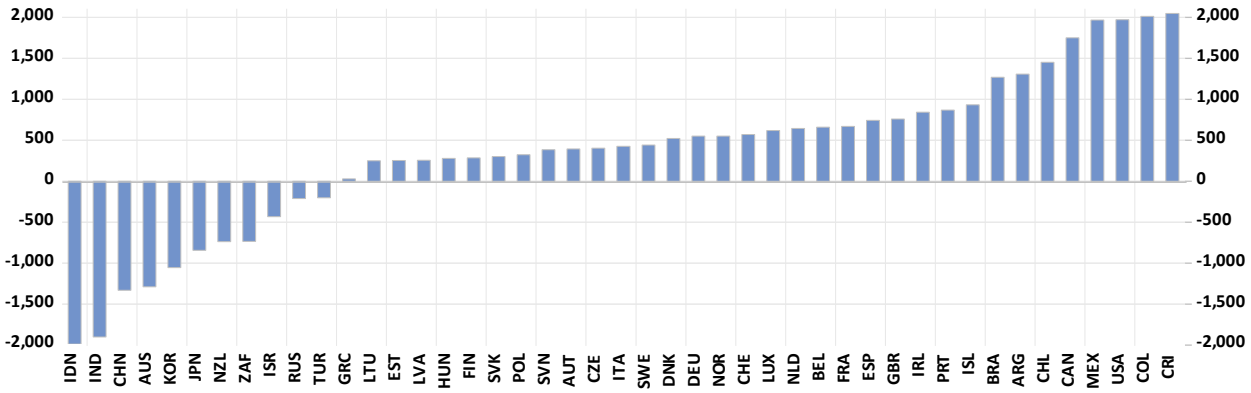
In the baseline scenario, the slowdown of world trend real GDP growth in coming decades is driven in large part by demographics (Figure 1, Panel D). First, expansion of the working-age population, which as recently as 2007 was contributing 1¼ percentage point per annum to real GDP growth, continues to slow. Its growth contribution vanishes by 2040 and turns negative thereafter. Second, population ageing also weighs on the aggregate employment rate (employment as a percentage of the population of working age) because older people tend to have lower employment rates than middle-aged people. This effect is relatively weak but is strongest in the coming decade as the last cohorts of the baby-boom generation finish their working lives.

2.2. The world's economic centre of gravity continues to shift towards Asia

One consequence of the rising importance of emerging markets in the world economy, notably China and India, but also Indonesia, is that the centre of gravity of world economic activity continues to move from North America and Europe toward Asia. Therefore, countries that are geographically closer to these large markets become less economically remote. These trends are captured in the long-term model via a 'remoteness' variable, which is a weighted average measure of geographic distance to other countries in the model, the weights being these other countries' shares of world GDP. As economic activity shifts toward Asia in the baseline scenario, North and South American countries become more economically remote, while countries in Asia and Oceania become less remote (Figure 2). European countries become slightly more remote. As is conventional in trade gravity equations, remoteness affects trade openness (i.e. trade intensity) and, in the long-term model, trade openness in turn affects trend labour efficiency. Declining remoteness therefore contributes positively to trend labour efficiency growth in Asia-Pacific countries, while increasing remoteness weighs on labour efficiency growth in American and, to a lesser extent, European countries. These effects are modest and slow-acting, however. For instance, by 2060 falling remoteness boosts openness in Australia by about 8 percentage points of GDP, and the level of labour efficiency by about 3%.

Figure 2. Change in remoteness by 2060 in the baseline scenario

Weighted average distance to export markets in kilometres

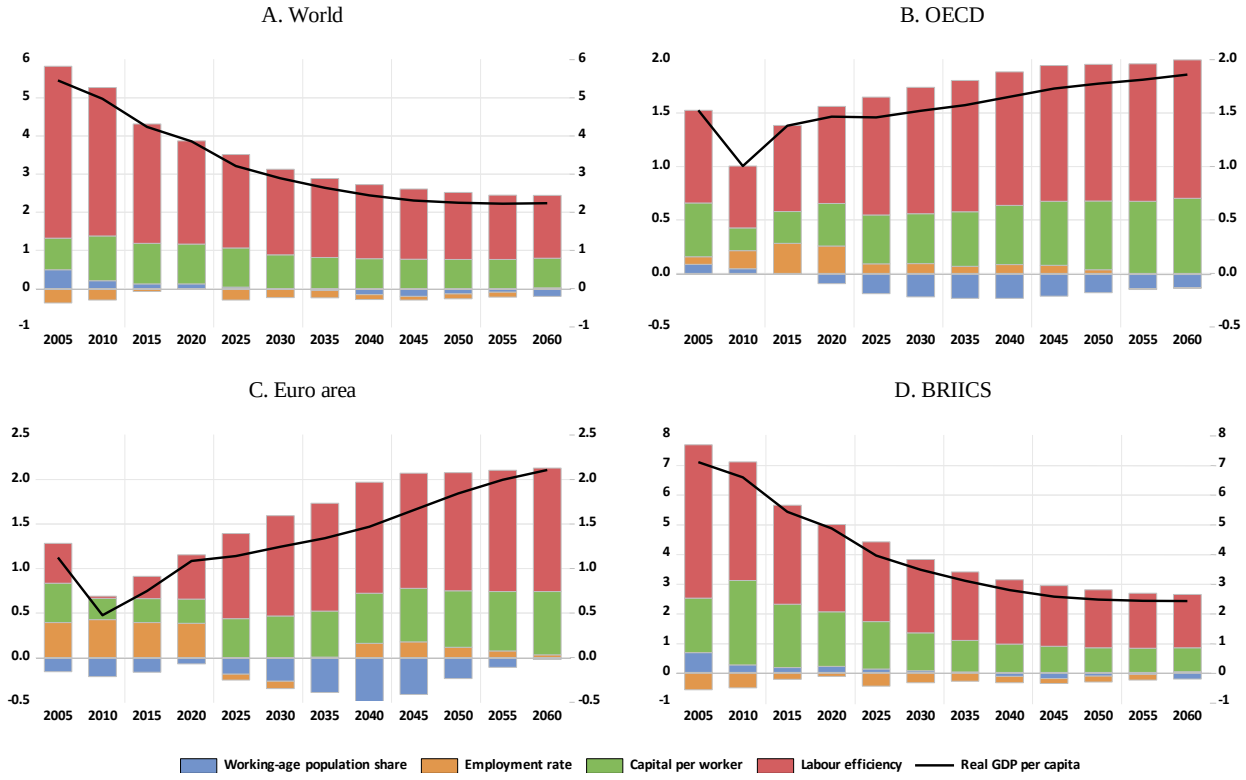


StatLink http://dx.doi.org/10.1787/888933776141

2.3. Living standards (real GDP per capita) continue to improve

Global trend real GDP per capita growth decelerates in the baseline scenario, driven by a deceleration in the BRIICS, but demographics is a less prominent part of the story. When focusing on a per capita metric, which is more relevant for living standards, it is the share of the working-age population within the total population that matters in the growth decomposition rather than the growth rate of the working-age population per se, and while the demographic story is visible in the small negative growth contributions of the working-age population share and the employment rate, the slowdown in trend labour efficiency growth largely dominates at the global level (Figure 3, Panel A). The regional stories differ in important aspects, however. The global deceleration in trend labour efficiency growth stems essentially from the large emerging market economies, where demographic factors are present but comparatively small (Figure 3, Panel D). On the other hand, a falling working-age population share eventually subtracts up to ¼ point to real GDP per capita growth in the OECD area, and up to ½ point in the euro area, significant headwinds given slower progression of living standards in these regions (Figure 3, Panels B and C). Growth in living standards nevertheless accelerates in the OECD and euro areas given the continuing recovery in trend labour efficiency growth.

Figure 3. Trend real GDP per capita growth, per cent



StatLink http://dx.doi.org/10.1787/888933776160

Note: 'World' refers to an aggregate of the 46 countries included in the long-term model, which today account for about 82% of world output measured at purchasing power parities (see Box 1 for the list).

Living standards continue to advance in all countries through 2060, although to varying degrees (Table 1 and Figure 4). Several factors explain the differing patterns of growth in real GDP per capita across countries. As already mentioned, the first is demographics. Over the 2018-to-2030 period, the change in the share of the population that is of working age subtracts about a quarter of a percentage point from GDP per capita growth in both the euro area and the OECD, whereas it adds a tenth of a point to growth in the BRIICS. The growth contribution is most positive in India, Indonesia and South Africa (about 0.3 percentage points) and most negative in Japan (-½ percentage point). The changing active population share also contributes negatively to growth in China over this period, whereas it was adding one percentage point to growth over the 2000-to-2007 period. Over the second part of the projection period (2030-2060), the contribution of the active population share remains the same in the OECD area but turns slightly negative in the BRIICS as population ageing takes hold there as well. Only India and South Africa continue to enjoy slight positive growth contributions from the population age structure, whereas Korea, Spain and Greece experience as much as a ½ percentage point per annum drag to growth in living standards.

Table 1. The sources of potential real GDP per capita growth in the baseline scenario

Per cent per annum

	Potential GDP per capita				Trend labour efficiency				Capital per worker				Potential employment rate				Share of active population			
	2000-07	2007-18	2018-30	2030-60	2000-07	2007-18	2018-30	2030-60	2000-07	2007-18	2018-30	2030-60	2000-07	2007-18	2018-30	2030-60	2000-07	2007-18	2018-30	2030-60
Australia	1.8	1.3	1.4	2.0	0.6	0.4	1.0	1.5	0.5	0.7	0.5	0.7	0.5	0.2	0.1	0.0	0.1	0.0	-0.2	-0.1
Austria	1.7	0.7	0.8	1.7	0.7	0.1	0.7	1.3	0.5	0.2	0.3	0.6	0.5	0.4	0.0	0.0	0.1	0.0	-0.2	-0.2
Belgium	1.5	0.6	1.0	1.9	0.2	0.0	0.8	1.4	0.8	0.5	0.5	0.6	0.6	0.2	-0.1	0.0	-0.1	-0.1	-0.1	-0.2
Canada	1.6	0.9	0.9	1.5	0.5	0.4	0.9	1.1	0.4	0.5	0.4	0.5	0.5	0.0	-0.1	0.0	0.2	0.0	-0.3	-0.2
Chile	3.0	2.6	1.7	1.7	0.9	0.0	0.6	1.3	0.7	1.3	0.7	0.6	0.7	1.0	0.4	0.1	0.6	0.3	0.0	-0.2
Czech Republic	3.8	1.6	2.6	1.8	2.9	1.1	2.0	1.4	0.6	0.3	0.6	0.8	0.1	0.4	0.3	-0.1	0.2	-0.3	-0.4	-0.3
Denmark	1.1	0.4	1.1	1.8	0.4	0.3	0.9	1.2	0.6	0.2	0.3	0.6	0.2	-0.2	0.2	0.1	0.0	0.1	-0.3	-0.1
Estonia	6.1	2.0	2.5	1.6	2.8	0.5	1.5	1.3	2.5	1.0	0.8	0.6	0.5	1.0	0.4	0.0	0.2	-0.4	-0.1	-0.3
Finland	2.3	0.4	1.1	1.6	1.2	0.1	0.8	1.0	0.3	0.2	0.4	0.5	0.7	0.1	0.3	0.2	0.0	-0.1	-0.4	-0.1
France	1.1	0.7	1.1	1.9	0.5	0.4	0.9	1.4	0.4	0.3	0.4	0.6	0.3	0.1	0.1	0.1	-0.1	-0.1	-0.3	-0.1
Germany	1.2	1.0	1.2	1.6	0.6	0.5	1.0	1.2	0.3	-0.1	0.3	0.6	0.4	0.9	0.1	0.0	-0.1	-0.3	-0.2	-0.2
Greece	2.1	-0.4	1.4	1.4	0.9	-0.7	0.8	1.3	0.8	0.0	0.4	0.3	0.7	0.4	0.2	0.3	-0.3	-0.2	0.1	-0.5
Hungary	3.2	1.8	2.7	1.6	2.1	0.6	1.4	1.3	1.2	0.5	0.8	0.6	-0.2	0.9	0.9	-0.1	0.1	-0.2	-0.4	-0.3
Iceland	2.5	1.4	1.9	2.1	1.4	1.2	1.2	1.4	0.9	-0.1	0.5	0.8	0.0	0.2	0.2	0.1	0.2	0.1	-0.1	-0.2
Ireland	3.0	3.8	2.2	2.0	0.8	1.5	1.2	1.5	1.3	2.6	0.9	0.7	0.7	-0.1	-0.1	0.0	0.2	-0.3	0.1	-0.3
Israel	1.4	1.8	2.2	1.9	0.8	0.8	1.0	1.2	0.2	0.1	0.8	0.5	0.4	0.9	0.4	0.1	0.0	0.0	0.1	0.0
Italy	0.4	-0.3	0.7	1.6	-0.4	-0.3	0.6	1.3	0.5	-0.1	0.2	0.5	0.6	0.3	-0.1	0.1	-0.3	-0.2	-0.1	-0.4
Japan	0.6	0.7	1.4	1.8	0.5	0.6	1.1	1.4	0.5	0.0	0.2	0.7	-0.1	0.5	0.6	0.1	-0.3	-0.4	-0.5	-0.3
Korea	3.9	3.0	2.3	1.7	1.8	1.3	1.3	1.5	1.5	0.9	0.9	0.6	0.3	0.6	0.5	0.2	0.4	0.2	-0.4	-0.6
Latvia	7.4	2.9	3.0	1.6	2.9	0.9	1.9	1.3	3.4	1.6	1.2	0.6	0.7	0.9	0.1	0.1	0.4	-0.5	-0.3	-0.4
Luxembourg	2.2	0.5	1.0	2.0	0.1	-0.1	0.9	1.5	0.1	0.1	0.2	0.8	1.9	0.3	0.1	0.0	0.0	0.2	-0.2	-0.2
Mexico	0.8	1.1	1.7	1.9	0.1	0.4	1.1	1.3	-0.1	0.0	0.2	0.7	0.2	0.1	0.0	0.0	0.6	0.6	0.3	-0.1
Netherlands	1.6	0.9	1.4	2.0	0.8	0.6	1.1	1.3	0.3	0.2	0.4	0.7	0.6	0.0	0.2	0.2	0.0	0.1	-0.4	-0.1
New Zealand	2.1	1.3	1.6	1.9	0.5	0.4	0.9	1.3	0.5	0.4	0.6	0.6	0.9	0.4	0.3	0.1	0.2	0.1	-0.2	-0.1
Norway	2.3	1.0	1.0	1.6	1.5	0.6	0.9	1.3	0.3	0.2	0.4	0.6	0.4	-0.1	-0.1	-0.1	0.2	0.3	-0.2	-0.1
Poland	3.9	3.2	2.5	1.3	2.5	1.5	1.6	1.3	0.9	1.1	0.9	0.6	0.1	0.7	0.2	-0.2	0.4	0.0	-0.2	-0.4
Portugal	1.3	0.7	1.7	1.9	-0.1	0.1	0.9	1.5	1.5	0.7	0.5	0.5	0.0	0.0	0.4	0.2	-0.1	-0.1	-0.1	-0.4
Slovakia	5.2	2.8	3.0	1.9	4.2	1.7	2.0	1.5	0.9	0.5	0.8	0.7	-0.4	0.5	0.4	0.1	0.5	0.0	-0.3	-0.4
Slovenia	3.0	1.2	1.4	1.6	1.5	1.0	1.5	1.4	1.0	0.3	0.6	0.6	0.5	0.3	-0.4	0.0	0.1	-0.4	-0.2	-0.4
Spain	1.7	0.7	1.1	1.4	-0.1	0.0	0.7	1.4	0.7	0.7	0.5	0.5	1.2	0.2	-0.1	0.1	-0.2	-0.2	0.0	-0.6
Sweden	2.2	1.0	1.4	1.7	1.4	0.7	1.1	1.3	0.5	0.3	0.6	0.6	-0.1	0.1	0.1	-0.1	0.3	-0.1	-0.3	-0.1
Switzerland	1.3	0.7	0.9	1.6	0.7	0.4	0.8	1.3	0.3	-0.1	0.4	0.6	0.1	0.5	0.0	0.0	0.2	0.0	-0.3	-0.3
Turkey	2.8	4.6	3.6	2.5	1.5	1.6	1.4	1.4	1.3	1.1	1.2	0.8	-0.5	1.6	0.7	0.4	0.4	0.3	0.3	-0.1
United Kingdom	1.7	0.6	1.1	1.8	0.7	0.1	0.8	1.4	0.6	0.5	0.5	0.6	0.2	0.1	0.0	0.1	0.2	-0.1	-0.2	-0.2
United States	1.5	1.0	1.1	1.5	1.1	0.9	1.0	1.1	0.6	0.3	0.4	0.5	-0.3	-0.3	-0.1	0.0	0.2	0.1	-0.3	-0.1
Euro area	1.3	0.7	1.1	1.7	0.5	0.2	0.9	1.3	0.5	0.2	0.4	0.6	0.5	0.4	0.0	0.1	-0.1	-0.2	-0.2	-0.3
OECD	1.6	1.3	1.5	1.7	0.9	0.7	1.1	1.3	0.5	0.3	0.4	0.6	0.1	0.2	0.1	0.0	0.1	0.0	-0.2	-0.2

Table 1. The sources of potential real GDP per capita growth in the baseline scenario (Cont.)

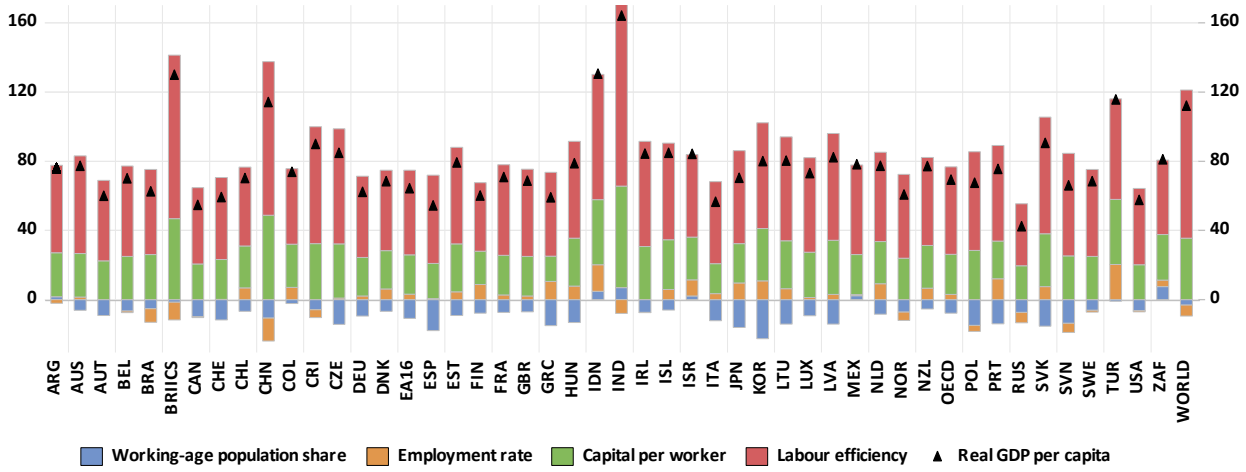
Per cent per annum

	Potential GDP per capita				Trend labour efficiency				Capital per worker				Potential employment rate				Share of active population			
	2000-07	2007-18	2018-30	2030-60	2000-07	2007-18	2018-30	2030-60	2000-07	2007-18	2018-30	2030-60	2000-07	2007-18	2018-30	2030-60	2000-07	2007-18	2018-30	2030-60
Argentina	2.0	1.9	2.0	1.8	1.1	1.3	1.1	1.2	-0.8	0.4	0.6	0.6	1.4	0.1	0.0	-0.1	0.2	0.2	0.2	0.0
Brazil	1.8	1.8	1.4	1.5	2.1	1.4	1.0	1.3	-0.4	0.1	0.4	0.7	-0.6	-0.1	-0.1	-0.2	0.6	0.5	0.1	-0.2
China	9.8	7.7	4.2	2.2	6.3	4.2	2.7	1.9	3.3	3.7	2.0	0.8	-0.8	-0.3	-0.5	-0.2	1.0	0.0	-0.1	-0.3
Colombia	3.0	3.0	1.8	1.7	1.9	0.6	0.6	1.2	0.7	1.1	0.7	0.6	-0.2	0.8	0.3	0.1	0.7	0.5	0.2	-0.2
Costa Rica	3.1	2.5	2.6	2.0	1.3	1.4	1.9	1.5	0.5	0.9	0.6	0.8	0.5	-0.2	0.0	-0.2	0.8	0.5	0.1	-0.2
India	6.0	6.0	5.3	3.5	4.1	3.8	3.3	2.3	1.9	2.3	1.8	1.3	-0.6	-0.6	-0.2	-0.2	0.5	0.6	0.3	0.1
Indonesia	2.9	4.1	3.6	3.0	2.3	2.4	1.9	1.7	0.3	0.9	1.0	0.9	0.0	0.5	0.4	0.4	0.2	0.3	0.3	0.0
Lithuania	7.4	3.5	2.8	1.6	4.2	1.2	1.7	1.3	2.8	1.4	1.3	0.4	0.0	1.1	0.2	0.2	0.3	-0.2	-0.3	-0.4
Russia	6.0	1.5	0.5	1.2	3.5	0.0	0.3	1.1	1.2	1.4	0.7	0.4	1.0	0.6	-0.4	-0.1	0.4	-0.5	-0.1	-0.2
South Africa	2.0	1.1	1.5	2.1	1.9	0.3	0.5	1.3	0.1	0.2	0.3	0.8	-0.4	0.3	0.4	0.0	0.5	0.3	0.3	0.1
Non-OECD	7.2	5.9	4.1	2.7	5.3	3.7	2.7	2.1	1.8	2.4	1.6	0.9	-0.6	-0.3	-0.3	-0.2	0.6	0.2	0.1	-0.1
BRIICS	7.2	6.1	4.2	2.7	5.2	3.7	2.8	2.1	1.9	2.5	1.6	0.9	-0.6	-0.3	-0.3	-0.2	0.6	0.2	0.1	-0.1
G20	5.7	4.8	3.5	2.5	4.7	3.7	2.6	1.9	0.9	1.2	1.1	0.8	-0.4	-0.2	-0.2	-0.1	0.5	0.2	0.1	-0.1
World	5.6	4.6	3.4	2.4	4.6	3.5	2.5	1.9	0.9	1.1	1.0	0.8	-0.4	-0.2	-0.2	-0.1	0.5	0.2	0.1	-0.1

StatLink http://dx.doi.org/10.1787/888933776635

Note: Starting year for decomposition is 2001 for South Africa, euro area and OECD; 2002 for Lithuania, Colombia, BRIICS and G20; and 2003 for Non-OECD and World. 'World' refers to an aggregate of the 46 countries included in the long-term model, which today account for about 82% of world output measured at purchasing power parities (see Box 1 for the list). The first column is the sum of the following four columns, with differences due to rounding. See Box 1 for an algebraic explanation of the decomposition.

Figure 4. Per cent increase in real GDP per capita between 2018 and 2060



StatLink http://dx.doi.org/10.1787/888933776179

In both the euro and OECD areas, the growth contribution of potential employment is essentially zero over the projection period, even though population ageing can also affect the potential employment rate. The larger the differences between entry/exit rates into/from employment of different age cohorts, and the larger the size differences between cohorts, the more the aggregate employment rate changes over time in the baseline scenario as various cohorts progress through their active life cycles. Population ageing tends to drag down the aggregate employment rate because older cohorts (55-74) tend to have lower employment rates than prime-age cohorts (25-54). In most countries, this effect is offset to an extent by rising aggregate female employment rates as younger female cohorts with higher employment rates replace older ones that exhibited lower employment rates. This effect is strong in Portugal, New Zealand, Korea, Japan and Turkey for instance, so these countries continue to enjoy positive growth contributions from the aggregate employment rate over the 2018-to-2030 period. In some other countries where female employment has not been rising as much – sometimes because it was already relatively high, as in Slovenia – then this offsetting effect is weaker, the growth contribution of the employment rate is lower and can be negative when the ageing effect dominates. In India and China, male employment rates are already high and the limited information available suggests that female employment rates have been falling. The growth contributions of potential employment therefore remain negative over the projection period in these countries and for the BRIICS area overall, highlighting the potential for policy-induced gains.

The largest contributor to the progression of living standards in the baseline scenario, and the largest differences across countries, come from growth in trend labour efficiency. In the very long run trend labour efficiency growth converges to an assumed exogenous rate of technological progress of 1½ per cent per annum, a mid-point between the weak performance recorded in advanced countries since the global financial and economic crisis and the stronger rates measured in earlier decades. However, two factors explain differences in labour efficiency growth rates over the projection period.

1. The first is momentum: the contemporaneous estimate of trend labour efficiency growth (which underlies near-term estimates of potential output growth in the *OECD Economic Outlook*) is assumed to evolve only slowly toward the rate

determined by convergence and global technological progress, for one practical and one theoretical reason. The practical reason is to ensure smoothness at the jump-off point for this variable and many other variables that depend directly or indirectly on it. The theoretical reason is that in the conditional convergence framework, the current trend labour efficiency growth rate is a function of the distance to equilibrium labour efficiency determined by fundamentals. With a relatively slow average convergence speed of a little over 2% per year, trend labour efficiency growth evolves only slowly toward the equilibrium rate.

2. The second factor is assumed changes to institutional and policy fundamentals over the projection period that change the equilibrium level of labour efficiency. In the baseline scenario, only average educational attainment is assumed to change significantly over the projection period.

Momentum therefore takes on special importance in explaining differences in trend labour efficiency growth across countries in the near term, and changes to educational attainment takes on greater importance over the medium to long term. Accordingly, as concerns trend labour efficiency in the baseline scenario, countries can be placed into four broad categories:

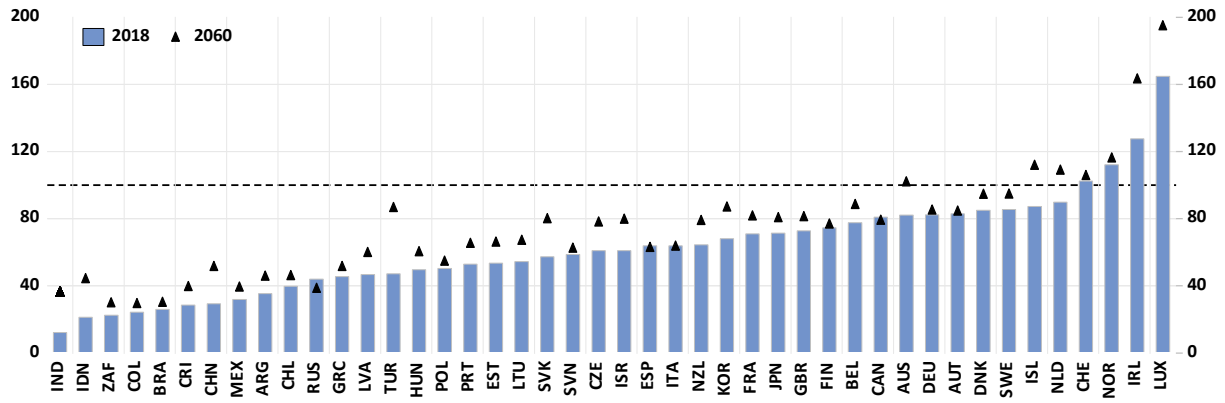
- *The high-growth emerging market economies*. High initial trend labour efficiency growth in China, India and Indonesia indicate strong catch-up momentum and still important gaps between current and equilibrium labour efficiency levels. High growth rates persist in the near term but decline gradually as gaps narrow. Average educational attainment improves significantly more in India than in China or Indonesia, which explains why trend labour efficiency growth remains higher in India in the latter part of the projection period. Nevertheless, labour efficiency levels in 2060 remain well below those of most OECD countries, for reasons discussed in the next section.
- *The low-growth emerging market economies*. Lower initial trend labour efficiency growth in Argentina, Brazil, Russia, Colombia and South Africa indicate weaker catch-up momentum and greater proximity to country-specific productivity equilibriums. Near-term growth rates are correspondingly lower, especially in Russia. Growth then gradually accelerates as the influence of momentum diminishes and educational attainment improves in these countries as well.
- *The high-growth Eastern European economies*. The Czech Republic, Estonia, Latvia, Poland, Slovakia and Slovenia all start off with relatively strong trend labour efficiency growth, in excess of 2% per annum. Like the high-growth emerging market economies mentioned above, this reflects levels of labour efficiency that have yet to fully catch-up with recent improvements in fundamentals. Momentum therefore keeps growth relatively strong during the 2018-to-2030 period. Educational attainment does not improve particularly strongly in these countries, however, so trend labour efficiency growth averages about 1¼ per cent over the 2030-to-2060 period.
- *All other advanced economies*. In all other advanced economies, estimated initial trend labour efficiency growth rates are closer to the assumed rate of global technological progress (1½ per cent), therefore differences across countries over the projection period are driven mainly by the evolution of educational attainment. Comparatively large gains in educational attainment explain why trend labour efficiency growth in the 2030-to-2060 period is slightly stronger in France and Portugal than in Germany, for instance.

In both the euro and OECD areas, capital intensity contributed ½ percentage points to real GDP per capita growth in the pre-crisis period, about a third of the total. This contribution is estimated to have slowed to ¼ point in the 2007-to-2018 period following the collapse of investment with the crisis. Over the projection period, it gradually recovers to between ½ and 1 percentage point per annum. Differences across countries are mainly due to differences in trend employment and labour efficiency growth because, other factors being equal, the working assumption is of a stable capital-to-output ratio in the long run (see Box 1). Other factors affecting capital intensity are indeed assumed unchanged for the baseline scenario, except the user cost of capital, which tends to increase as interest rates rise back to estimated neutral rates (see section 5.1). In the BRIICS, the capital intensity growth contribution is much higher than in the OECD because of high investment rates, notably in China. Moreover, this contribution did not fall during the 2007-to-2018 period, but rather increased. Over the projection period, however, capital intensity provides gradually smaller growth impulses to the BRIICS as trend labour efficiency growth declines and less additional capital is required per worker to stabilise capital-to-output ratios.

In relation to the United States, the country traditionally used as reference in economic convergence discussions, living standards generally continue to converge through 2060, although to varying degrees (Figure 5). The high-growth emerging market economies mentioned above improve their relative positions substantially, mainly on the back of convergence in labour efficiency. Turkey's living standards also improve noticeably and reach 86% of the US level by 2060. Turkey's performance has less to do with trend labour efficiency growth and more with favourable demographics, however. It is one of the only countries with essentially no negative growth contribution from a shrinking active population share or from a declining aggregate employment rate (Table 1 and Figure 4). At the other extreme, Russia's living standards regress slightly relative to those of the United States, mostly because of weak trend labour efficiency growth at the start of the projection period. Despite relatively strong trend labour efficiency growth at the start of the projection period, convergence in countries like Poland and Slovenia is held back by relatively unfavourable demographics. Finally, several advanced economies remain close to the US standard of living in 2060 given similar growth performances over the coming decades.

Figure 5. Convergence in living standards in baseline scenario

Real GDP per capita at 2010 Purchasing Power Parities, USA = 100



StatLink http://dx.doi.org/10.1787/888933776198

If a country reaches its equilibrium labour efficiency level, and there is no change to fundamentals providing a growth impulse, then labour efficiency growth is equal to the assumed exogenous rate of global technological progress. This parameter is common to all countries and scenarios and represents the rate at which technological know-how is assumed to improve. As mentioned previously, the rate is set at 1½ per cent per annum. It should be emphasised, however, that this assumption is highly uncertain. A different assumption would commensurately change growth in living standards in all countries and scenarios considered in this paper. It would not, however, change the extent of convergence in living standards since it applies to all countries equally. It would also not change the impact of institutional and policy changes in alternative scenarios relative to the baseline.

3. Institutional reforms would speed up the convergence of emerging market economies

A large body of theoretical and empirical work has established that a preponderance of income differences between poor and rich countries can be attributed to differences in the quality of institutions.[5] Though the empirical literature has tended to emphasise security of property rights as being the most crucial institution, it also recognises that what matters for development is a cluster of related institutions, including economic, political, legal and social aspects. Institutions are important because they can create positive incentives for business investment, technology adoption and human capital accumulation, or they may discourage such activities. They may encourage politicians to work towards creating a growth-enhancing environment, or they may reward rent seeking activities, corruption and personal gain at the expense of the rest of society. But while institutions broadly understood are known to be important, how exactly specific aspects of institutions influence economic outcomes remains little understood. Furthermore, the specific aspects of 'institutions' or 'governance' used in the economic literature are often vaguely defined, highly interrelated and difficult to quantify.

In the long-term model, institutional quality is proxied by the rule of law index, one of six governance indicators regularly updated by the World Bank since 1996 and covering over 200 countries (Kaufmann, Kraay and Mastruzzi, 2010[9]).[6] It is a perceptions-based index intended to capture "…the extent to which agents have confidence in and abide by the rule of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence". Because of the importance of these factors in economic development and also because it is the only governance indicator included in the background estimation work for the model, the rule of law is estimated to have a very large impact on equilibrium labour efficiency. Moreover, a better governance score is also found to increase the speed at which a

5. Seminal papers include Hall and Jones (1999[32]), Acemoglu, Johnson and Robinson (2001[33]; 2005[34]) and Acemoglu and Robinson (2012[37]). See Lloyd and Lee (2018[38]) for a recent critical survey of the literature.

6. In its own empirical work to explain differences in GDP per capita, the World Bank has tended to use the rule of law, rather than other governance indicators, because it relates most closely to issues of contract enforcement and property rights, which as mentioned previously are considered most critical in the growth literature (Kaufmann and Kraay, 2002[35]). See Appendix 7 in Guillemette et al. (2017[3]) for more on this indicator and its interpretation in the model.

country catches up to its equilibrium labour efficiency level, and vice-versa (Guillemette et al., 2017[3]).

Another fundamental growth determinant is human capital. Even though macroeconomic empirical evidence from cross-country growth regressions is mixed, with some studies finding only a weak impact on growth, evidence for the economic benefits of human capital and for the role of formal education in its acquisition comes from many different approaches, including estimates of private and social rates of return, firm, industry and sector-level results as well as studies considering broader measures of well-being than GDP.[7] This work shows that education not only embeds knowledge and skills in individuals, but also encourages participation in groups, opens doors to job opportunities, develops social interactions, makes individuals better aware of their rights, improves health, reduces poverty and facilitates the sharing and transmission of knowledge needed for developing new technologies.

There can be little doubt then that educational attainment matters greatly in a country's growth trajectory. The unevenness of results in the cross-country growth literature can probably be traced to the difficulty of measuring human capital consistently across countries and time and to the narrowness of the indicators used in most studies. These tend to measure the quantity of formal education, such as years of schooling, but neglect quality or means of skills acquisition other than formal education. The background estimation work for the long-term model relies on a measure of average years of schooling in the adult population, but adjusted to incorporate the assumption of diminishing marginal returns to additional years of schooling (Morrisson and Murtin, 2010[10]). In part because of this adjustment, as well as the large number of countries included in the estimation work and the absence of country fixed effects, human capital is found to have a large positive and statistically significant effect on labour efficiency.[8]

A third potentially important factor determining the growth trajectory of emerging market economies is trade openness.[9] Trade is an important channel of knowledge and technology transfers and it is also a vector of external competitive pressure on domestic producers to keep improving efficiency. As such, in the long-term model, trade openness has a substantial impact on the equilibrium level of labour efficiency. It is a function of remoteness, as illustrated in the previous section, and also of average domestic and foreign tariffs on international trade. Like the rule of law, openness is also found to influence the speed of convergence to the equilibrium level of labour efficiency. While there are no such countries in the model, it is even conceptually possible for labour efficiency not to improve at all following a positive reform shock if a country simultaneously trades little (low openness) and has very poor governance (low rule of law), because the convergence speed would then be close to zero. The intuition behind this feature of the model is that without some minimum quality of governance and external competitive pressure, reforms have little traction on the economy.

Given the importance of governance, education and openness in determining a country's productivity level, and the fact that productivity differences explain most of the current

7. See Krueger and Lindahl (2001[41]), Stevens and Weale (2004[42]) and Hanushek and Woessmann (2010[43]) for surveys of the empirical literature.

8. An ongoing OECD project is attempting to design a better measure of human capital and future vintages of the long-term model may incorporate this work.

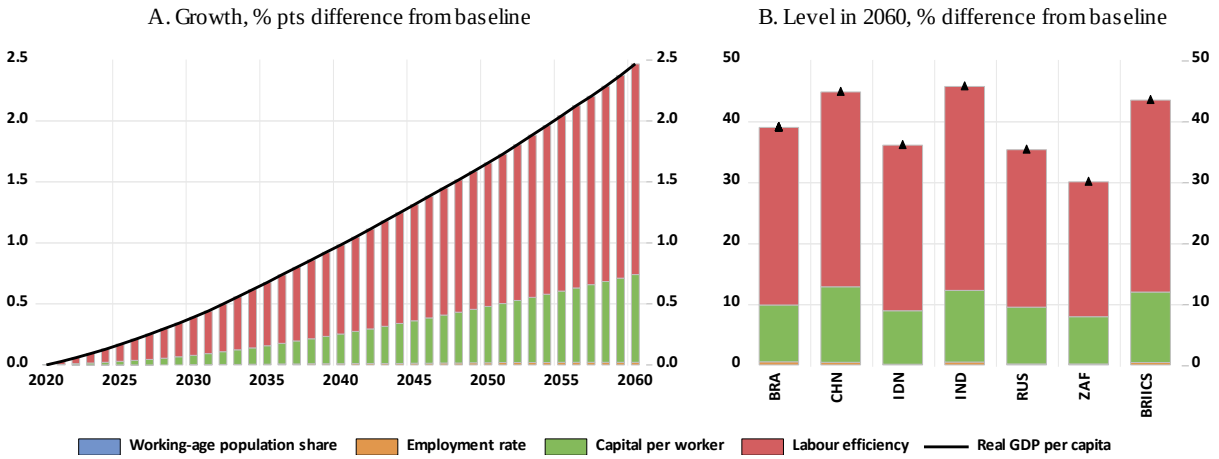
9. Trade openness is measured as the sum of exports and imports as a percentage of GDP.

gaps in living standards between poor and rich countries, the catch-up of living standards in emerging market economies toward advanced economy levels must go hand in hand with efforts at improving these aspects of the economic environment. Not surprisingly, emerging market economies have the most room for improvement when comparing governance scores and education levels across countries. The rule of law score is constructed by the World Bank to range between -2 (worst) and 2 (best) with a zero mean. Among the BRIICS, the latest scores range from -0.8 (Russia) to 0.07 (South Africa), whereas the OECD median is 1.4. Mean years of schooling in the adult population in the BRIICS currently range from 6.8 (India) to 10.8 (Russia), whereas the OECD median is 12.2 (and improvements in the baseline scenario are not necessarily stronger in the BRIICS than in other countries). On import tariffs, the BRIICS have less room for improvement. Tariffs have already come down a lot over the past few decades and are now 6.6% of the value of imported goods in the median BRIICS country, compared to 3½ per cent in the median OECD country.

To illustrate the potential impact of governance reform, educational attainment gains and tariff reductions in the BRIICS on their living standards, an alternative scenario assumes that rule of law scores and mean years of schooling in these countries catch up to the OECD medians over the 2020-to-2060 period, while average import tariffs decline to the OECD median by 2030 if they are not already lower. The resulting increases in rule of law scores are certainly ambitious, even over a 40-year period, but conceivable considering the experiences of some eastern European countries over the past 20 years. Likewise for educational attainment: in view of the educational progress made in Spain and Portugal over the past 20 years and the even larger gains in some developing countries, the implied increases in educational attainment over a 40-year period in this scenario are ambitious but plausible.

Relative to the baseline scenario, growth in real GDP per capita rises gradually during the reform implementation period, driven mostly by higher labour efficiency growth (Figure 6, Panel A). By 2060, living standards in the BRIICS are between 30% and 50% higher than in the baseline scenario (Figure 6, Panel B). The positive growth effects from the reforms would start tapering off gradually after 2060 and the full long-term impacts of the reforms would eventually be larger than those shown for 2060, corresponding to the long lags involved in benefitting fully from structural reforms.

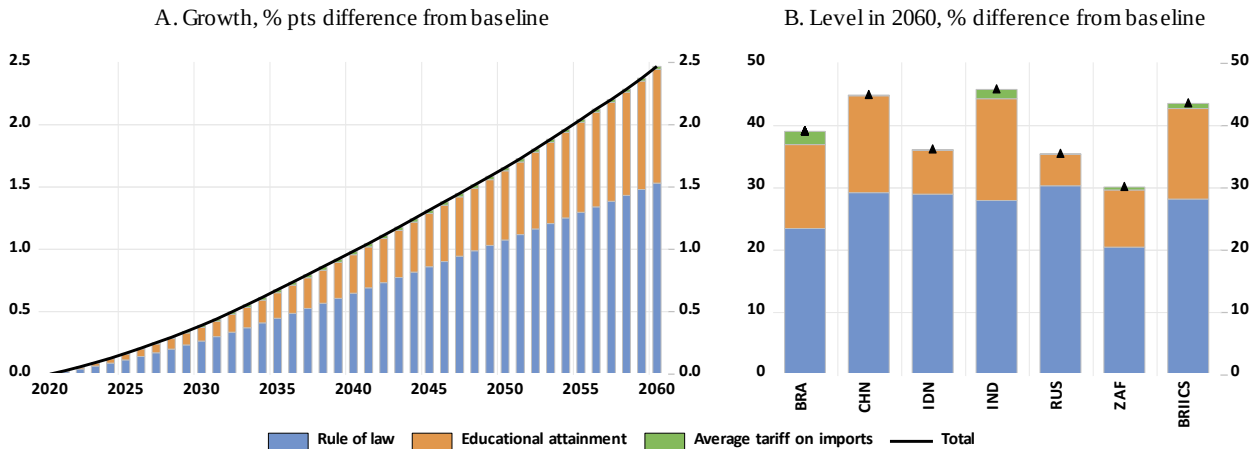
Figure 6. Impact of governance reform, convergence in educational attainment and import tariff reductions on real GDP per capita in the BRIICS – decomposition by component



StatLink http://dx.doi.org/10.1787/888933776217

As hinted above, in terms of relative importance, governance reform makes the largest contribution to gains in living standards by 2060 in this alternative scenario, with two thirds of the aggregate BRIICS effect (Figure 7). In line with the broad coverage of the rule of law indicator, the goal of improving governance in these countries can be interpreted as targeting a wide range of objectives, from reducing corruption, improving law enforcement and the judicial process, increasing the effectiveness of public services and the accountability of those in power, to enhancing access and voice of the citizenry in public affairs. Governance appears a relatively potent source of potential economic gains in Russia, while Brazil, China and India also have much to gain by improving educational attainment. The influence of tariff reductions is comparatively small, but largest for Brazil where the average import tariff is highest among all OECD and BRIICS countries. It must be emphasised, however, that the tariff effect captures only the long-term impact of reduced trade via trend labour efficiency and none of the potentially large short-run impacts via the demand side.

Figure 7. Impact of governance reform, convergence in educational attainment and import tariff reductions on real GDP per capita in the BRIICS – decomposition by reform area



StatLink http://dx.doi.org/10.1787/888933776236

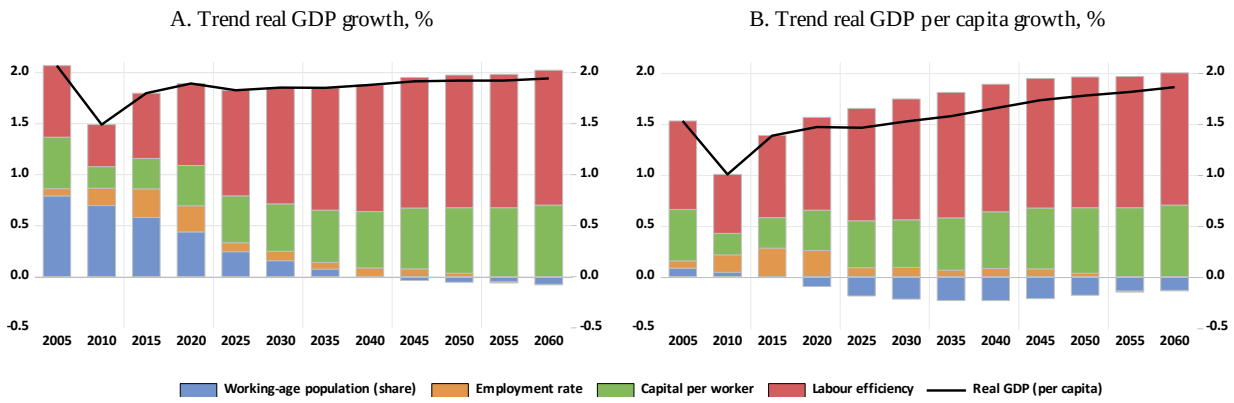
The results underscore the importance for the BRIICS of targeting education and governance as areas for improvement, and of taking a long-term view of their importance for growth and living standards. And while the BRIICS are used here for illustrative purposes, other countries could similarly benefit from faster gains in education and from governance reforms. Notably Mexico, Argentina, Colombia and Turkey score relatively low on governance.

4. The evolution of living standards in the OECD and the potential gains from structural reforms

4.1. Population ageing will drag down growth in living standards

With a generally older population, much lower fertility and higher life expectancy than the rest of the world, the effects of population ageing will be felt more acutely in the OECD area. The combination of a rising active population share and employment rate, the latter driven in large part by greater integration of women in the labour market, has been adding about ¾ percentage point to trend real GDP growth in the past decade (Figure 8, Panel A). In the baseline scenario, this contribution diminishes steadily in the coming decades and turns slightly negative around 2045. In per capita terms, population ageing subtracts up to ¼ percentage point to trend growth at the height of the demographic transition in the 2030s (Figure 8, Panel B).

Figure 8. Growth in the OECD area in the baseline scenario



StatLink http://dx.doi.org/10.1787/888933776255

Like the BRIICS, OECD countries could also benefit from structural reforms to raise living standards over time beyond those of the baseline scenario. However, most OECD countries already have fairly good governance frameworks and high levels of education. Also, because of the particular prominence of population ageing, the focus in OECD countries could instead be on reforms of product and labour markets, where many countries still have substantial room for improvement toward best practices. The rest of this section therefore puts emphasis on the potential for reforms to improve economic outcomes in the coming decades in OECD countries. To this end, the analysis incorporates the latest OECD estimates of the impacts of structural reforms (see Box 1) and calibrates the size of shocks to be in line with actual country-specific distances from best-practices.

4.2. Policy reforms have the potential to counteract the negative pressures

4.2.1. Product market liberalisation could lift all three components of potential output

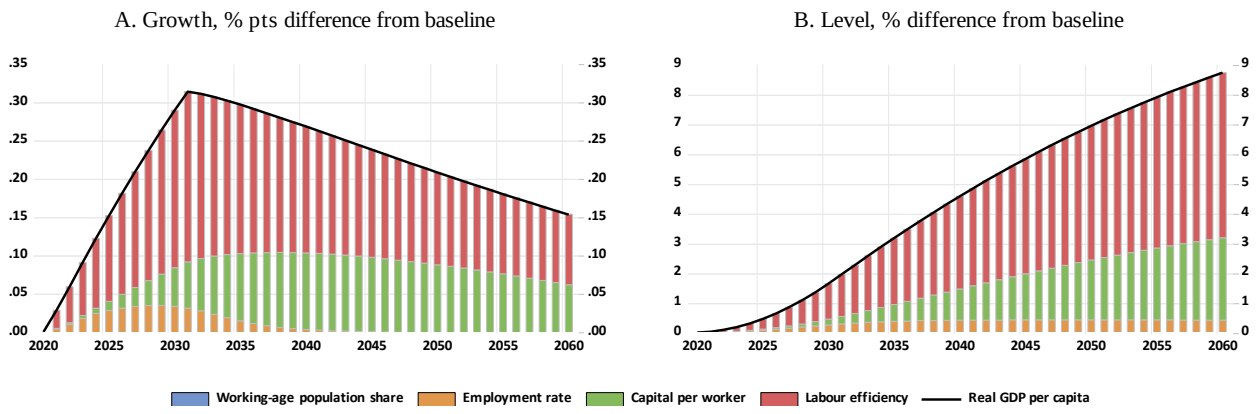
Various strands of OECD research have found that product market regulation influences a country's productivity, investment and labour market performances.[10] In line with these findings, in the long-term model product market liberalisation boosts potential output through all three components of the production function (see Box 1). To illustrate the potential combined impact of product market reforms designed to promote competition, OECD countries are assumed to implement a package of reforms over the 2020-to-2030 period that would improve OECD measures of product market regulation to the average levels for the five leading countries.[11] The implied reform effort in the median country is 2¼ times the size of a typically observed product market reform as computed by Égert and Gal (2017[4]), but these authors looked at a two-year period, whereas the alternative scenario here considers a 10-year reform window.

The reforms boost OECD trend real GDP per capita growth by about $^{1}/_{3}$ percentage point at the peak in 2030, with cumulative effects rising through the projection period and reaching nearly 9% by 2060 (Figure 9). Most of the output gains occur through higher labour efficiency, but the capital intensity effect is non-negligible, adding as much as a tenth of a percentage point to growth five years after the end of the reform implementation period. The employment effect is small and is fully phased in within about 20 years given the faster convergence speed estimated for employment effects. The full long-term effect would be even larger than shown here for 2060 given that labour efficiency and capital stock dynamics are still playing out, owing to the slow adjustment speeds estimated for these components.

10. The effects used in the long-term model are from Guillemette et al. (2017[3]), Égert (2017[46]) and Égert and Gal (2017[4]), but the body of OECD work on this topic is much larger; see the aforementioned papers for references.

11. Both Product Market Regulation (PMR) and Energy, Transport and Communication Regulation (ETCR) indices, which respectively measure the extent to which regulation enhances competition in the whole economy and in network industries, are used because the empirical work incorporated in the model relies on both. Unweighted averages for the five leading countries are 1.1 for PMR (based on the latest scores for the Netherlands, the United Kingdom, Austria, Denmark and New Zealand) and 1.3 for ETCR (based on the latest scores for the United Kingdom, Germany, Australia, Austria and the Netherlands). Hence the reform efforts are country-specific and depend on distances to best-practices. Median reductions are 0.3 points for PMR and 0.7 points for ETCR, roughly one cross-country standard deviation for both indices.

Figure 9. Impact of product market liberalisation on OECD trend real GDP per capita



StatLink http://dx.doi.org/10.1787/888933776274

The countries with the most to gain are those currently furthest away from the leading countries, including Turkey, Israel, Korea, Slovenia and Mexico (Figure 10). The United Kingdom and the Netherlands gain nothing in this simulation as their product market policy settings are already among the most competition-friendly. The slight negative effects shown for these countries stem from stronger global investment in this scenario putting upward pressure on global interest rates, and therefore on the user cost of capital in all countries.

Figure 10. Per cent increase in real GDP per capita by 2060 relative to baseline with product market liberalisation

StatLink http://dx.doi.org/10.1787/888933776293

4.2.2. Labour market reforms could lift employment rates

Labour market reform appears particularly desirable in the context of ageing to encourage higher employment and longer working lives and so directly offset the consequences of demographic change. According to OECD estimates, labour market reform also has the added advantage of filtering through to potential output more quickly than reforms affecting labour efficiency. OECD work on the impact of labour market reforms on the economy is extensive, but the specific policy effects used in the long-term model are from

the recent work of Gal and Theising (2015[5]) and Égert and Gal (2017[4]). As in product markets, different countries have more or less scope for policy improvement from the standpoint of leading OECD countries.

To illustrate, OECD countries are assumed to implement a permanent policy reform package between 2020 and 2030 that, for a number of policy indicators, would close half of the current gaps relative to simple (unweighted) averages of these indicators for the five leading countries. Hence, as in the product market simulation, the magnitudes of the policy changes depend, for each country and indicator, on the gap relative to best-practices according to the latest available data. That only half the gaps are assumed to close over the reform period reflects the usually greater difficulty of reforming labour markets than other policy areas. More specifically:

- Public spending on active labour market policies (ALMP) per unemployed person averages 76.1% of GDP per capita in Denmark, Austria, the Netherlands, France and Finland. To close half of the gap with this target, the median country increases ALMP spending by 24 percentage points.
- Union bargaining excess coverage[12] averages -1.6% of the workforce in New Zealand, Mexico, Japan, Canada and Turkey. The median decline is 9 percentage points.
- Public spending on family benefits in kind averages 2.1% of GDP in Iceland, Denmark, Sweden, Norway and Finland. The median increase is 0.6 percentage points.
- Maternity leaves average 40 weeks in the United Kingdom, Greece, Ireland, Slovakia and the Czech Republic. The median increase is 12 weeks.
- Tax wedges for single earners average 17.8% of labour costs in Chile, New Zealand, Mexico, Switzerland and Israel, while tax wedges for couples average 8.5% of labour costs in New Zealand, Chile, Ireland, Switzerland and Canada. Median declines are about 10 percentage points for each indicator.

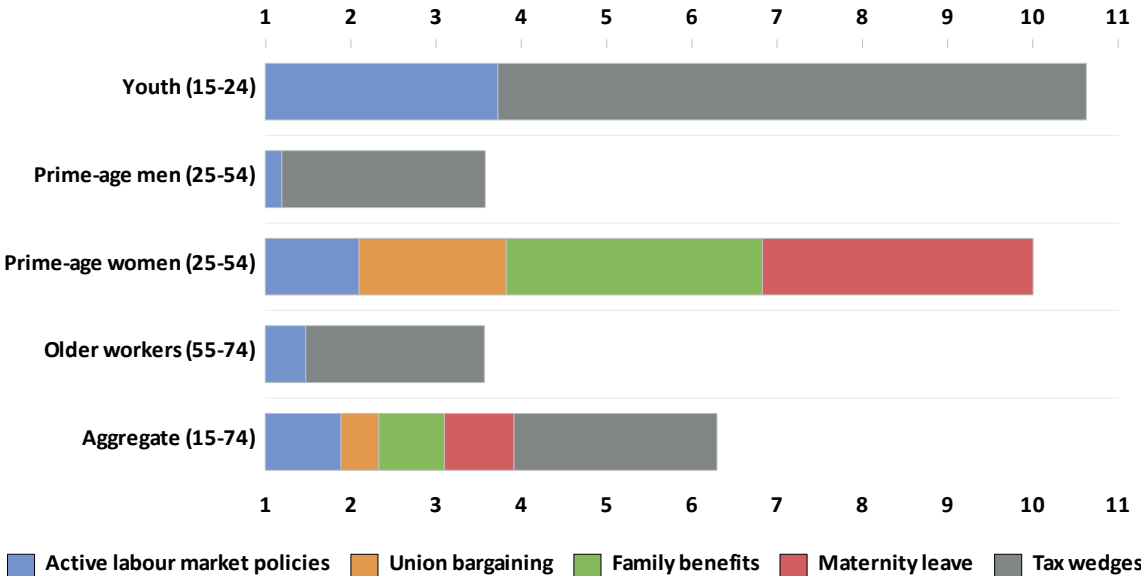
The package of reforms just described raises employment rates for all age groups, but especially youth and prime-age women.[13] The exact magnitudes vary across countries and age groups depending on the size of the various country-specific reforms. For the OECD area, by 2040 the aggregate employment rate is about 6½ percentage points higher than in the baseline scenario, driven in large part by the boost to female employment coming from improvements to family benefits and maternity leave (Figure 11). In terms of policies, tax wedge reductions have the largest impact on the aggregate employment rate seeing as they affect employment rates for youth, prime-age men and older workers. Lowering tax wedges and enriching family benefits in kind would support the inclusive growth objectives of promoting employment among the lower-income segments of the population as well as the integration of women in the labour market (OECD, 2017[11]).

12. This indicator measures the difference between the coverage of collective contracts and union density. A positive number indicates “excess coverage”.

13. Possible negative supply-side effects stemming from the need to finance these reforms are not taken into account. Modelling these links is an avenue for future work.

Figure 11. Impact of labour market reforms on OECD employment rates

Difference from baseline by 2040, % pts of labour force



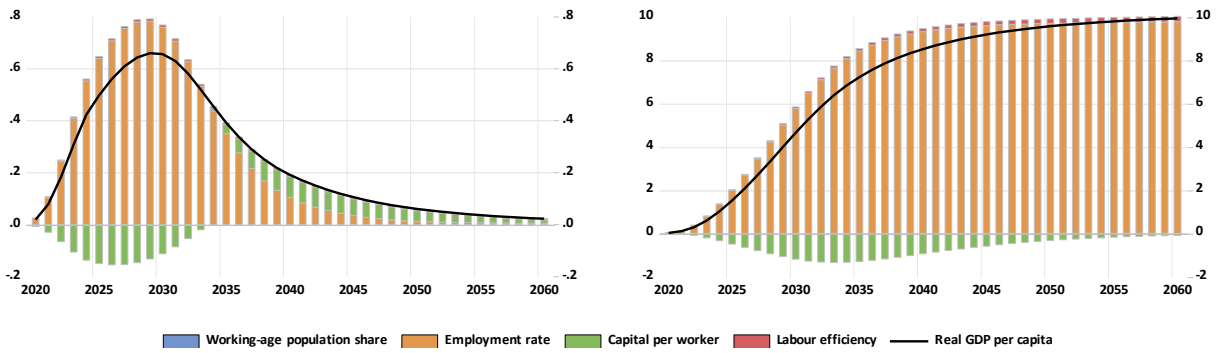
StatLink http://dx.doi.org/10.1787/888933776312

In turn, rising employment rates boost OECD trend real GDP per capita growth by $^{2}/_{3}$ percentage points at the peak toward the end of the reform implementation period (Figure 12, Panel A). The impact is felt more quickly than for reforms affecting labour efficiency given the faster convergence speeds estimated for labour market reforms. The rapidity with which employment reacts actually drags down the amount of capital available per worker, hence the slight negative growth contribution of capital intensity. This spurs investment to rise and eventually capital intensity also contributes positively to growth. OECD living standards are some 4% higher than in the baseline scenario when the reforms are fully implemented in 2030 and 10% higher by 2060 (Figure 12, Panel B).

Figure 12. Impact of labour market reforms on OECD trend real GDP per capita

A. Growth, % pts difference from baseline

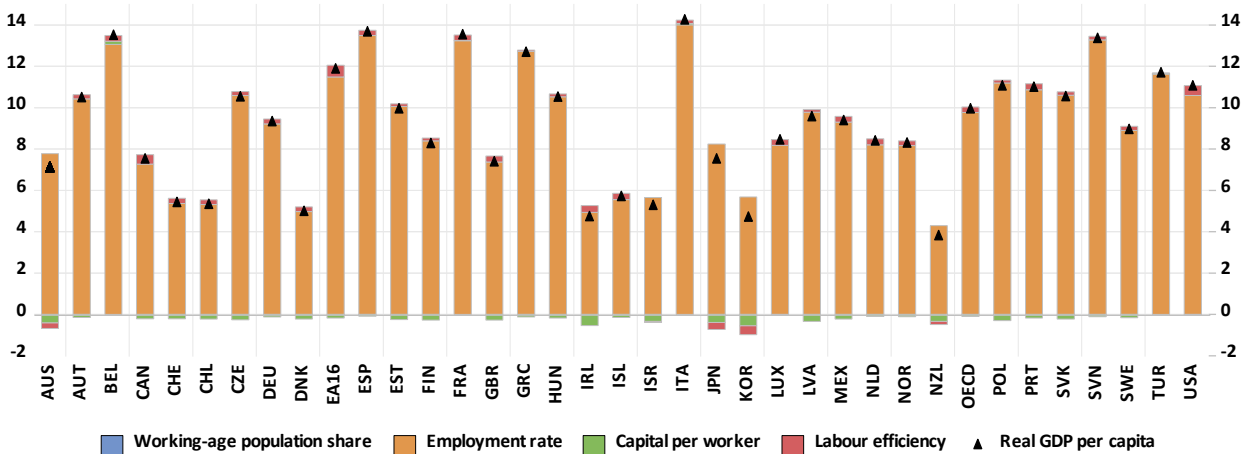
B. Level, % difference from baseline



StatLink http://dx.doi.org/10.1787/888933776331

The cumulative improvement in living standards relative to the baseline scenario is as much as 12% to 15% in countries that are currently furthest away from best-practices on the set of labour market policies considered here, including Italy, Belgium, Spain, France, Greece and Slovenia (Figure 13). The impact is weakest in New Zealand, which is among or close to the leaders on most labour market indicators.

Figure 13. Per cent increase in real GDP per capita by 2060 relative to baseline with labour market reforms



StatLink http://dx.doi.org/10.1787/888933776350

The reform areas considered in this subsection's scenario do not exhaust all the possibilities for boosting employment rates. Other policy settings that OECD work has found can raise employment rates include unemployment benefits replacement rates, minimum wage policy, education policy as reflected in educational attainment, product market regulation and the legal retirement age. In view of the relatively low aggregate employment rate of older workers in many countries relative to the leading ones (e.g. Iceland, New Zealand, Korea) and the swelling wave of retirements associated with the baby boomer generation, raising legal retirement ages beyond what OECD governments are currently planning appears like an especially attractive avenue to help offset the demographic drag on living standards in the years ahead.

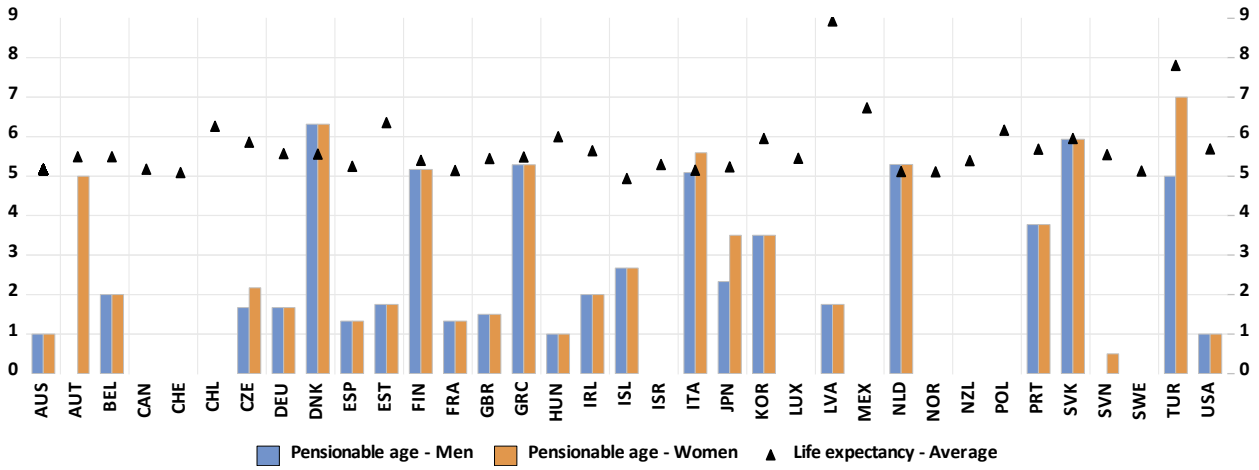
4.2.3. Rising life expectancy justifies some increase of the legal retirement age

Over the past few decades, legal pensionable ages in OECD countries have generally not been keeping pace with increases in life expectancy. In the case of men for instance, the OECD average pensionable age would now be about seven years higher had it increased at the same rate as life expectancy since 1989. In recent years, many countries have legislated reforms that have raised and/or will raise the retirement age in coming years. These already-legislated changes are incorporated in the baseline scenario and raise employment rates for older age groups (55-74) in the countries concerned.[14] Still, in most

14. The legislated increases in retirement ages included in the baseline scenario are sourced from OECD (2017[44]), European Commission (2017[39]), The Finnish Centre for Pensions (2017[40]) and in some cases national authorities via the Economics' Department country desks. A one-year increase in the legal retirement age raises the participation rate of the 55-to-74 age group by 3 percentage points, an effect consistent with Mastrobuoni (2009[51]).

countries, legislated retirement ages for men and women do not keep pace with projected improvements in average life expectancy (Figure 14). Thus, room for reform remains significant in many countries.

Figure 14. Change in legislated pensionable age and average life expectancy between 2019 and 2060, years



StatLink http://dx.doi.org/10.1787/888933776369

Note: For countries where future changes to pensionable ages are linked to life expectancy, the model uses average life expectancy at birth as a guide, even though the policy details may be slightly different (e.g. refer to life expectancy at 65). Also, the bars may show a smaller increase than in life expectancy if the policy change comes into force after 2019 and pensionable ages increase by little or not at all in the meantime (e.g. Finland). The converse is also possible (e.g. Denmark).
Sources: United Nations' World Population Prospects, July 2017 revision. See footnote 14 for pensionable ages.

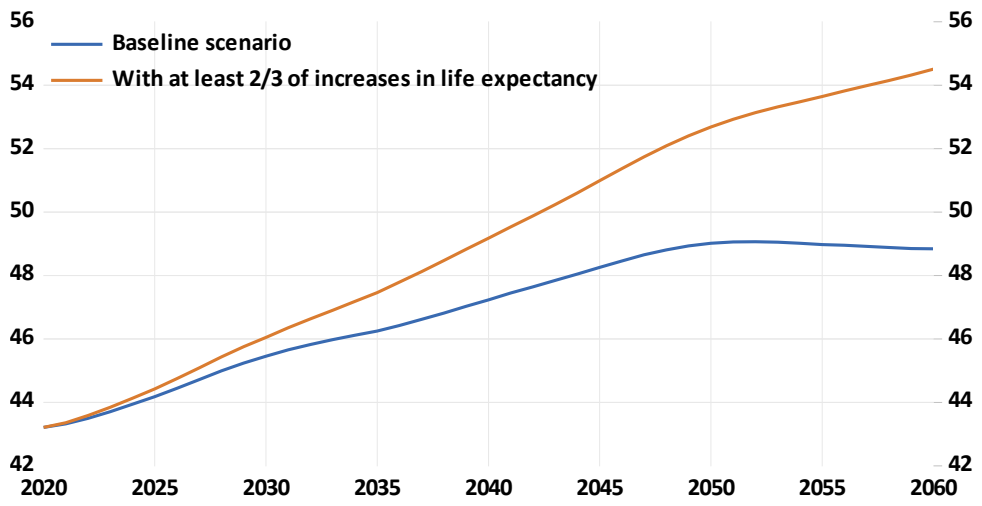
Best practice in this area is set by the few countries that have legislated an explicit link between the legal retirement age and life expectancy. One option, chosen by Denmark, Finland, Greece, Italy, the Netherlands and Slovakia, is to fully add future increases in life expectancy at birth (or at age 65) to the legal retirement age, although for most of these countries the policy changes do not come into force until later, for some not until 2030. However, there are both pros and cons to raising the retirement age. On the one hand, raising employment rates of older workers boosts GDP and, in doing so, helps to ensure the sustainability of public pension systems and to reduce the downward pressure on material living standards brought on by demographic change. On the other hand, work is generally considered less desirable than leisure, so a longer retirement period also provides welfare benefits. Policymakers must take a broad view of welfare and balance out the two sets of considerations. From this perspective, the approach taken by Portugal appears reasonable: its government has legislated, an increase in the legal retirement age equal to two-thirds of future increases in life expectancy. This approach incorporates the idea that some increases in life expectancy should also be enjoyed in retirement as opposed to work.

The Portuguese approach informs the alternative scenario considered here: it assumes that as of 2020, legal pensionable ages for men and women in all OECD countries increase in line with two-thirds of predicted improvements in country-specific life expectancy, unless the increases currently legislated are even larger, in which case the latter remain in

force.[15] In this scenario, the employment rate of workers aged 55 to 74 increases more quickly than in the baseline scenario, and does not fall after 2050 (Figure 15). The aggregate OECD increase, of about 5½ percentage points by 2060, hides substantial variation across countries depending on the retirement age reforms already incorporated in the baseline scenario and the predicted evolution of life expectancy. In Slovakia, for instance, which is already planning to raise men and women's retirement ages by the full increases in life expectancy, there is no effect. In the many countries planning no change to retirement ages, employment rates for 55-to-74 year-olds increases by about 5 percentage points by 2040 relative to baseline, and 10 percentage points by 2060.

Figure 15. Impact of increasing legal retirement ages in OECD countries by at least two-thirds of country-specific increases in life expectancy

OECD employment rate for 55-to-74 year-olds, % of labour force

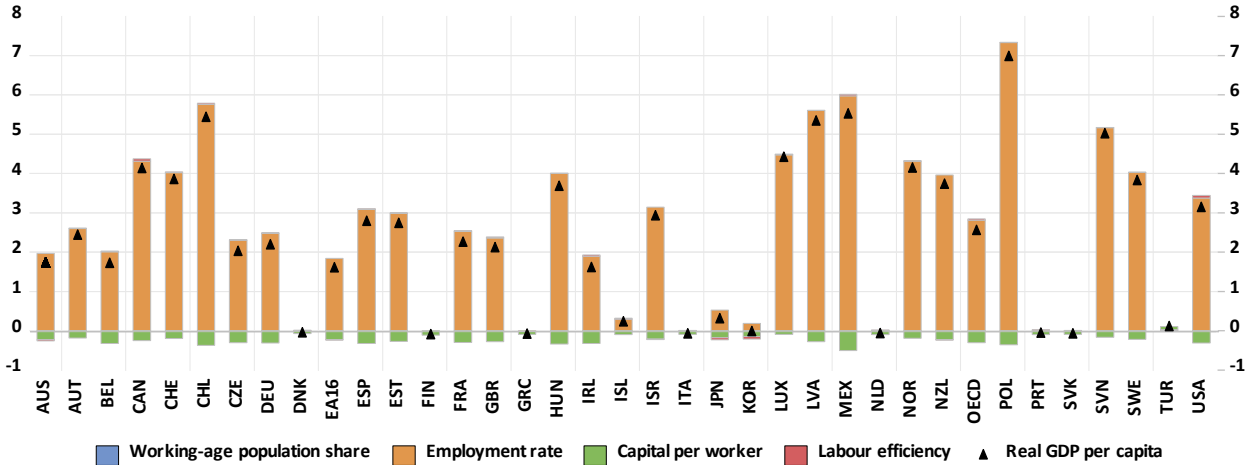


StatLink http://dx.doi.org/10.1787/888933776388

Increases in real GDP per capita in the scenario likewise vary a lot across countries depending on the additional room for reform and also on the relative size of the 55-to-74-year-old cohort in the population (Figure 16). Poland gains up to 7% in living standards by 2060, while Chile, Mexico and Slovenia, all countries planning little or no changes to retirement ages, gain between 5% and 6%. Cross-country differences depend not only on the scope for reform but also on demographics; for example, even though Luxembourg has not legislated any future change to current retirement ages, in the reform scenario its living standards increase by less than Latvia's, which is already planning a modest increase to a retirement age of 65 by 2025, simply because life expectancy in Latvia rises more than in Luxembourg. The countries mentioned above which are already planning to incorporate the full increases in life expectancy into their retirement ages see no gain in living standards in this scenario. Iceland, Japan, Korea and Turkey also see little gain because, despite not having linked retirement ages to life expectancy, they have nevertheless legislated important increases in retirement ages over the projection period.

15. Projections of life expectancy are taken from the 2017 revision of the United Nations' medium population scenario.

Figure 16. Per cent increase in real GDP per capita by 2060 relative to baseline with pension age increase equal to at least two-thirds of projected gain in life expectancy



StatLink http://dx.doi.org/10.1787/888933776407

4.3. The importance of innovation

Innovation is known to be an important driver of labour efficiency growth. In the long-term model, the rate of innovation is proxied by total research and development (R&D) spending as a percentage of GDP. As in the case of physical capital, R&D spending is assumed in the model to accumulate into a stock of R&D capital (representing intangible knowledge), and to depreciate over time. In turn, a country's equilibrium labour efficiency level depends on this stock of R&D capital. But knowledge being largely non-rival and non-excludable, a country's equilibrium labour efficiency is also a function of the global stock of R&D, which is obtained by aggregating individual country stocks. This model feature is consistent with the idea that knowledge tends to diffuse across borders. The sizes of both the own-country and global effects are taken from a recent meta-analysis of the effects of local and global R&D on productivity (Donselaar and Koopmans, 2016[12]). Thus, unlike the other reforms considered so far, innovation has the distinction of giving rise to supply-side spillovers across countries.

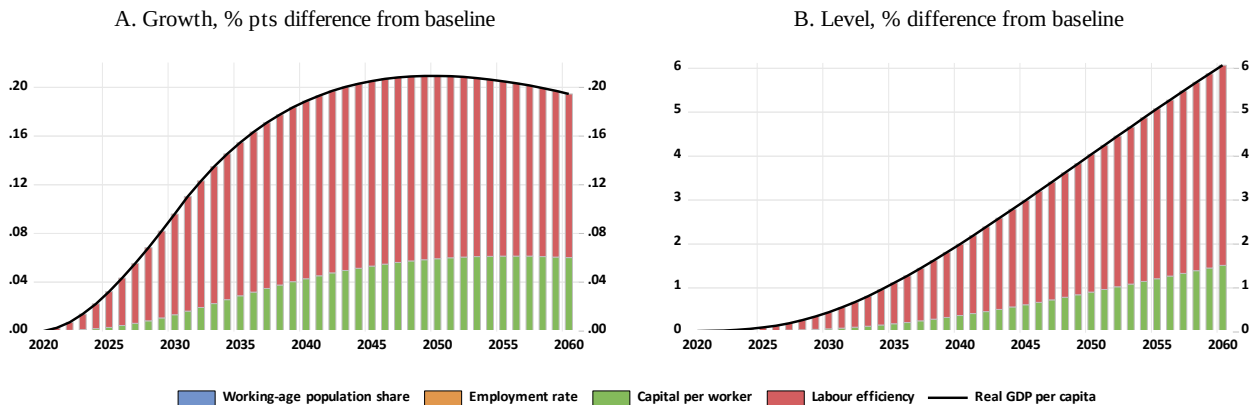
In the baseline scenario, local and global R&D stocks are assumed to be stable at levels consistent with current R&D spending levels. However, in alternative scenarios, R&D spending can be shocked, affecting local and global stocks of R&D and in turn labour efficiency, with the spillover effects due to a given country commensurate with the relative share of this country in the global R&D stock. In the scenario considered here, countries where total R&D expenditure is currently less than 3.6% of GDP, the average for the five leading OECD economies (Israel, Korea, Japan, Sweden and Austria), are assumed to raise spending to this level by 2030 and keep it there. Such a scenario can be interpreted as either a direct increase in public expenditure on R&D, or as a set of other policy changes that, through incentive effects, raises private R&D spending by the same amount.[16]

The R&D spending boost in this scenario, of 1¾ percentage points of GDP in the median country, raises annual trend real GDP per capita growth in the OECD area by a tenth of a

16. Future elaborations of the model may include more explicit modelling of the policy channels.

percentage point by 2030, and two-tenths by 2045, mostly via higher trend labour efficiency growth, but also through higher capital intensity, physical investment being spurred on by higher productivity growth (Figure 17, Panel A). The peak growth effect occurs around 2050 given the lags involved in adding significantly to the existing R&D stock and the slow convergence speed to equilibrium labour efficiency. Given enough time, the global stock of knowledge would eventually stabilise at a higher level than in the baseline scenario and the growth effect would taper down to zero.[17] The cumulative impact on OECD aggregate living standards, which are 6% higher than in the baseline scenario by 2060, would continue to rise and eventually exceed 10% (Figure 17, Panel B).

Figure 17. Impact of R&D spending boost on OECD trend real GDP per capita

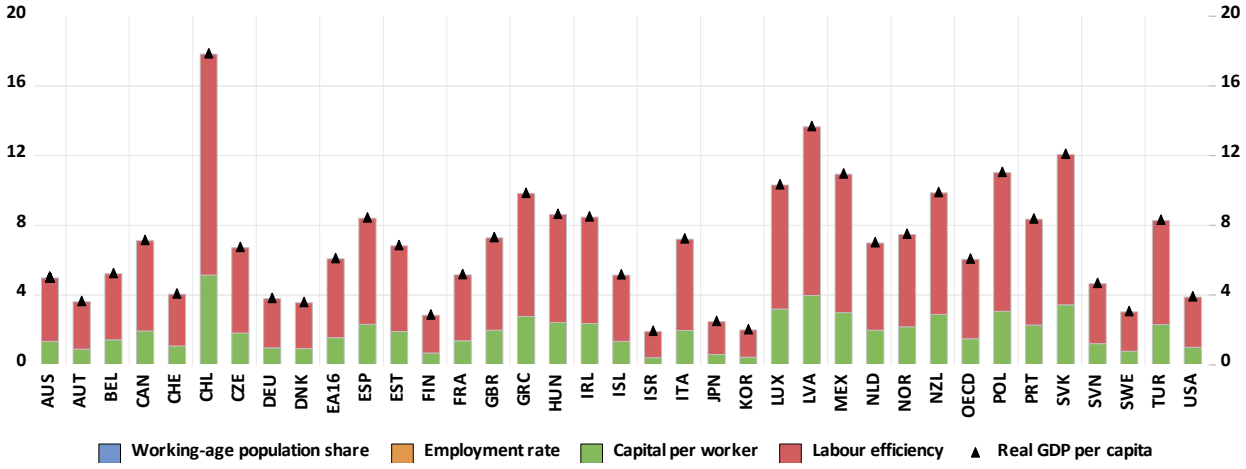


StatLink http://dx.doi.org/10.1787/888933776426

The increase in aggregate OECD living standards by 2060 hides some substantially larger impacts in some countries, and is held down by some of the largest OECD countries, such as the United States and Japan, which already spend close to the assumed target of 3.6% of GDP on R&D. In countries further away from the target, particularly Chile, but also Latvia, Slovakia, Poland and Mexico, the cumulative impact on living standards by 2060 is much larger than for the OECD area as a whole (Figure 18). Israel and Korea, the two countries where R&D spending is already above the assumed target and which therefore do not raise spending in this scenario, get a small boost to their living standards relative to baseline, illustrating the spillover effects discussed previously.

17. A different modelling approach could link the strength of innovation to labour efficiency *growth*, rather than to its equilibrium *level*, in which case a permanent innovation shock could raise growth (of real GDP per capita via labour efficiency) permanently rather than temporarily. The modelling approach chosen here can therefore be considered conservative in that innovation has a long-lasting, but ultimately only temporary, impact on growth.

Figure 18. Per cent increase in real GDP per capita by 2060 relative to baseline with R&D spending boost



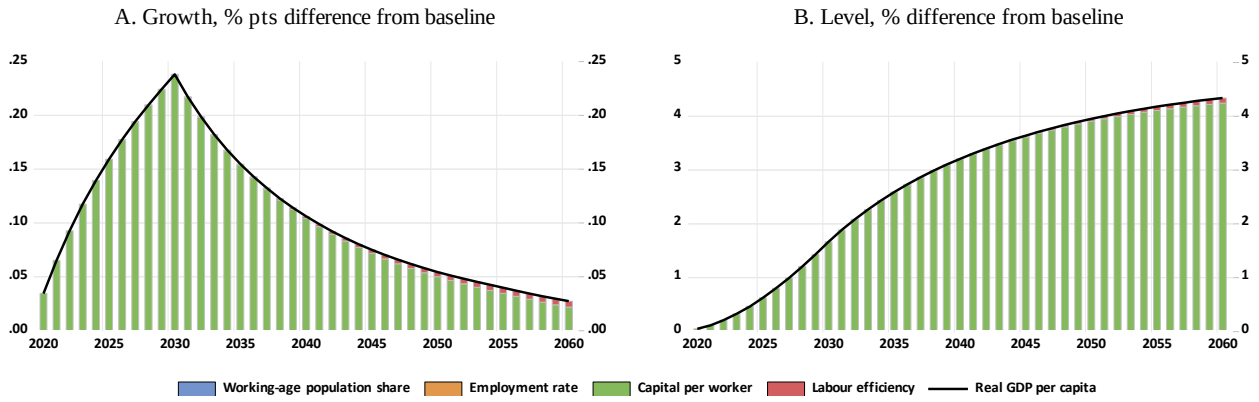
StatLink http://dx.doi.org/10.1787/888933776445

4.4. The impact of raising public investment

Another avenue for reform in OECD countries concerns public capital formation, in particular infrastructure. Public infrastructure, such as transit systems, roads, ports, electricity grids and telecommunication systems, is an important ingredient supporting private activity and quality of life. The OECD has recently added its support to that of many policy commentators, for instance Summers (2017[13]), who are calling for raising public investment (OECD, 2015[14]; Mourougane et al., 2016[15]). While the case is less obvious now than in the depths of the crisis, when a fiscal boost would have sped up the closure of output gaps and benefitted the hard-hit construction sectors of many countries, it remains a strong one. Governments' access to very low financing rates, combined with large infrastructure needs in many countries after years of underinvestment, suggest the existence of many positive net return projects that would boost potential output and raise future living standards (Global Infrastructure Hub, 2017[16]).

Here again, governments' choices vary widely. In the five leading OECD countries, namely Luxembourg, Hungary, New Zealand, Slovenia and Norway, public investment averages 6% of GDP, but many governments invest much less. In a scenario where all OECD countries gradually raise public investment to this level between 2019 and 2030, the median effort is around 2½ percentage points of GDP. Higher investment in turn raises potential output per capita growth in the OECD area by nearly ¼ percentage point at the peak in 2030, driven entirely by higher capital intensity (Figure 19, Panel A). The cumulative impact on total OECD productive capacity rises throughout the projection period, reaching over 4% by 2060, and would rise some more beyond 2060 given the slow dynamics of the capital accumulation process (Figure 19, Panel B). The impacts could be larger in reality because the simulation does not take into account the possibility that judiciously chosen public investment projects could also spur additional private investment.

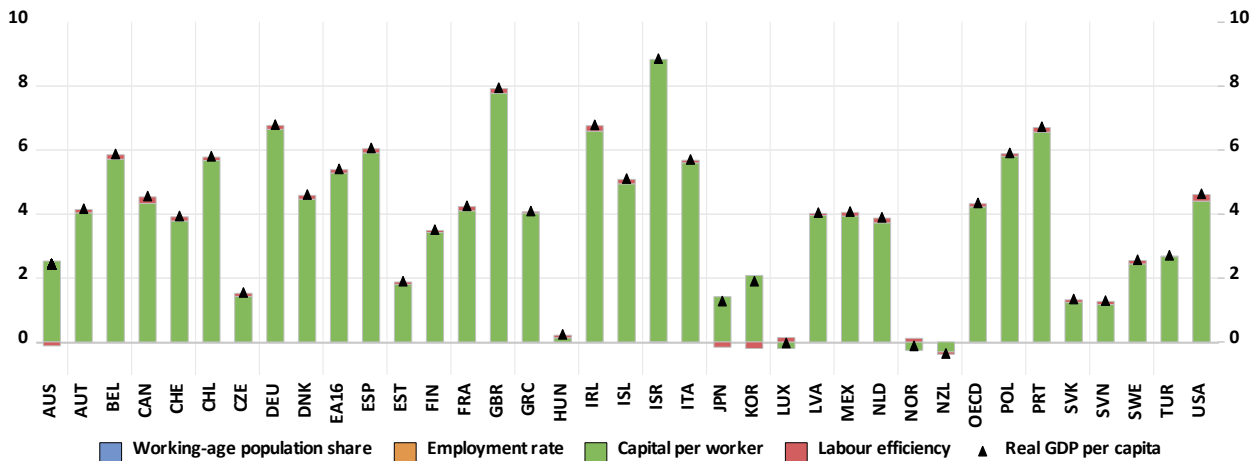
Figure 19. Impact of public investment boost on OECD trend real GDP per capita



StatLink http://dx.doi.org/10.1787/888933776464

As in previous scenarios, increases in living standards relative to baseline across countries are commensurate with the initial distances to best-practices, such as defined by the five leading countries. Israel and the United Kingdom have the most room for boosting public investment in this scenario, with cumulative increases in their standards of living in excess of 7% by 2060 (Figure 20). Many other countries could hope to raise their productive capacity by between 5% and 7% by then (Belgium, Chile, Germany, Spain, Ireland, Iceland, Italy, Poland and Portugal). As in some previous scenarios, the small negative effects on capital intensity in countries where the stock is zero or very small occurs because of upward pressure on global interest rates – and thus on the private user cost of capital – that rising global investment demand engenders in the model.

Figure 20. Per cent increase in real GDP per capita by 2060 relative to baseline with public investment boost

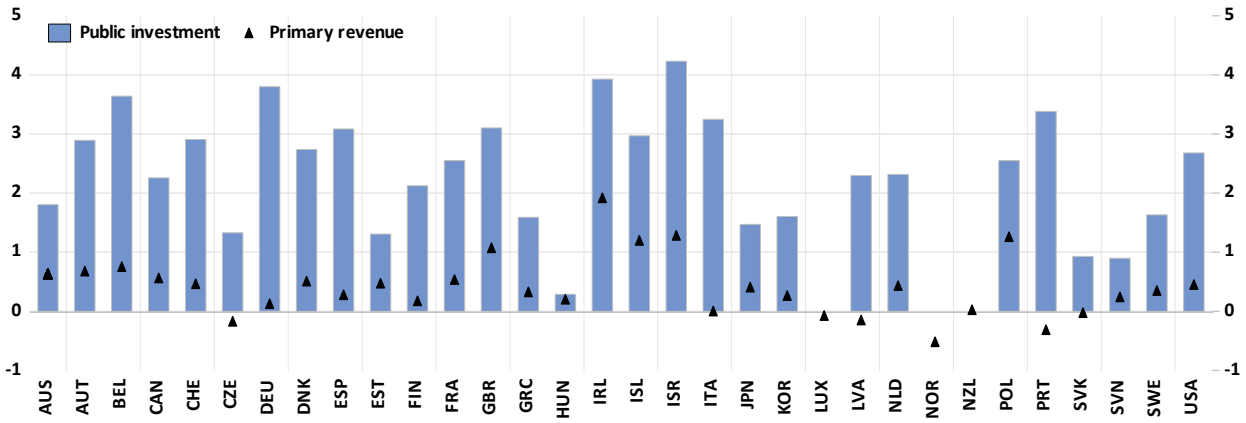


StatLink http://dx.doi.org/10.1787/888933776483

Higher public investment must be financed, and in this scenario the impact of the investment boost on the fiscal burden follows an inverse U-shaped pattern.[18] Government primary revenue first rises to finance the extra investment expenditure given the model's target of keeping the public debt-to-GDP ratio stable. Eventually, however, the extra output associated with higher capital intensity generates extra fiscal revenue, which allows the fiscal burden to fall again. Whether it ends up slightly higher or lower than in the baseline scenario in 2060 depends on country-specific factors (Figure 21). The size of the initial investment shock is one such factor. Another is the baseline level of primary revenue as a percentage of GDP, which can be thought of as an overall tax rate. The higher this initial tax rate, the more revenue the extra output generates and the less the rate needs to increase. The median increase in primary revenue as a percentage of GDP relative to baseline by 2030 (1.7 percentage points of GDP) is somewhat smaller than the median investment shock, given the extra revenue generated by the higher output level; and by 2060 it is just one eighth of the investment shock ($^{1}/_{3}$ percentage points of GDP). In some countries – the Czech Republic, Italy, Latvia, Portugal and Slovakia – higher public investment is self-financing in this scenario by 2060.

Figure 21. Impact of higher public investment scenario on the fiscal burden

Public investment and tax revenue as a percentage of GDP in 2060, % pts difference from baseline



StatLink http://dx.doi.org/10.1787/888933776502

Note: The figure shows the increase in taxes, or strictly speaking primary government revenue as a percentage of GDP (triangles), necessary to maintain the same long-run public debt ratio as in the baseline while financing an increase in public investment sufficient to achieve the 6% of GDP benchmark (bars). The investment shock is zero for New Zealand, Luxembourg and Norway because public investment is already above the target at the start of the projection period. The noticeable fall in Norway's required primary revenue is due to the positive effect of higher global interest rates in this scenario on the Norwegian government's large stock of financial assets.

5. Fiscal sustainability in OECD countries

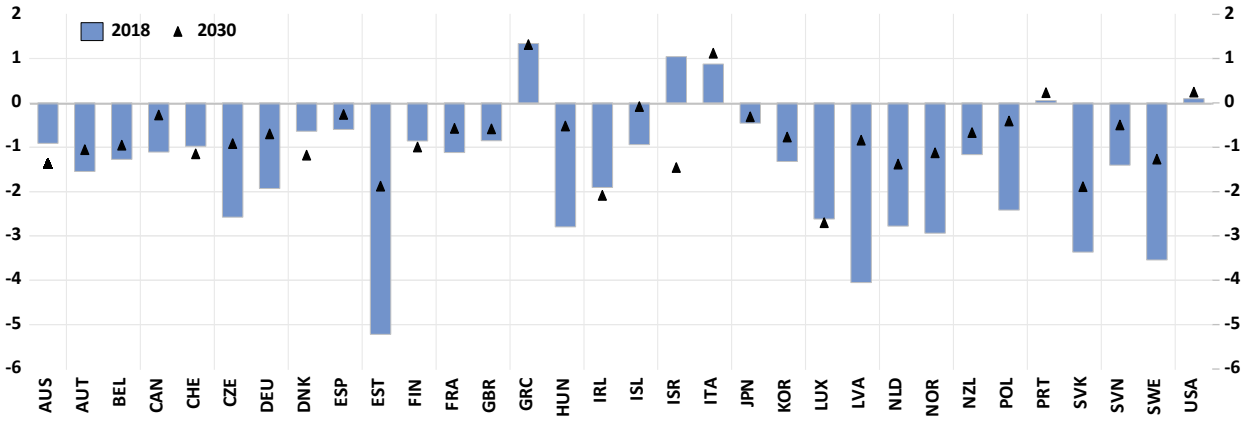
5.1. Low interest rates have eased fiscal pressures, but may not last

In the period since the last global economic downturn, OECD countries have made considerable progress in reducing structural primary deficits. The OECD aggregate

18. The fiscal impact analysis here does not consider the cyclical effects of extra investment on output and tax revenue, but only the structural effects. In addition, tax increases in the model do not have negative supply-side effects.

underlying primary deficit went from 4½ per cent of potential GDP in 2010 to ¼ per cent in 2016, and that of the euro area went from 1¾ to a 1½ per cent surplus over the same period. Public debt levels have nevertheless generally continued to increase over this period, rising by about 15 percentage points of GDP in both the OECD and euro area, and are now high by historical standards. But with interest rates having fallen to historically low levels, debt servicing has remained affordable. In most OECD countries, the gap between the interest rate paid on government liabilities (*r*) and the growth rate of potential GDP (*g*) has even turned negative, implying that issuing public debt provides real resources that governments can use to either reduce taxes or increase expenditure (Figure 22). Were this a permanent state of affairs, governments could fully finance public spending by issuing debt and not have to worry about ever needing to raise taxes to repay it. Public debt would not explode, but converge to a finite value, no matter how large the deficit. In the few countries where $r - g$ is not negative, it is low in historical context. From the sole perspective of current conditions, then, debt sustainability is not an immediate concern for most OECD governments.

Figure 22. Difference between implicit interest rate on government debt and potential growth rate, % pts



StatLink http://dx.doi.org/10.1787/888933776521

The cyclical fall in interest rates since the great recession has played out over the background of a long-running secular decline in global interest rates that has been well documented (IMF, 2014[17]; Holston, Laubach and Williams, 2017[18]). The precise confluence of factors behind this trend continues to be debated, but one hypothesis is that desired saving has been relatively stronger than desired investment, leading to a global saving glut (Bernanke, 2005[19]; 2015[20]).[19] In the baseline scenario, both investment and saving rates fall as of the early 2020s. The decline in investment is driven largely by slowing employment and labour efficiency growth, so less capital investment is required to maintain a given capital-to-output ratio. The decline in saving is driven mostly by population ageing, but is limited by rising life expectancy. In *ex ante* terms, the downward pressure on investment exceeds that on saving over the first half of the projection period, so the global interest rate premium – which affects interest rates in all countries to help balance global saving with investment (see Box 2) – keeps downward

19. Some authors, such as Borio et al. (2017[36]), have cast doubt on the idea that real interest rates are driven by variations in desired saving and investment.

pressure on neutral interest rates (Figure 23). Thus, to the extent that a global saving glut has been weighing on real interest rates, this pressure does not dissipate anytime soon in the baseline scenario, which is a positive factor for fiscal sustainability.

Box 2. The determination of saving rates, current account balances and interest rates

Saving rates

Total saving rates for all countries are determined according to an estimated equation which suggests that demographic effects, captured by the old-age dependency ratio and life expectancy, are major drivers of long-term trends in saving, but with additional effects from the fiscal balance (for those countries where it is modelled explicitly), labour productivity growth, net oil trade balances, the availability of credit and the level of social protection. When the fiscal balance enters as a determinant, changes in private saving offset 40% of changes to public saving due to partial Ricardian equivalence.

Current accounts

Current account balances are determined as the difference between national investment and savings, and in turn determine the evolution of net international investment positions. An exception is a group of non-OECD oil exporting countries, for which no individual projections of current balances are made. Rather, the combined current account balance of all non-OECD oil exporting countries is calculated based on projections of their balance of trade in oil, assuming that real oil prices increase by 1% per annum.

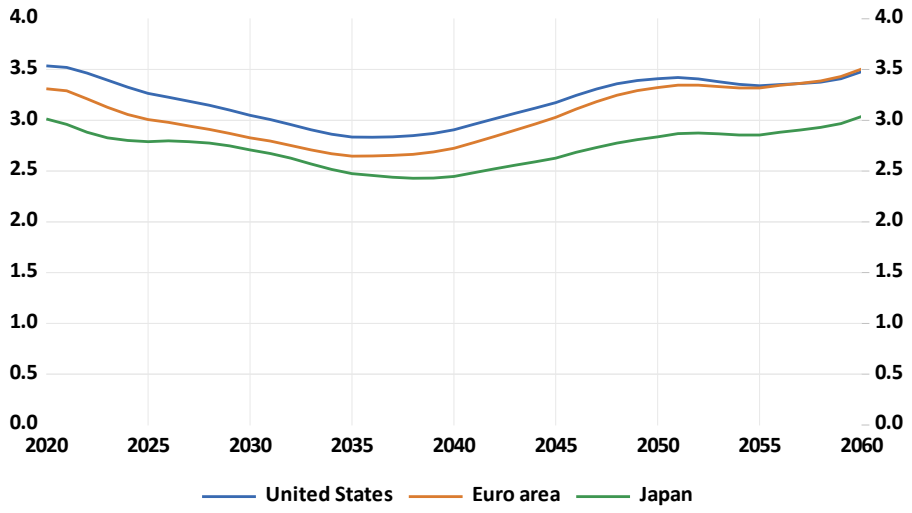
Interest rates

Short-term interest rates are assumed to vary with the cycle, so that as output gaps close, short-term interest rates return to neutral levels which are determined consistently with nominal potential growth.

Long-term interest rates are determined as a convolution of short-term rates plus a fiscal risk premium conditioned on the level of government debt: For every percentage point that the debt ratio exceeds a threshold of 75% of GDP, the fiscal risk premium applied to long-term interest rates increases by 2 basis points, with an additional increase of 2 basis points for every percentage point that the debt ratio exceeds 125% of GDP. Japan is an exception to this rule, given the high proportion of government debt which is financed domestically, so that the fiscal risk premium is computed at one quarter the rate for other OECD countries.

Finally, a global premium, common to all countries and applying to both short and long rates, helps to ensure that global saving and investment remain roughly aligned – the tolerance band for the difference accounting for the missing countries in the model. If the ex-ante sum of current account balances is more positive than in previous periods, signifying an ex ante excess of global savings, this premium is reduced, which stimulates investment and helps to brings global savings and investment back into ex-post balance.

Figure 23. Neutral nominal short-term interest rates in the baseline scenario, %



StatLink http://dx.doi.org/10.1787/888933776540

Notwithstanding huge uncertainty around how to estimate, let alone project, neutral interest rates, these are likely higher than actual rates, as indeed they are in the baseline scenario. The risk, then, is that actual rates could rise quickly with a return to equilibrium conditions. A sustained rise in interest rates relative to growth could eventually make large debt stocks costly to service and unsustainable (how quickly would depend on the debt maturity structure). Such reversals are historically fairly common: Analysing the experience of 17 advanced countries over the 1870-to-2013 period, Mehrotra (2017[21]) finds that instances in which the interest rate is lower than GDP growth cover nearly half of all observations, and are not driven by historical outliers such as world wars or the great depression. However, conditional on $r < g$ in a given five-year period, the difference has a 30% probability of turning positive in the subsequent period, and a 38% probability at a horizon of six to ten years. In the baseline scenario, $r - g$ indeed generally increases by 2030, raising the likelihood that it could turn positive (Figure 22). Preparing for this eventuality is one reason to keep a lid on public debt.

Another reason why lower public debt levels might be desirable is that in a low interest rate world, central banks are at greater risk of hitting the zero lower bound on policy rates as they respond to business cycle fluctuations, implying that fiscal policy may take on greater importance going forward (Blanchard and Summers, 2017[22]). More fiscal space for cyclical increases in the government debt-to-GDP ratio could support larger fiscal stimulus in future recessions.

5.2. Population ageing will place substantial pressure on OECD public finances

In addition to the desirability of insuring against rising interest rates and rebuilding fiscal buffers, another challenge to public finances in OECD countries will be posed by demographic change. For one, population ageing is likely to be associated with rising public expenditure on health (including long-term care) and pensions, which already account for a third to a half of primary expenditure in OECD countries. Declining employment-to-population ratios will place additional fiscal pressure on public finances if expenditure is more closely related to population, whereas revenue is more closely tied to employment (see Box 3).

Box 3. The determination of the main fiscal indicators

In a long-term model solved over many decades, it is necessary to ensure that the government debt-to-GDP ratio eventually stabilises. To this end, for OECD countries featuring a fiscal block, the model seeks to stabilise the debt ratio at its initial value (i.e. the projected value for the last year of the EO horizon) and does so by adjusting the ratio of primary revenue to potential GDP, which can be interpreted as an overall tax rate on the economy. A cap on overall fiscal consolidation (generally one percentage point of potential GDP on the underlying primary balance) in any single year is imposed to reflect political economy constraints. This assumption may contradict current government plans and is not necessarily consistent with national or supra-national fiscal objectives, targets or rules. No allowance is made for Keynesian effects of consolidation on demand. The difference between actual and cyclically-adjusted revenue is pinned down by the output gap (which is assumed to close gradually within a few years) and a semi-elasticity parameter estimated in previous OECD work (Price, Dang and Botev, 2015[23]).

The effects on public finances from population ageing are explicitly incorporated:

- Projected growth in real per capita public expenditure on health care is a function of real GDP per capita growth, changes in the share of the population aged 65 and up, and a time trend according to an estimated equation similar to that in Lorenzoni et al. (2018[24]). The time trend captures the excess of wage inflation over productivity growth in the health sector (Baumol effect) as well as upward cost pressures due to technological progress. In the baseline scenario, current policies and historical cost trends are assumed to be maintained, so the time trend is calibrated on the average experience of 34 OECD countries over the 1995-to-2015 period and takes a value of 1.3% per year. In the alternative 'cost containment' scenario, this value is halved, implying future policy reforms.
- Projected government pension expenditures are from European Commission (2018[25]) and Standard and Poor's (2016[26]). They incorporate legislated future changes in eligibility and benefits, but do not assume any general linking of the pension age to life expectancy (unless this has been already legislated).
- For "other" primary expenditure (i.e. primary expenditure excluding health and pensions), the baseline assumption is that such expenditures are maintained in real terms on a per capita basis. Maintaining expenditure on a per capita basis means that government finances are sensitive to the employment rate, as tax revenue follows employment whereas expenditure is linked to the total population. This introduces an additional channel through which public finances respond to demographic developments and also means that structural reforms that boost employment have an additional benefit on the fiscal position.

In view of the fiscal rule described above, fiscal pressures from demographic and other sources are visible in what happens to the overall tax rate. Endogenising the tax rate in this way infringes somewhat on the 'no policy change' assumption that otherwise characterises the baseline scenario, but at the same time, given that a minimal goal of fiscal policy should be to avoid an unstable debt path, this assumption can also reasonably be characterised as 'neutral'. The model does not currently take into account possible disincentive effects of higher taxes on activity, which is an avenue for future work.

More details on the fiscal block are available in Guillemette and Turner (2017[27]).

The government health care expenditure projections used in the baseline scenario take account of both demographic drivers (age structure of the population) and non-demographic ones (income elasticity of health services). Nevertheless, the combination of demographic and income effects fails to explain a large part of historical increases in public health-care expenditure. The residual – which can be attributed to technological progress, underlying health policies and institutions, as well as Baumol's cost disease – is assumed to continue to grow at a relatively high rate in the 'cost pressure' scenario (1.3% per annum), consistent with the general no-policy change approach. In the median OECD country, public health expenditure increases by about 4¾ percentage points of GDP between 2018 and 2060 (Figure 24, Panel A).

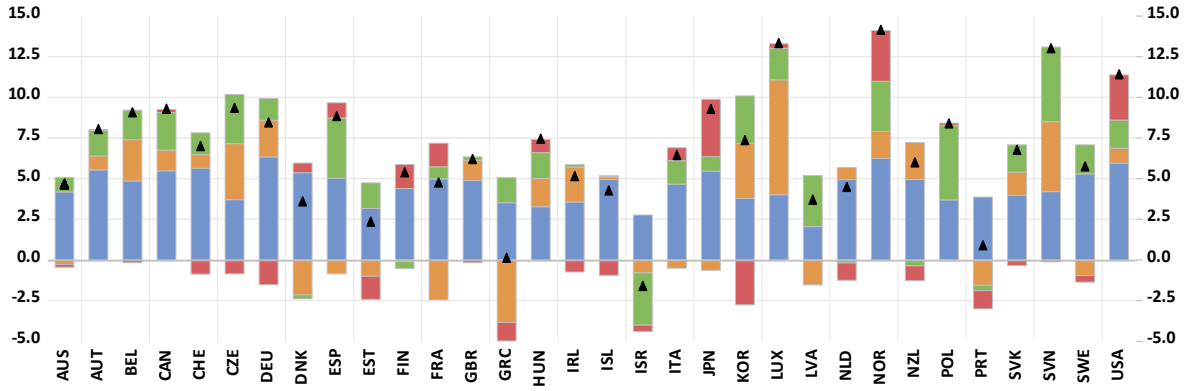
Government pension spending projections include not only increases in the number of beneficiaries, but also the future impacts of already-legislated measures such as retirement age increases, in-built pension system stabilisers, phasing out of early retirement provisions and changes to benefit formulas. Public pension expenditure increases by ¾ percentage points of GDP between 2018 and 2060 in the median country, but this figure hides substantial variation across countries. Korea, Luxembourg and Slovenia's fiscal burdens from pension promises rise by between 3 and 7 percentage points of GDP for instance, whereas they fall in other countries, such as Denmark, France and Greece (Figure 24, Panel A).

Given the model's working objective of stabilising public debt-to-GDP ratios at their initial levels, increases in health and pension expenditure in the baseline scenario are reflected in rising fiscal burdens over the projection period (Figure 24, Panel A). In addition, with other primary expenditures driven by the goal of maintaining a constant level of per capita service provision, whereas fiscal revenue is more closely tied to employment, declines in employment-to-population ratios generally push fiscal burdens up, especially in Poland, Slovenia and Spain. Other factors, primarily large initial gaps in structural primary revenue relative to levels that would permanently stabilise government debt-to-GDP ratios, add to needed fiscal efforts in about a third of countries, notably Japan and the United States. Overall, primary revenue as percentage of GDP increases by 6½ percentage points of GDP from 2018 to 2060 in the median OECD country. Luxembourg, Norway[20], Slovenia and the United States appear under most fiscal pressure in the baseline scenario, each requiring a more than 10 percentage points of GDP increase in primary revenue by 2060, with many other countries not far behind. Italy, usually included in lists of fiscally challenged countries, indeed faces a substantial rise in its fiscal burden, but is helped by a recent pension reform linking the retirement age to life expectancy.

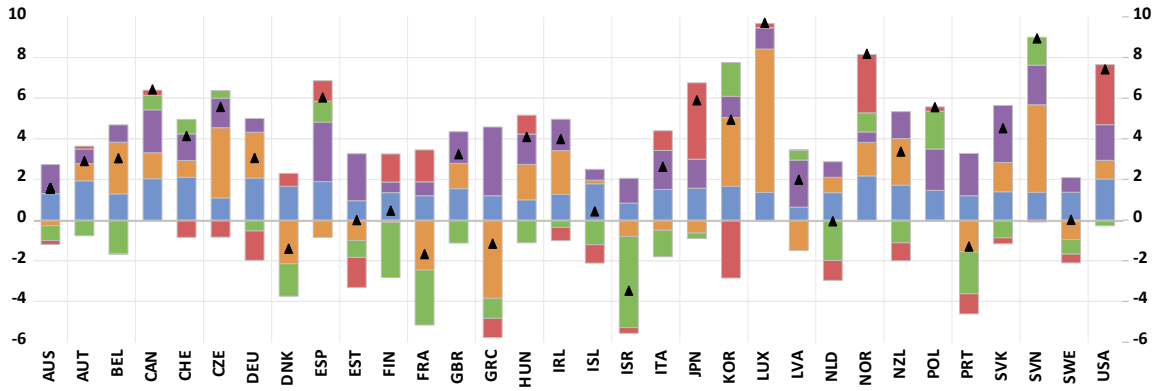
[20] Part of the required increase in primary revenue in Norway is due to the necessity of compensating for the recent decline in offshore revenue (from 10-16% of GDP over the 2000-to-2012 period to less than 6% of GDP in 2017) and appears in the 'other factors' component in Panel A of Figure 24. Even setting aside this component of the decomposition, however, Norway's required increases in primary revenue by 2060 would still be one of the largest. On the other hand, Norway's government has a large and positive net financial asset position so its fiscal situation is not problematic.

Figure 24. Change in primary revenue necessary by 2060 to stabilise public debt ratios, % pts of potential GDP

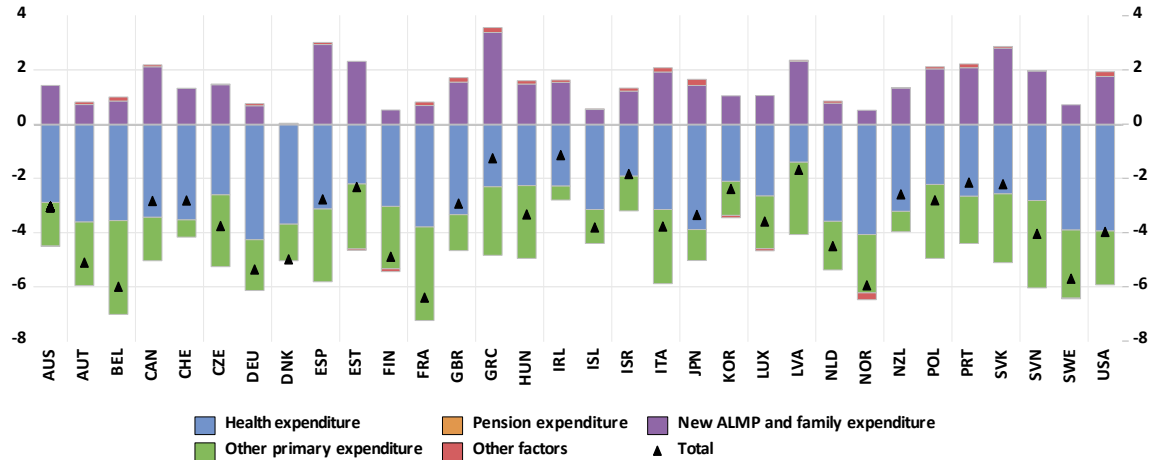
A. Baseline scenario



B. With health cost containment and labour market reforms



C. With health cost containment and labour market reforms, difference from baseline



StatLink http://dx.doi.org/10.1787/888933776559

Note: Health expenditure projections correspond to a 'cost pressure' scenario in Panel A and to a 'cost containment' scenario in Panel B (see Box 3). Pension expenditure projections are from European Commission (2018[25]) and Standard and Poor's (2016[26]). The 'other primary expenditure' category mostly captures the impact of changes to the employment-to-population ratio (see Box 3). The 'other factors' category mostly captures the initial gap between primary revenue and the level that would stabilise the debt-to-GDP ratio, but also changes in GDP growth rates over the projection period.

Many governments have more ambitious targets than stabilising gross public debt ratios at current levels. Reducing debt ratios would necessitate greater increases in fiscal burdens in the near term, although not in the long run as a lower debt ratio can be maintained with a lower primary balance. In an alternative scenario targeting gross debt ratios of 60% of GDP in European countries, with fiscal consolidation limited to 1% of GDP per annum, primary revenue in Italy and Portugal needs to be about 8 percentage points of GDP higher than in the baseline scenario at the peak in the mid-2020s, but can be about 2 percentage points lower by 2060. Similarly, lowering the gross debt ratio to 170% of GDP in Japan (implying reducing net debt to the current OECD average) requires the fiscal burden to rise by an extra 5¼ percentage points of GDP in the near term relative to baseline, but alleviates it by 1¼ percentage points in the long run. While fiscally demanding in the short run, public debt reduction can thus help alleviate fiscal burdens in the long run and in so doing make room for the fiscal costs associated with population ageing.

5.3. Structural reforms could alleviate fiscal pressures

To illustrate the potential for structural reforms to lower the fiscal pressures that build up in the baseline scenario, an alternative scenario combines reforms in the health sector that would lower health cost inflation with labour market reforms that would help boost employment and therefore the government revenue-to-expenditure ratio.

The first set of reforms are not modelled explicitly but are implicit in the assumed reduction in health care cost inflation between an alternative ‘cost containment’ scenario and the ‘cost pressure’ scenario used in the baseline, which amounts to 0.65% per annum (see Box 3). While the specific policy measures that could lead to such a decline are not spelled out, they can be thought of as changes to the governance of health institutions that would alter the incentives faced by health practitioners, or improvements in the efficiency of health care delivery, which recent OECD work has found to vary greatly between countries (Murtin et al., 2018[28]). Median public health care expenditure as a percentage of GDP rises by only about a third of its increase in the baseline scenario, thus subtracting about 3 percentage points to the increase in primary government revenue as a percentage of GDP necessary by 2060 to stabilise public debt ratios (Figure 24, Panels B and C).

The second set of reforms could include any labour market measure that would raise employment rates above those of the baseline scenario. For simplicity, the package of reforms described in subsection 4.2.2 is used again here, whereby OECD countries close, by 2030, half of the gaps with the five leading OECD countries on a number of labour market indicators. Some of the reforms involve raising government spending: additional expenditure on active labour market policies (ALMP) and family benefits in kind are included in this scenario, but other measures are assumed to require no additional spending (lowering excess coverage of union bargaining) or to be financed by less distortionary forms of taxation (reducing tax wedges and lengthening maternity leave).[21] No additional increases in legal retirement ages are assumed in this scenario relative to the baseline, but such reforms could contribute doubly to lowering future fiscal pressures: once by directly lowering future pension costs, and again by boosting employment rates at older ages and therefore government revenue. So the increases in pension costs are the same here as in the baseline scenario.

21. The direct budgetary impacts of changing tax wedges and maternity leave are not straightforward to estimate and could be the subject of future model extensions.

Fiscal consolidation efforts required to keep public debt-to-GDP ratios stable are lessened substantially in this alternative scenario: the median OECD government would need only a 3 percentage points of GDP increase in primary revenue by 2060 (Figure 24, Panel B), a 3½ percentage points reduction relative to baseline (Figure 24, Panel C). Countries where fiscal burdens are most alleviated are those where government expenditure as a percentage of GDP is relatively high and, simultaneously, where labour market policy settings indicate the most potential for reform. They include Belgium, France, Norway and Sweden. In most countries, the indirect fiscal gain resulting from the increase in the employment-to-population ratio (visible in the other primary expenditure component as explained in Box 3 and amounting to 2 percentage points of GDP in the median country) more than compensates for the direct costs of the labour market reforms (1.4 percentage points of GDP in the median country). With health care and other primary expenditure making smaller contributions to rising fiscal burdens in this scenario, pension expenditure takes on greater relative importance. The potential fiscal gains from pension reforms appear particularly large in Korea, Luxembourg and Slovenia (Figure 24, Panel B).

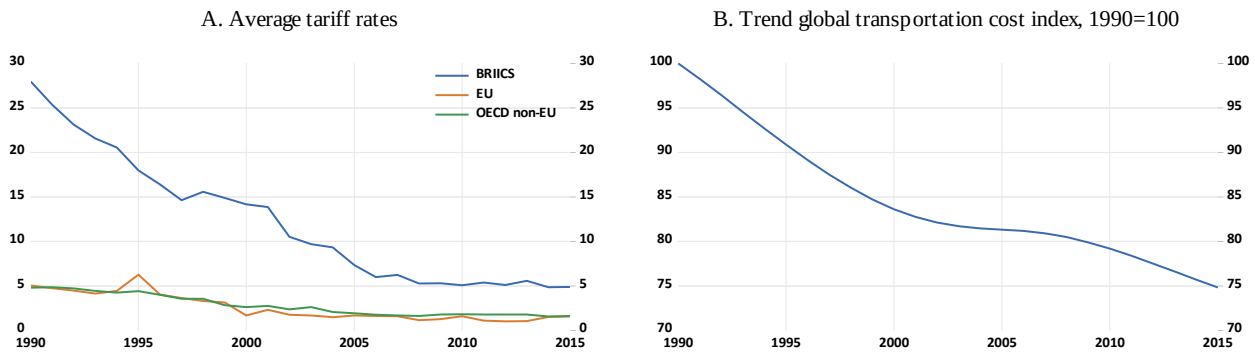
6. The importance of keeping an open trade regime

Over the past few decades, tariffs on international trade in goods have fallen steadily, along with transportation costs (Figure 25). These trends have boosted supply chain integration across countries and increased trade intensity. Because trade is an important channel through which technology and know-how diffuse across borders, the increase in world trade has supported labour efficiency growth in countries that were, or have become, more open to trade. In the long-term model, an increase of one percentage point in the ratio of trade to GDP raises income per person by about 0.4 per cent in the long run, an effect similar to that estimated by Frankel and Romer (1999[29]). Like governance (rule of law), it operates not only via the equilibrium level of labour efficiency but also the speed at which this equilibrium is reached (see Box 1). As discussed previously, in the model trade openness is a function of geographical remoteness, but also of domestic and foreign tariffs on international trade in goods.[22]

To illustrate the potential negative impact on the world economy of slipping back toward protectionism, a scenario is run in which average import tariffs gradually rise over the 2020-to-2030 period back to their 1990 levels. In the case of most OECD countries, this represents only a modest increase – of 3½ percentage points for the median country – because average tariffs were already relatively low in 1990. Australia, Chile, Mexico, New Zealand and Switzerland are exceptions where the scenario implies more substantial tariff increases. For the BRIICS, where trade liberalisation is a more recent phenomenon, going back to 1990 settings signifies a 6.6 percentage point increase in the average tariff of the median country, but a five-fold increase in the GDP-weighed BRIICS aggregate given the weight of China and India and these countries high average tariffs circa 1990 (Figure 25, Panel A).

22. The impacts of remoteness and tariffs on openness are calibrated to match the most common estimates in the international trade literature. Specifically, the elasticity of trade volumes to distance is set to -1 (Head and Mayer, 2013[48]) and the elasticity of trade volumes to prices is set to -4 (Imbs and Méjean, 2010[49]; 2015[50]).

Figure 25. The costs of trade: average tariff rates and transportation costs

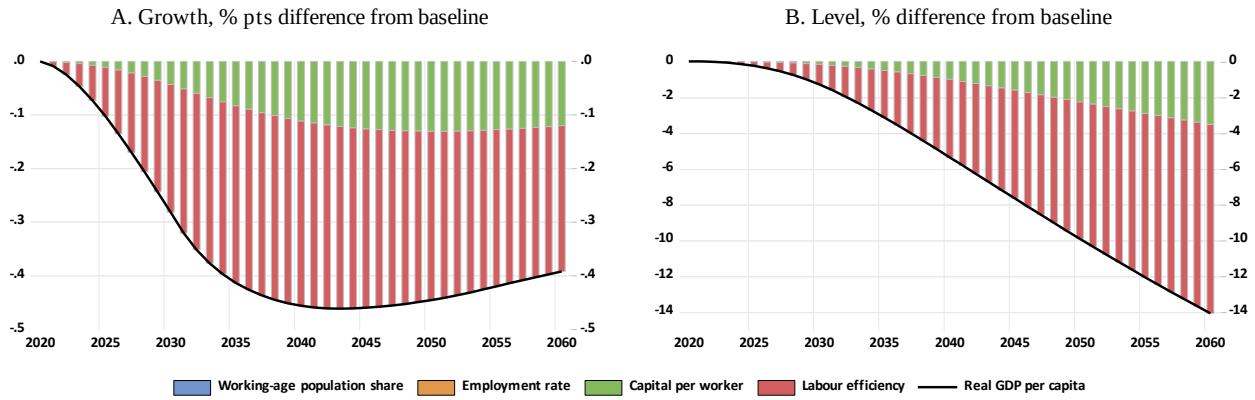


StatLink http://dx.doi.org/10.1787/888933776578

Note: Average tariff rates are aggregates computed from the World Bank's World Development Indicators database using fixed 2000 GDP weights. The global transportation cost index is computed from the ratio of the import value of traded goods, which includes the costs of insurance and freight (CIF), to their export value, which is on a Free on Board (FOB) basis, using bilateral trade flows from the IMF's Direction of Trade Statistics Database (DOTS). A regression approach is used to control for country-pair-direction fixed effects and a filter is applied to obtain a trend measure.

An increase in average import tariffs depresses world trend real GDP per capita growth by nearly ½ percentage point at the peak in the two decades after the tariff increases are fully implemented, tapering off only slowly thereafter (Figure 26, Panel A). The gradual build-up and persistence of the growth impact is due to the slow speed of adjustment of labour efficiency to trade openness in the conditional convergence framework. Nevertheless, by 2060, world average living standards are about 14% lower than in the baseline scenario, with one quarter of the decline due to lower labour efficiency and the rest to lower capital intensity (Figure 26, Panel B).

Figure 26. Impact of rising trade protectionism on world trend real GDP per capita



StatLink http://dx.doi.org/10.1787/888933776597

The increase in protectionism in this scenario lowers trend labour efficiency and capital intensity in all countries, even those for which the average import tariff does not increase because it has not changed since 1990, such as Norway (Figure 27). This occurs because a country's openness in the model does not only depend on its own average import tariff, but also on a weighted average of import tariffs in its export partners. The most negatively affected countries are those for which the average import tariff increases most

– Australia, Brazil, Chile, China, India, Indonesia, New Zealand and Switzerland – as well as those for which the aforementioned countries, especially China and India, are relatively important export markets – Australia, Korea and New Zealand. The outsized impacts in Australia and New Zealand are due to those countries combining both features. In aggregate, the loss in real GDP per capita by 2060 is about 18% for the BRIICS, 6% for the OECD area and 4½ per cent for the euro area given the high proportion of intra-European Union (EU) trade and the fact that tariffs were already low in the EU in 1990.

Figure 27. Per cent change in real GDP per capita by 2060 relative to baseline with increase in average import tariffs back to 1990 levels

StatLink http://dx.doi.org/10.1787/888933776616

It should be emphasised that the scenario here does not consider all of the potential economic impacts of rising import tariffs, but only the supply-side impacts of shrinking international trade on labour efficiency growth arising through reductions in import competition, technology transfers and specialisation. In reality, growth would likely decline more quickly and strongly than in this scenario via negative demand-side effects on confidence and investment. It is reasonable to expect that the effect of reversing the trend toward trade liberalisation might be commensurate with the positive historical effect of liberalisation, only with the opposite sign. According to Wacziarg and Welch (2008[30]), countries that liberalised their trade regimes over the 1950-to-1998 period grew 1½ percentage point more per annum immediately after liberalisation. Billmeier and Nannicini (2013[31]) likewise find that trade liberalisation had large positive effects on real GDP per capita for some countries, although with a lot of heterogeneity across countries and time periods, with some countries seeing no measurable benefits. Although a limited increase in average import tariffs is not as substantial a policy shift as going from a closed to a liberal trade regime as defined in these studies, such findings nevertheless suggest that slipping back on trade openness, be it via tariff or non-tariff measures, could have larger and more immediate effects on living standards than the long-term model obtains.

References

Acemoglu, D., S. Johnson and J. Robinson (2005), "Institutions as a Fundamental Cause of Long-Run Growth", in Aghion, P. and S. Durlauf (eds.), *Handbook of Economic Growth, Volume 1A*, Elsevier B.V., North Holland. [34]

Acemoglu, D., S. Johnson and J. Robinson (2001), "The Colonial Origins of Comparative Development: An Empirical Investigation", *American Economic Review*, Vol. 91, pp. 1369-1401. [33]

Acemoglu, D. and J. Robinson (2012), *Why Nations Fail: The Origins of Power, Prosperity, and Poverty*, Crown Business, New York. [37]

Bernanke, B. (2015), "Why Are Interest Rates So Low, Part 3: The Global Savings Glut", *Ben Bernanke's Blog*. [20]

Bernanke, B. (2005), *The Global Savings Glut and the U.S. Current Account Deficit*, Remarks at the Homer Jones Lecture. [19]

Billmeier, A. and T. Nannicini (2013), "Assessing Economic Liberalization Episodes: A Synthetic Control Approach", *The Review of Economics and Statistics*, Vol. 95/3, pp. 983-1001. [31]

Blanchard, O. and L. Summers (2017), "Rethinking Stabilization Policy. Back to the Future", *Prepared for the "Rethinking macroeconomic policy" conference*, Peterson Institute for International Economics, Washington. [22]

Borio, C. et al. (2017), "Why So Low for So Long? A Long-Term View of Real Interest Rates", *BIS Working Papers*, No. 685, Bank for International Settlements, Basel. [36]

Braconier, H., G. Nicoletti and B. Westmore (2014), "Policy Challenges for the Next 50 Years", *OECD Economic Policy Papers*, No. 9, OECD, Paris, http://dx.doi.org/10.1787/5jz18gs5fckf-en. [45]

Cavalleri, M. and Y. Guillemette (2017), "A revised approach to trend employment projections in long-term scenarios", *OECD Economics Department Working Papers*, No. 1384, OECD, Paris, http://dx.doi.org/10.1787/075f0153-en. [6]

Donselaar, P. and C. Koopmans (2016), "The Fruits of R&D: Meta-analysis of the Effects of Research and Development on Productivity", *Research Memorandum*, No. 2016-1, Vrije University, Amsterdam. [12]

Égert, B. (2017), "Regulation, institutions and aggregate investment: New evidence from OECD countries", *OECD Economics Department Working Papers*, No. 1392, OECD, Paris, http://dx.doi.org/10.1787/a4ece3c5-en. [46]

Égert, B. and P. Gal (2017), "The quantification of structural reforms in OECD countries: A new framework", *OECD Economics Department Working Papers*, No. 1354, OECD, Paris, http://dx.doi.org/10.1787/2d887027-en. [4]

European Commission (2018), "The 2018 Ageing Report: Economic and Budgetary Projections for the EU Member States (2016-2070)", *Institutional Paper*, No. 079, European Commission, Brussels, https://ec.europa.eu/info/publications/economy-finance/2018-ageing- [25]

report-economic-and-budgetary-projections-eu-member-states-2016-2070_en.

European Commission (2017), "The 2018 Ageing Report: Underlying Assumptions and Projection Methodologies", *Institutional Paper*, No. 065, European Commission, Brussels, https://ec.europa.eu/info/sites/info/files/economy-finance/ip065_en.pdf. [39]

Frankel, J. and D. Romer (1999), "Does Trade Cause Growth?", *American Economic Review*, Vol. 89/3, pp. 379-399. [29]

Gal, P. and A. Theising (2015), "The macroeconomic impact of structural policies on labour market outcomes in OECD countries: A reassessment", *OECD Economics Department Working Papers*, No. 1271, OECD, Paris, http://dx.doi.org/10.1787/5jrqc6t8ktjf-en. [5]

Global Infrastructure Hub (2017), *Global Infrastructure Outlook | Infrastructure investment needs for 50 countries, 7 sectors to 2040*, Global Infrastructure Hub, https://www.oxfordeconomics.com/publication/open/283970. [16]

Guillemette, Y., A. de Mauro and D. Turner (2018), "Saving, Investment, Capital Stock and Current Account Projections in Long-Term Scenarios", *OECD Economics Department Working Papers*, No. 1461, OECD, Paris, http://dx.doi.org/10.1787/aa519fc9-en. [8]

Guillemette, Y. et al. (2017), "A revised approach to productivity convergence in long-term scenarios", *OECD Economics Department Working Papers*, No. 1385, OECD, Paris, http://dx.doi.org/10.1787/0b8947e3-en. [3]

Guillemette, Y. and D. Turner (2017), "The fiscal projection framework in long-term scenarios", *OECD Economics Department Working Papers*, No. 1440, OECD, Paris, http://dx.doi.org/10.1787/8eddfa18-en. [27]

Hall, R. and C. Jones (1999), "Why Do Some Countries Produce so Much More Output per Worker than Others?", *The Quarterly Journal of Economics*, Vol. 114, pp. 83-116. [32]

Hanushek, E. and L. Woessmann (2010), "Education and Economic Growth", in D.J. Brewer and P.J. McEwan (eds.), *Economics of Education*, Elsevier, Amsterdam. [43]

Head, K. and T. Mayer (2013), "Gravity Equations: Workhorse,Toolkit, and Cookbook", *CEPII Working Paper*, No. 2013-27, Centre d'études prospectives et d'informations internationales (CEPII). [48]

Holston, K., T. Laubach and J. Williams (2017), "Measuring the Natural Rate of Interest: International Trends and Determinants", *Journal of International Economics*, Vol. 108/S1, pp. 59-75. [18]

Imbs, J. and I. Méjean (2015), "Elasticity Optimism", *American Economic Journal: Macroeconomics*, Vol. 7/3, pp. 43-83. [50]

Imbs, J. and I. Méjean (2010), "Trade Elasticities: A Final Report for the European Commission", *Economic Papers*, No. 432, European Commission, Brussels. [49]

IMF (2014), "Perspectives on Global Real Interest Rates", in *World Economic Outlook*, International Monetary Fund, Washington, D.C.. [17]

Johansson, A. et al. (2013), "Long-Term Growth Scenarios", *OECD Economics Department Working Papers*, No. 1000, OECD, Paris, http://dx.doi.org/10.1787/5k4ddxpr2fmr-en. [52]

Jones, C. (2015), "The Facts of Economic Growth", *NBER Working Papers*, No. 21142, National Bureau of Economic Research. [7]

Kaufmann, D. and A. Kraay (2002), "Growth without Governance", *World Bank Policy* [35]

Research Working Papers, No. 2928, World Bank, Washington, D.C..

Kaufmann, D., A. Kraay and M. Mastruzzi (2010), "The Worldwide Governance Indicators", *World Bank Policy Research Working Papers*, No. 5430, World Bank, Washington, D.C.. [9]

Krueger, A. and M. Lindahl (2001), "Education for growth: why and for whom?", *Journal of Economic Literature*, Vol. 39/1, pp. 1011-1136. [41]

Lloyd, P. and C. Lee (2018), "A Review of the Recent Literature on the Institutional Economics Analysis of the Long-Run Performance of Nations", *Journal of Economic Surveys*, Vol. 32/1, pp. 1-22. [38]

Lorenzoni, L. et al. (2018), "Which policies increase value for money in health care?", *OECD Health Working Papers*, No. 104, OECD, Paris, http://dx.doi.org/10.1787/a46c5b1f-en. [24]

Lutz, W., W. Butz and S. KC (2014), *World Population and Human Capital in the Twenty-First Century*, Oxford University Press, London. [2]

Mastrobuoni, G. (2009), "Labor supply effects of the recent social security benefit cuts: Empirical estimates using cohort discontinuities", *Journal of Public Economics*, Vol. 93, pp. 1224-1233. [51]

Mehrotra, N. (2017), "Debt Sustainability in a Low Interest Rate World", *Hutchins Center Working Papers*, No. 32, Hutchins Center on Fiscal and Monetary Policy at Brookings. [21]

Morrisson, C. and F. Murtin (2010), "The Kuznets curve of human capital inequality: 1870–2010", *The Journal of Economic Inequality*, Vol. 11/3, pp. 283-301. [10]

Mourougane, A. et al. (2016), "Can an Increase in Public Investment Sustainably Lift Economic Growth?", *OECD Economics Department Working Papers*, No. 1351, OECD, Paris, http://dx.doi.org/10.1787/a25a7723-en. [15]

Murtin, F. et al. (2018), "The Cost-Efficiency of Health Systems: from Measurement to Policies", No. Forthcoming, OECD, Paris. [28]

Nordhaus, W. (2017), "Evolution of Assessments of the Economics of Global Warming: Changes in the DICE model, 1992-2017", *NBER Working Paper*, No. 23319, National Bureau of Economic Research, http://www.nber.org/papers/w23319. [1]

OECD (2017), *Bridging the Gap: Inclusive Growth 2017 Update Report*, OECD, Paris, http://www.oecd.org/inclusive-growth/Bridging_the_Gap.pdf. [11]

OECD (2017), *Pensions at a Glance 2017 - OECD and G20 Indicators*, OECD Publishing, Paris, http://dx.doi.org/10.1787/pension_glance-2017-en. [44]

OECD (2015), "Lifting Investment for Higher Sustainable Growth", in *OECD Economic Outlook, Volume 2015 Issue 1*, OECD Publishing, Paris, http://dx.doi.org/10.1787/eco_outlook-v2015-1-46-en. [14]

OECD (2014), "Growth Prospects and Fiscal Requirements over the Long Term", in *OECD Economic Outlook, Volume 2014 Issue 1*, OECD Publishing, Paris, http://dx.doi.org/10.1787/eco_outlook-v2014-1-44-en. [47]

Price, R., T. Dang and J. Botev (2015), "Adjusting fiscal balances for the business cycle: New tax and expenditure elasticity estimates for OECD countries", *OECD Economics Department Working Papers*, No. 1275, OECD, Paris, http://dx.doi.org/10.1787/5jrp1g3282d7-en. [23]

Standard and Poor's (2016), *Global Aging 2016: 58 Shades Of Gray*, Standard and Poor's. [26]

Stevens, P. and M. Weale (2004), "Education and Economic Growth", in G. Johnes and J. Johnes (eds.), *International Handbook on the Economics of Education*, Edward Elgar, Cheltenham. [42]

Summers, L. (2017), *The case for a proper program of infrastructure spending*, larrysummers.com, http://larrysummers.com/2017/01/17/the-case-for-a-proper-program-of-infrastructure-spending/ (accessed on 23 January 2018). [13]

The Finnish Centre for Pensions (2017), *Retirement Ages in Member States*, https://www.etk.fi/en/the-pension-system-2/the-pension-system/international-comparison/retirement-ages/ (accessed on 15 November 2017). [40]

Wacziarg, R. and K. Welch (2008), "Trade Liberalization and Growth: New Evidence", *The World Bank Economic Review*, Vol. 22/2, pp. 187-231. [30]