WPS8663

Policy Research Working Paper 8663

Potential Growth

Outlook and Options for the Russian Federation

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WORLD BANK GROUP
Development Prospects Group
&
Macroeconomics, Trade and Investment Global Practice
December 2018

Policy Research Working Paper 8663

Abstract

This paper examines the past and future trajectory of the Russian Federation's potential growth: the speed at which an economy could grow if all resources were utilized efficiently. The findings show that it peaked before the 2008 global financial crisis and continued to decline up to 2017. The estimated potential growth rate was 3.8 percent in 2000–09 and 1.7 percent in 2010–17, a 2.1 percentage point decline. The most recent deceleration was due to a slowdown of productivity growth and a shrinking potential labor force, rather than a shortfall in capital accumulation. For its future trajectory, under the baseline scenario, Russia's potential growth is expected to continue its gradual downward trend, from 1.5 percent in 2017 to 1.3 percent in 2022. It is expected to recover gradually thereafter, primarily driven by stabilization of the labor force. The simulations of proposed reform measures currently being considered by policy makers, including a combination of pension reform, more migration, higher investment, and gradual acceleration of total factor productivity growth, can double Russia's potential growth rate to 3.0 percent by 2028. Under the assumptions discussed in the paper, pension reform, increases in migration, investment, and productivity contribute 0.4, 0.2, 0.6, and 0.3 percentage points, respectively, to the increase in Russia's potential growth rate. Potential growth is found to be most sensitive to changes in total factor productivity growth, suggesting that reforms that increase productivity may have the most impact on boosting Russia's potential growth.

This paper is a product of the Development Prospects Group, Development Economics and the Macroeconomics, Trade and Investment Global Practice. It is part of a larger effort by the World Bank to provide open access to its research and make a contribution to development policy discussions around the world. Policy Research Working Papers are also posted on the Web at http://www.worldbank.org/research. The authors may be contacted at asanghi@worldbank.org.

Potential Growth: Outlook and Options for the Russian Federation*

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World Bank

JEL Classification: **E6, O20**

Keywords: Potential growth, potential output, emerging markets, developing economies, Russia, pension, structural reform, investment.

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*This paper is a product of the Development Prospect Group and Macro, Trade and Investment Global Practice. It is part of a larger effort by the World Bank to provide open access to its research and make a contribution to development policy discussions around the world. Policy Research Working Papers are also posted on the Web at http://www.worldbank.org/research. The author may be contacted at asanghi@worldbank.org. This paper was produced with valuable contributions from Sinem Kilic Celik and Y. Modeste Some in World Bank (2018), and benefited from the comments and suggestions of Zoran Anusic, Olga Emelyanova, Evsey Gurvich, Andras Horvai, Sandeep Mahajan, Alexander Morozov, Franziska Ohnsorge, Irina Rostovtseva, Marc Stocker, Maria Ustinova, and seminar participants at the Central Bank of Russian Federation.
The findings, interpretations, and conclusions expressed in this paper are entirely those of the authors and should not be attributed to the World Bank, its Executive Directors, or the countries they represent.
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I. Introduction

Although economic activity in the Russian Federation has continued to recover from the 2015-16 recession, potential growth — the rate at which the economy can grow when labor and capital are fully employed — has continued to decline. A weakness in potential growth is not specific to Russia. Potential growth has been adversely affected in both advanced economies (AEs), where it was evident even before the financial crisis, and emerging markets and developing economies (EMDEs), especially since 2010-12. However, a faster-than-average decline in Russia's potential growth raises concerns about its medium-term prospects and the risks of stalled convergence in GDP per capita with advanced economy levels.

Since per capita income growth is the overriding long-run force for the sustained improvement of living standards, this trend is also cause for concern about Russia's ability to meet its broader development goals.

Against this backdrop, this paper addresses the following questions:

- How has potential growth evolved since the turn of the century?
- What are the prospects for Russia's potential growth?
- What policy options are available to lift potential growth in Russia?

To help answer these questions, this paper estimates potential growth and simulates the impact of various policy outcomes on output, employment, capital stock, and productivity. Estimates of potential growth for other EMDEs provide useful benchmarks to analyze cross-country differences (World Bank 2018) .

II. Methods

Potential growth is the rate of increase of potential output, which is the level of output an economy would sustain at full capacity utilization and full employment. Since it is not directly observable, the measurement of potential growth relies on a range of assumptions about its relationship to observable variables. Different estimates of potential growth capture different time-horizons: "short-term" versus "long-term" (Basu and Fernald 2009)

Short-term potential growth is the growth of potential output that can be achieved without putting pressure on production capacity and inflation when factors of production cannot immediately

relocate in response to shocks (Okun 1962.). The short-term measure is particularly useful for monetary policy since supply constraints or adverse demand shocks, even if they are not permanent, reduce the effective slack in the economy and therefore influence the policy interest rate at a given decision point.

Long-term potential growth is a function of the available capital stock, labor input, and current technology (Solow 1962). As such, long-term potential growth captures movements in the slow-moving fundamental drivers of output, assuming allocation of all factors of production to their most productive uses regardless of temporary supply shocks. Long-term potential output sets the underlying trend of short-term potential output as well as actual output (see Box 1 above for various estimation methods).

Other studies have also documented a potential growth slowdown in Russia (Entov and Lugovoy 2013; IMF 2012; Kaitila 2016; Kuboniwa 2011; OECD 2018). This paper fills a gap in the literature by providing a cross-country perspective using a large data set of comparable estimates (World Bank 2018). The analysis is also innovative in its examination of the impact of multiple reforms in a single platform. While the appendix provides the technical details, Box 1 provides an overview of how potential growth is measured.

Box 1: How to measure potential growth?

Estimates of short-term output may be computed using filtering techniques, including univariate and multivariate filters, while estimates of long-term potential output rest on structural models or long-term growth expectations.

Filtering techniques. Univariate filters involve estimates of trend output using only GDP series. Multivariate filters take into account the relationship between GDP and other variables (such as inflation or unemployment rates) to help distinguish short-run deviations of output from trends.

Production function approach. This approach represents potential output as a (Cobb-Douglas) production function of the amount of full-employment capital and labor, as well as technology and efficiency of factor allocation that drive total factor productivity (TFP).

Expectations. The approaches above are supplemented with long-term growth expectations, such as five-year-ahead growth forecasts from Consensus Economics or the IMF's World Economic Outlook. These growth expectations reflect both model estimates and forecasters' judgment. Judgment can be especially useful during periods of major structural changes, which model-based estimates may not be well-equipped to capture.

The key results pertaining to potential growth presented in this paper are broadly robust to the choice of potential growth measures: the faster-than-average post-crisis slowdown in Russian potential growth (see Appendix for more technical detail).

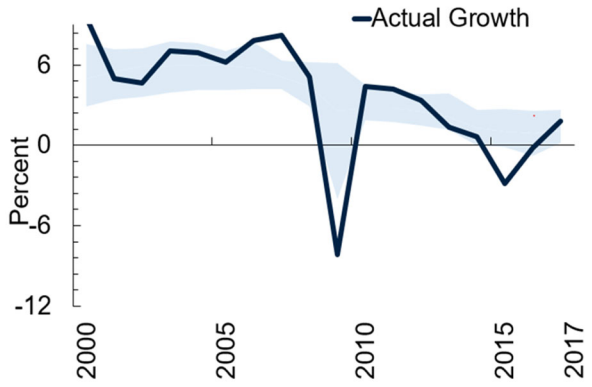
III. Evolution and drivers of potential growth in the short and long terms: Productivity, capital, and labor

After demonstrating remarkable resilience in the early 2000s, Russia's potential growth slowed in the late 2000s and continued to weaken. Various measures of potential growth show the same declining trend (Figure 1). The recent potential growth slowdown is a global phenomenon. During 2013-17, potential growth was below its longer-term average in 87 percent of advanced economies and in almost half of EMDEs (World Bank 2018)

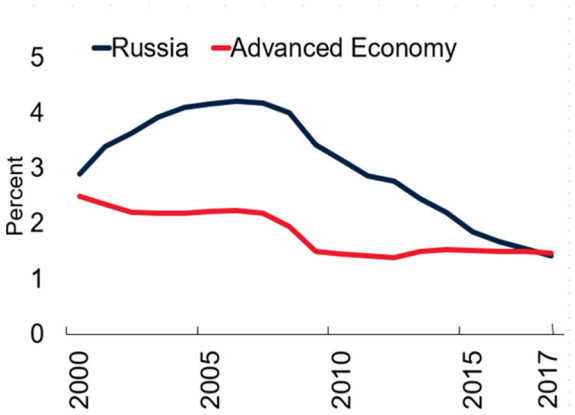
The slowdown of potential growth was more serious in Russia than the rest of the world, reflecting weaker productivity growth and worse demographic outcomes. In the production function approach, which we will focus on in the remainder of this section, the average potential growth rate was 3.8 percent in 2000-09 and 1.7 percent in 2010-17, a 2.1 percentage point decline. On the other hand, the potential growth rate for advanced economies declined by 0.7 percentage point in the same period. The recent deceleration in Russia was due to a slowdown of productivity growth and a shrinking potential labor force rather than a shortfall in capital accumulation.

Figure 1: Russian potential growth has been declining

A. Range of potential growth estimates



B. Comparison of potential growth



Source: World Bank.
Notes:
A. Solid line indicates annual GDP growth for Russia. Shaded area shows range of 10 potential growth estimates (Production Function approach, multivariate filter, Hodrick-Prescott filter, Baxter and King filter, Christiano and Fitzgerald filter, Butterworth filter, 5 years ahead forecasts from IMF World Economic Outlook and Consensus Economics, potential growth estimates from OECD Economic Outlook and OECD Long-Term Baseline Projections).
B. Comparison of potential growth using a production function approach and multivariate filter. Advanced Economy is GDP weighted average of 32 advanced economies. Advanced economy is defined in the *Global Economic Prospects*, World Bank.

A. Productivity

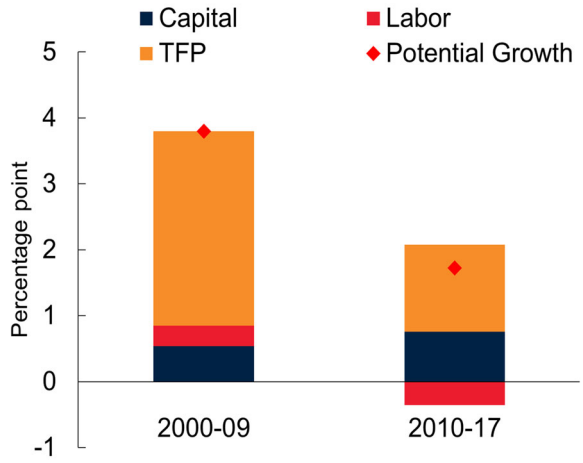
Total factor productivity (TFP) growth has historically been a critical driver of sustained growth in per capita output and prosperity, allowing output to expand beyond what was previously considered possible with a given amount of factor inputs (Romer 1986; Lucas 1988; Grossman and Helpman 1991). Differences in TFP account for about two-thirds of the variation in per capita income across the world (Jones 2016). TFP growth can rise with the adoption of new technologies, an adaptation of existing technologies, the introduction of more efficient processes, or changes in management practices (EBRD 2014). Higher productivity lifts firms' marginal product and reduces their marginal cost, which allows them to increase their demand for factors of production. Technological advances reduce the price of capital equipment, encouraging further capital accumulation, which in turn embodies further improvements in productivity (Greenwood, Hercowitz and Krusell 1997; Sakeflaris 2004).

Russian productivity growth outpaced the advanced economy average and global average during the previous decade. On average, TFP growth was 2.9 percent in Russia compared to 0.7 percent in AEs in 2000-2009. This high TFP growth reflects a one-off transition process characterized by the reallocation of excess capacity to more productive sectors of the economy (World Bank 2014).

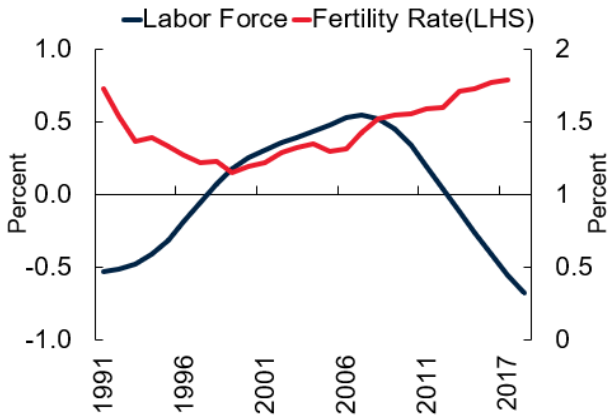
As Figure 2 shows, Russian TFP growth began to slow down during the global financial crisis period in 2008-09, and ultimately declined to 1.3 percent in 2017. The declining trend in TFP is a global phenomenon that started well before the global financial crisis in AEs and spread to EMDEs after the crisis. Weaker productivity growth has been attributed to slower investment growth, partly because of deleveraging pressures and other crisis legacies, combined with population aging and maturing global value chains (World Bank 2018). In Russia, TFP growth slowed as productivity gains from first generation reforms wore off (World Bank 2014). The changing composition of investment from machinery to construction could have also contributed to lower TFP growth (Voskoboynikov 2017).

Figure 2: Slower potential growth was driven by TFP growth slowdown and decline in labor force

A. Decomposition of potential growth



B. Labor



Source: International Labor Organization(ILO), World Bank.
Notes:
A. Average contribution to the potential growth for capital, labor, and total factor productivity (TFP) for Russia. The diamonds show average potential growth.
B. Labor force is the estimated annual potential labor force growth. Fertility rate is ILO model estimate of total fertility rate.

B. Capital

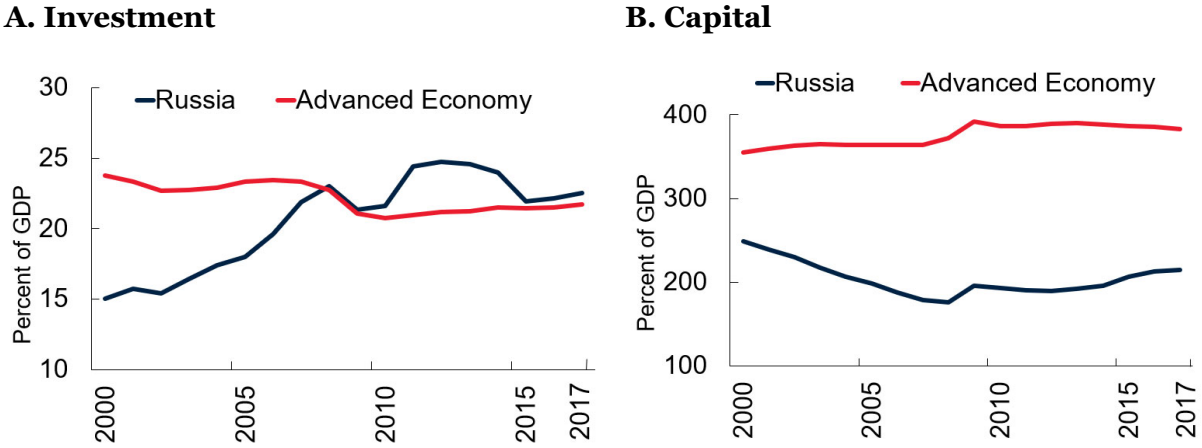
Investment can lift potential growth through direct and indirect channels. Directly, investment is the source of capital accumulation, which raises labor productivity and potential output—provided that investment is not channeled into excess capacity and wasted (Devarajan, Swaroop and Zou 199; Presbitero 2016). Indirectly, investment can raise TFP because technological improvements are often embodied in investment (Solow 1962).

Globally, investment growth halved between 2010 and 2016, with the weakness shifting from advanced economies to EMDEs over this period. Investment growth in advanced economies declined during the Euro Area crisis, and after a brief rebound, declined again following a drop in oil prices that disrupted energy sector investment in the United States. In EMDEs, investment growth slowed sharply following the global financial crisis, from double-digit rates in the immediate wake of the crisis to a post-crisis low of 3 percent in 2016. Investment growth has been well below its pre-crisis average as well as its longer-term average in more than half of the EMDEs in the sample. In Russia, although investment growth slowed from an average growth of 10.4 percent during the previous decade to 2.8 percent in 2010 – 2017, the investment as a share of

GDP increased. This helped to accelerate capital growth over the period 2010-17[1] (Figure 3) (Voskoboynikov 2017).

While investment weakness in advanced economies mainly reflects sluggish demand and output growth, in EMDEs, a broader range of factors has been at play. In commodity importers, slowing FDI inflows and spillovers from soft activity in major advanced economies accounted for much of the slowdown in investment growth after 2011. In commodity exporters, including Russia, a sharp deterioration in terms of trade (particularly for energy exporters), slowing growth in China, and mounting private debt burdens accounted for much of the slowdown in investment growth. In several EMDEs, political and policy uncertainty was a key factor in investment contractions or slowdowns (Kose, et al. 2017; Entov and Lugovoy 2013).

Figure 3: Russia's Investment-to-GDP ratio stopped increasing, and its capital-to-GDP ratio remains low



Source: Haver Analytisc, Penn World Table, World Bank.
Notes:
A. B. Red line indicates GDP weighted average of 23 advanced economies.
A. Gross fixed capital formation as a percent of GDP for Russia
B. Capital as a percent of GDP for Russia.

C. Labor

Like capital, growing working-age populations can lift potential growth through both direct and indirect channels. Directly, increasing the working-age population lifts the potential labor force and has been associated with "demographic dividends" to output growth. Indirectly, a higher

[1] While investment growth and capital accumulation are closely related, they sometimes do not move together. When the *level* of investment is high relative to GDP or capital, the capital *growth rate* is high.

share of the working-age population has been accompanied by higher capital accumulation and faster productivity growth (Bloom and Canning 2004; World Bank 2018).

The recent demographic shifts towards older population structures affect potential output in several ways. Population aging may reduce the working-age population, which directly reduces potential labor supply. Aging populations have also been associated with slower labor productivity growth for various industries and occupations (Maestas, Mullen and Powell 2016). Russian demographic trends are worse than those found in other EMDEs, as the country's low total fertility rate in the early 1990s accelerated population aging. Russia's total fertility rate remained low until the mid-2000s (Figure 2B). The decline in the total fertility rate began to take a toll on the working-age population after 15 years, with potential labor force growth peaking in 2007 at 0.7 percent before declining to -0.7 percent in 2017.

Over the past five decades, global growth was supported by rapidly growing working-age populations—until the mid-1980s in advanced economies and around 2010 in EMDEs. With the retirement of the baby boom generation and lower fertility rates, demographic trends have turned less favorable to growth and will continue to do so over the next decade. In advanced economies, the working-age share of the population is set to decline from 65.4 percent in 2015 to 62.3 percent by 2025. In EMDEs, the working-age share of the population peaked at 65.8 percent in 2015 and is expected to stabilize around this level for the next 10 years.

Another important driver of increased labor supply is labor force participation among less represented groups, including women, young, and old workers. Rising female labor force participation rates have been attributed to better educational attainment (opening access to higher-earning jobs), lower fertility rates, a technology-driven shift towards non-manual skills, and cheaper home production (lowering the opportunity cost of working). While the Russian labor market participation rate is on an upward trend, it is not enough to offset the rapid decline in the population.

IV. Russia's potential growth: Outlook

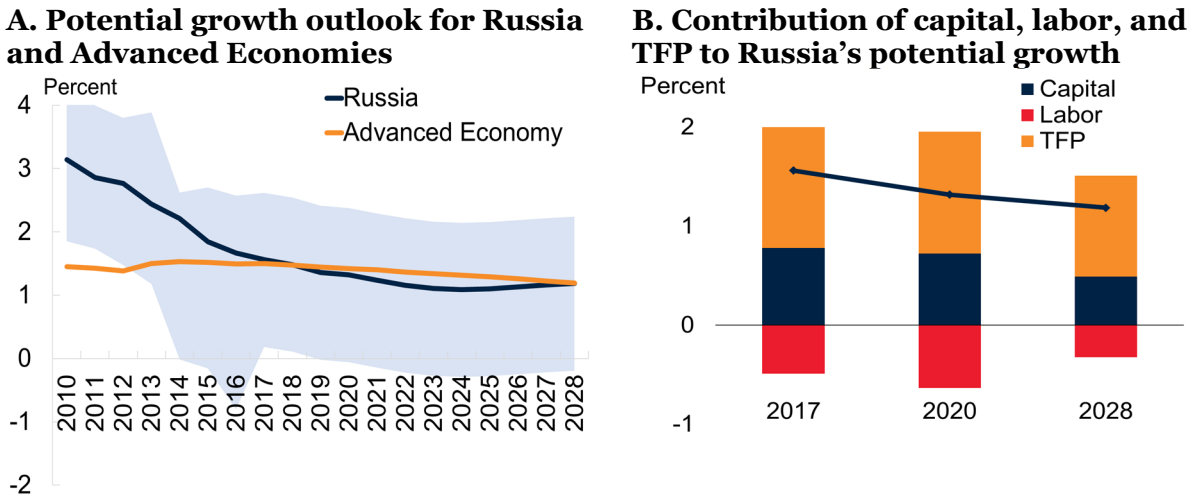
Factors weighing on potential growth for Russia are likely to persist over the next decade. Demographic trends are expected to become less favorable. This will weigh on potential growth even if trend improvements in human capital and labor force participation continue. Short of unexpected surges in productivity growth, these trends imply an outlook of mediocre potential growth.

The forward-looking scenario ("baseline scenario") presented below applies the production function approach to assumed paths for capital, population statistics, and education and health outcomes:

- Investment to potential GDP ratio is assumed to stay at the 2010-2017 average level (of 23 percent). This means investment growth is roughly in line with the potential growth.
- The size of the Russian population and its composition are assumed to grow in line with a median fertility scenario (as in the UN Population Projections).
- Labor market participation rates are taken from International Labour Organization (ILO) forecasts.

Our scenario focus on long-term factors, or the supply side of the economy. While oil price fluctuations can have large, short-term impact on growth through changes in demand, they have a limited impact on long-term growth.[2]

Figure 4: Russia's potential growth is expected to decline slowly due to declining productivity growth



Source: World Bank.
Notes:
A. Blue line indicates potential growth estimates and forecasts for Russia using a production function approach. Orange line indicates GDP weighted average of potential growth estimates and forecasts for 23 advanced economies. The shaded area is maximum and minimum of 10 potential growth estimates for Russia (Production function approach, multivariate filter, Hodrick-Prescott filter, Baxter and King filter, Christiano and Fitzgerald filter, Butterworth filter, 5 years ahead forecasts from IMF World Economic Outlook and Consensus Economics, potential growth estimates from OECD Economic Outlook and OECD Long-Term Baseline Projections). It is assumed that confidence interval remains constant for the year 2018 and after.
B. The contribution of capital, labor, and total factor productivity (TFP) to potential growth in Russia. The solid line shows average potential growth.

[2] Higher oil prices could affect the long-term potential growth through higher investment. However, we found that the empirical relationship between oil prices and investment is not robust in Russia.

Under the baseline scenario, Russia's potential growth is expected to continue on a gradual downward trend from 1.5 percent in 2017 to 1.3 percent in 2023. It is expected to bottom out in 2023 and to recover gradually thereafter. This recovery is primarily driven by labor inputs. According to the UN's forecasts, the rate of contraction in the working-age population is expected to bottom out in 2022 (0.9 percent decline) but subsequently bounce back. While our forecasts contain significant variations, the upper bound of forecasts without reforms is expected to remain below 2.5 percent in our forecasting horizon.

In 2019, Russian potential growth is expected to be below the advanced economy average for the first time in 20 years, reflecting a faster contraction of the potential labor force. The difference is at most 0.2 percentage point and well within the confidence interval. While expected demographic improvements will raise the Russian potential growth above the advanced economy average again in 2026, a minor difference in potential growth suggests that Russia's catching-up to the advanced economy average is expected to stall for the next decade.

V. Boosting potential growth: Role of pensions, migration, investment and productivity

While a detailed analysis for boosting Russia's potential growth is beyond the scope of this paper, the production function framework can be applied to examine some stylized policy scenarios. The impact of better policy outcomes is estimated as the difference between potential growth under a counterfactual scenario of higher growth of physical or human capital or labor supply compared with the baseline scenario. The estimates provided in these stylized scenarios may well be lower bounds because they disregard nonlinearities in reform impacts as well as synergies between different reform measures.

A. Pensions

In Russia, both the mandatory retirement age and labor force participation rate for aged workers, especially for females, are low compared to advanced economies (Figure 5). Increases in the retirement age can lift potential growth as the labor force participation rate for aged workers increases.

In 2018, the Russian government proposed a gradual increase in the retirement age—by five years to 65 for men to 60 for women—starting in 2019 and ending in 2028.[3] We simulated the impact

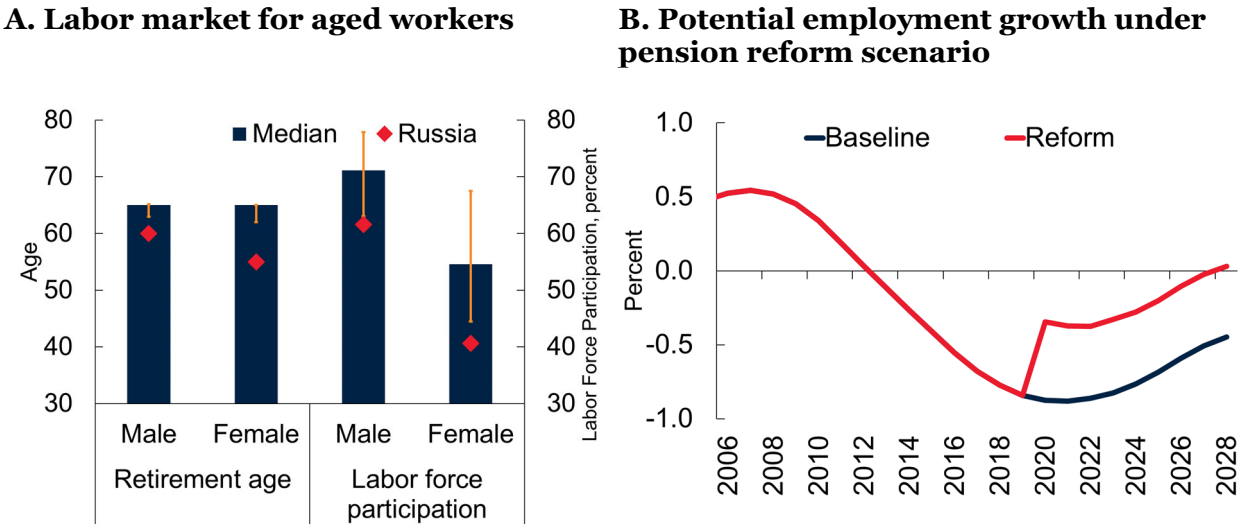
[3] The proposed pension reforms go beyond retirement age reform. For purposes of this paper, we consider the effect of only the increase in retirement age.

of this reform on potential growth. In line with the other countries, we assume that this reform will increase the average retirement age by half as much as the increase in the mandatory retirement age.[4]

As a result, pension reform is expected to raise the potential growth throughout the enacted time period. During 2020-2028, with a rise in the retirement age for both men and women, potential labor force growth is expected to increase by about 0.9 percentage point per year compared to the baseline scenario. The potential growth rate is expected to increase by 0.3-0.4 percentage point over 2020-2028. The cumulative impact of pension reform is around 3-4 percent of potential output during 2020-2028 (after which additional increases will be negligible).

We emphasize that the realized impact of the reform could be smaller than this number. Data limitations forced an emphasis on evidence from advanced economies to estimate the impact of retirement age reform. Also, reforms could be potentially backtracked during the implementation period.

Figure 5: The simulated effects of pension reform in Russia



Source: International Labour Organization (ILO), Organization for Economic Cooperation and Development (OECD), World Bank.
Notes:
A. Blue bar indicates median of OECD countries. Yellow lines indicate first and third quantile. Retirement age means mandatory retirement age. Labor force participation rates are for ages 55-64.
B. Potential employment growth under pension reform scenario discussed in this section. Baseline scenario refers to the assumptions mentioned in the outlook section.

[4] In the United States, the mean retirement age of the affected cohorts has increased by about half as much as the increase in the normal retirement age (Giovanni Mastrobuoni 2009). Similar evidence was found in Germany (Börsch-Supan et al. 2008; Fehr et al 2012) and Switzerland (Lalive and Staubli 2014).

B. Migration

Traditionally, linguistic, family, cultural, and economic ties between Russia and neighboring countries created strong migration flows to Russia, especially from Central Asia (World Bank 2017). An increase in migration flows will partially offset the adverse demographic implications on potential growth.

We simulated the impact of increased migration on potential growth.[5] We used the medium variant population projection from the Russian Federation Federal State Statistics Service, which assumes successful implementation of ongoing reforms to improve Russia's demographic outlook (Federal State Statistics Service 2017). The most notable difference from our baseline assumption taken from the United Nations is the expected number of migrants.

In this scenario, the number of net migrants per year increases to 289,000 until 2028 (while the United Nations forecast is 100,000 in the same year). This results in a 0.2 percentage point higher potential growth. The effects are expected to continue after 2028. The cumulative impact of increased migration is around 2 percent of potential output during 2018-2028.

C. Investment

Many countries have sizable investment needs. UNCTAD (2014) estimated that unfilled global investment needs amount to up to 3 percent of global GDP. A low capital to GDP ratio suggests that Russia has substantial room for expanding investment.

Russian investment needs are vast and estimated at 75 percent of its 2015 GDP (World Bank 2016). Underinvestment in physical infrastructure limits connectivity, which damages the profits of firms due to higher transport costs, and it reduces income opportunities and well-being by limiting labor mobility or access of the population to services. By mobilizing private capital through public-private partnerships (PPPs) and opening up infrastructure subsectors to direct private investment, infrastructure can be expanded without creating excessive pressure to the fiscal deficit.

[5] Even though the government projects higher net migration, it is worth noting that recently, Russia saw less, not more net in-migration due to a weaker exchange rate and mediocre income growth, which has made Russia less attractive for migrants. Also, due to data limitations, we do not consider the quality of migrant labor. As of now, most migrant labor into Russia is cheap, unqualified labor, in low-productivity sectors of economy.

We calculated the impact of higher investment growth. The investment growth path is taken from the Ministry of Economy and Development's projections up to year 2025 and extrapolated afterwards. These forecasts imply that the ratio of investment to potential GDP is expected to increase from 23 percent[6] in 2017 to 34 percent by 2028. Since 1990, more than 70 countries have experienced such an increase. Other than the well-known example of China, other relevant examples include Indonesia, India, the Republic of Korea, Saudi Arabia and Turkey. All these countries experienced over a 11 percentage points increase in their investment rates in 11 years.

The increase in the investment/GDP ratio raises potential growth by 0.2 percentage point in 2020 and 0.6 percentage point in 2028. The cumulative impact of the higher investment rate is around 4 percent of potential output during 2018-2028.

D. Productivity

Russian TFP growth began slowing down around the global financial crisis period in 2008-09, and declined to 1.3 percent in 2017. The decline of TFP growth in Russia is supported by firm-level data (World Bank 2016): firm-level TFP has been declining since 2007 in all sectors. At the same time, productivity dispersion, especially in the service sector, has risen since 2005, which may imply increasing economic distortions. These economic distortions ultimately create an uneven playing field, limiting the entry and expansion of more efficient firms and the exit of less efficient ones. It is expected to decline further to 1.1 percent in 2028, as the declining share of young working age population will weigh on TFP.

We assumed substantial strengthening of institutions for regulation of private enterprises and successful implementation of policies focused on (1) leveling the playing field for firms by stimulating competitive markets and eliminating barriers to the entry of productive firms and the exit of unproductive incumbents; and (2) upgrading firm capabilities, such as innovation, and technology adoption and better managerial skills, in order to help firms, especially start-ups and SMEs, become more competitive.

[6] 23 percent refers to the investment to GDP ratio using 2010 PPP numbers. Russia's nominal investment to GDP ratio was 21.6 percent in 2017.

In addition, greater exposure to international competition could substantially improve firms' efficiency. Russia advanced to 31st place in the World Bank's 2019 global ease of doing business ranking, representing an improvement from the 35th place last year and 40th place two years ago. However, there is room for further improvement in several areas, including Trade Across Borders, Resolving Insolvency and Protecting Minority Investors. Progress in easing barriers to trade would also support productivity growth.

We assumed a gradual acceleration of TFP growth in the reform scenario. In this scenario, TFP will increase by 0.1 percentage point in 2028 from the 2017 level instead of the 0.2 percentage point decline expected in the baseline scenario. This increase would push potential growth up by 0.3 percentage point. The cumulative impact of increasing the TFP growth rate is around 2 percent of potential output. It is worth noting that unlike for capital and labor, a one percentage point increase of TFP growth would increase potential growth by the same one percentage point.

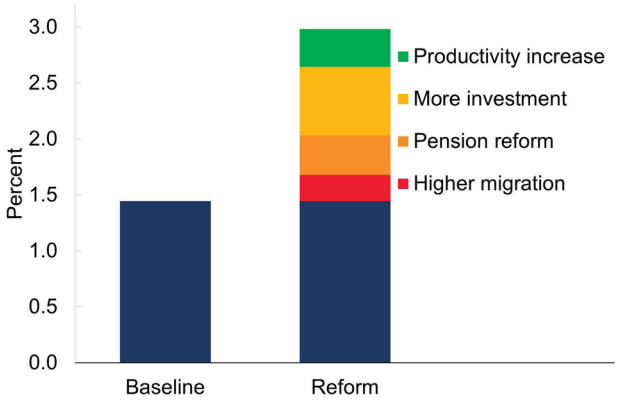
VI. Can Russian potential growth match global growth?

Global growth is expected to remain around 3 percent. As we have seen, in the baseline case, Russian potential growth is expected to remain around 1.3-1.5 percent for the same period. This suggests a relative decline of the Russian economy for the coming decade.

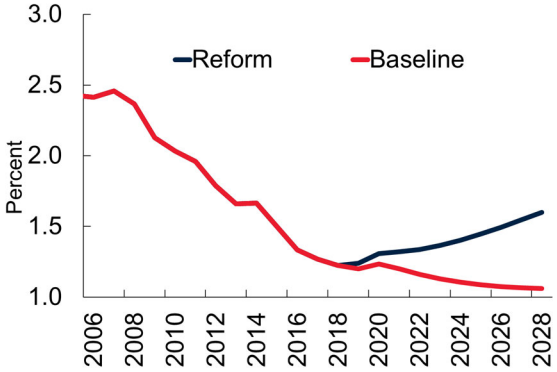
However, simulations of specific reform measures currently being considered by the government, such as pension reform, more migration, higher investment, and gradual acceleration of TFP growth, *can* increase Russia's potential growth rate to 3 percent in 2028 (Figure 6). Pension reform, and increases in migration, investment, and productivity contribute 0.4, 0.2, 0.6, and 0.3 percentage point, respectively, to the increase in the potential growth rate. Improvement in the demographic conditions by 2028 contributes to the potential growth rate as well. Even without reforms, the potential employment growth rate in 2028 is 0.2 percentage point higher than that in 2023.

Figure 6: Comprehensive reforms can raise potential growth to the global growth

A. Impact of reforms on potential growth (%)



B. Total Factor Productivity



Source: World Bank.
Notes:
A. B. Baseline scenario refers to the assumptions mentioned in Section IV. Reform refers to the assumptions outlined in section V.
A. Potential growth rate estimate in 2028.
B. Annual growth rate of total factor productivity. Baseline scenario refers to the assumptions mentioned in the outlook section.

However, good policies could be thwarted by bad luck. Historically, the Russian economy has experienced a major recession every decade; this included the Russian financial crisis of the 1990s, the global financial crisis in 2007-2008, and the recent recession of 2015-16.

If this trend serves as a guide, it is not possible to rule out another slowdown in Russia over the next decade. If so, past crises have often been associated with severe short-term output losses.

Short-term contractions, in turn, have tended to be followed by highly persistent losses in output levels in other economies. A recession would also have lasting effects on potential growth in addition to the obvious short-term output disruptions. Contractions in EMDEs lasted 1.3 years on average and were associated with an annual average growth of -4.4 percent. On average, they were followed by about 1 percentage point lower potential growth five years after the event (World Bank 2018).

There are several additional considerations for the implementation of the reform package in Russia:

- *Synergies*. Implementing multiple reforms simultaneously rather than piecemeal can generate mutually-reinforcing synergies. For example, in OECD countries, labor and product market reforms, FDI, and trade regulation potentially yield important synergies (OECD 2017). In another example, land, fiscal, and social benefit reforms yield larger growth benefits in China when implemented jointly (Ran et al. 2011). In addition, cross-country synergies from coordinated reforms may arise. The potential for growth spillovers puts a premium on reform efforts in advanced economies that have large repercussions for their EMDE trading partners.
- *Timing*. Reform payoffs may take more time to materialize than in the stylized scenarios discussed here. There is some evidence that reforms had the largest growth dividends when they were well timed—at least in the context of advanced economies. For example, labor market reforms may lift growth more during economic upswings, when job entrants can more easily find jobs appropriate to their skills, than during downturns (IMF 2016). Pension reforms can have a larger impact on the labor market participation rate and potential employment when the potential labor force is declining.
- *Political economy*. While a meaningful discussion of the political economy goes beyond the scope of this paper, it is important to emphasize that any structural reform creates winners and losers. Moreover, minority vested interests may upend reforms that benefit the public at large.

The current cyclical upswing is an auspicious time for Russia to implement reforms that may yield long-term gains. There can be no quick fix for reversing the expected slowdown in potential growth at the global level, since it reflects underlying economic factors that are not susceptible to rapid change. More importantly, if history repeats itself, a possible crisis over the next decade may have a substantial adverse impact on potential growth prospects. Mitigating pressures from short-term risks and long-term headwinds requires the adoption of appropriate policies over time. A package that delivers substantial material benefits at an early date thus stands more chance of success in the long run.

Table 1: The simultaneous impact of proposed reforms could be major

Reform Measure	Contribution to potential growth (percentage point)	Cumulative increase in potential output during 2019-2028(percentage)
1. Increase in retirement age (60 to 65 for men; 55 to 60 for women)	0.4 %	3.2%
2. Increase in migration flows (number of migrants increases annually from 100,000 to 289,000)	0.2%	1.8%
3. Increase in investment rate (Investment / GDP ratio increases by 13 percentage points)	0.6%	4.1%
4. Increase in TFP growth (increases to 1.4 percent by 2028)	0.3 % *	1.6 %

Note: Because this table summarizes the simultaneous impact of proposed reforms, and thus capture the interaction between various reforms, results shown in this table differ slightly from those in section V (which are piece-meal reforms).
* Contribution in 2028. The contribution is assumed to be increase gradually.

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Appendix

Regression analysis for long-term potential growth

The production function approach assumes that potential output can be captured by a Cobb Douglas production function:

$Y_t = A_t K_t L_t$

where Yt is potential output, At is potential total factor productivity (TFP), Kt is the potential capital stock, and Lt is potential employment. To extend the sample beyond 2014—the latest available data from Penn World Tables—TFP was recalculated as the Solow residual of output, employment (extended using data from Haver Analytics), and capital (extended using investment data from Haver Analytics and the perpetual inventory method). Labor shares are assumed at standard 0.66. Two of the three components of potential output—potential TFP and potential employment—are proxied by the fitted values from panel regression estimates. The third component, the contribution of capital to potential growth, is assumed to be the same as the contribution of capital to actual growth. Capital stock data from Penn World Table 9.0 is used until the latest available year in the data set (2014 for most countries in the sample). For 2015-17, investment data are compiled from national statistics offices and Haver Analytics, while the capital stock is estimated from investment data by the perpetual inventory method using historical average depreciation rates.

We paid special attention to the Russian data. Russian potential employment data and forecast are calculated using population and smoothed employment data in each age group obtained from ILO as the fitted value fails to capture Russia's low labor market participation rate for the aged. Russian capital stock data are taken from the capital stock index growth rate from the Russian Federation Statistical Service as it is more up-to-date than the Penn World table. The perpetual inventory method estimation that was employed for other countries generated similar results.

	(1)
Variables	**TFP**
Working age population share	4.218**
	(2.13)
GDP per capita relative to advanced economy	-0.055***
	(0.00855)
Investment growth	0.030***
	(0.0066)
Trade openness	0.00799**
	(0.00322)
Observations	2,318
Number of countries	111
Within R2	0.231

Note: ** denotes 5 percent significance and *** denotes 1 percent significance. Investment growth is the five-year moving average real investment growth; trade openness is a share of exports plus imports over GDP.

Multivariate filtering for the short-term potential growth estimation

A univariate statistical filter decomposes a series y_t into trend and cyclical components. Univariate filters (UVF) have the advantage of being simple to implement since the only data required in the estimation are y_t (here, real GDP). The trend component is used as a proxy for potential output. However, the resulting estimates do not ensure consistency between cyclical output and other cyclical indicators or between potential output and its fundamental drivers.

The unobserved components model can be expanded to include additional indicators of domestic demand pressures to help identify the output gap (Benes et al 2015). The most commonly used indicators are inflation and the unemployment rate. Specifically, the univariate model of equations (1)-(4) is augmented with a Phillips curve relationship between inflation and output gaps (equation 5), an Okun's Law relationship between unemployment rates and output gaps (equation 6-9), and a relationship between capacity utilization and output gaps (equations 10-13).

Phillips Curve. The Phillips curve relates inflation to output gap, controlling for the impact of supply side shocks such as import prices on domestic inflation.

$$\pi_t = \rho\pi_{t-1} + (1-\rho)\pi_{t+1} + \alpha_1 YGAP_t + \lambda_1 \pi^m_{t-1} + \varepsilon^{\pi}_t \quad (5)$$

where π_t is quarter-on-quarter inflation at time t and π^m_t is import price inflation at time t. Expectations are assumed to be an average of adaptive and rational expectations.

Okun's Law. Okun's law relates the unemployment gap $UNGAP_t$ (defined as the difference between the actual unemployment rate UN_t and the equilibrium (or natural) unemployment rate $\overline{UN_t}$ in equation 6) to the output gap as:

$$UNGAP_t = UN_t - \overline{UN_t} \qquad (6)$$

$$UNGAP_t = \gamma UNGAP_{t-1} - \alpha_2 YGAP_t + \varepsilon^{UNGAP}_t \quad (7)$$

Following Blagrave et al. (2015), the equilibrium unemployment rate process is specified in deviation from steady state. Equation (8) specifies the process for $\overline{UN_t}$. It implies that following a shock, the NAIRU converges back to its steady state value $\overline{U}_{ss}$ according to the parameter τ_1 and has a trend component G^U_t which has an autoregression process (9).

$$\overline{UN_t} - \overline{U}_{ss} = \tau_1(\overline{UN}_{t-1} - \overline{U}_{ss}) + G^U_t + \varepsilon^{\overline{U}}_t \qquad (8)$$

$$G^U_t = \tau^u G^U_{t-1} + \varepsilon^{G^U}_t \qquad (9)$$

Capacity utilization. Since **c**apacity utilization is highly pro-cyclical, it can help identify the cyclical component of output even during jobless recoveries. Equations (10) – (13) describe the relation between capacity utilization and output gaps and the exogenous process for capacity utilization, where $\overline{CAPU}_{ss}$ is the steady state of capacity utilization rate.

$$CAPUGAP_t = \theta CAPUGAP_{t-1} + \alpha_3 YGAP_t + \varepsilon^{CAPUGAP}_t \quad (10)$$

$$CAPU_t = CAPUGAP_t + \overline{CAPU_t} \qquad (11)$$

$$\overline{CAPU_t} - \overline{CAPU}_{ss} = \tau_2\left(\overline{CAPU}_{t-1} - \overline{CAPU}_{ss}\right) + G^C_t + \varepsilon^{\overline{CAPU}}_t \qquad (12)$$

$$G^C_t = \tau^c G^C_{t-1} + \varepsilon^{G^C}_t \qquad (13)$$

Output gap. To close the model, a process for the output gap needs to be specified. Inflation and unemployment might fail to capture all domestic demand pressures, such as credit or asset price growth or commodity price cycles.[7] This may lead to an underestimation of the output gap and an overestimation of potential output especially at the peak of the cycle. Instead of assuming that the output gap process is exogenous as in the traditional multivariate Kalman filter, three additional indicators are included in the output gap equation: house price, credit and commodity price growth:

$$YGAP_t = \beta_1 YGAP_{t-1} + \beta_2 hpr_{t-1} + \beta_3 compr_{t-1} + \beta_4 cr_{t-1} + \varepsilon_t^{YGAP} \qquad (14)$$

where cr_t, hpr_t, and $compr_t$ are cyclical components of year-on-year private sector credit growth deflated by consumer price inflation, quarterly seasonally adjusted house prices, and export-weighted real average commodity prices, respectively.

Estimation. The model parameters are estimated using Bayesian techniques and the state variables are estimated by a Kalman filter algorithm. A key parameter determining the shape of potential output is the variance of the output gap relative to potential growth innovations. The variances of the innovations ε_t^{YGAP} and ε_t^{G} are set such that the ratio of the variances matched the typically used smoothness parameter of the Hodrick-Prescott filter. All priors for the persistence parameter follow a beta distribution.[8] The priors for the slope of the Philipps curve α_1, the sensitivity of inflation to import prices λ_1, the elasticities of output gap with respect to house price, and credit growth cycles β_2 and β_4, respectively, as well as α_2 and α_3 are set as gamma distributions. The prior for the elasticity of output gap with respect to commodity price β_3 follows a normal distribution to allow for a potentially negative impact of commodity price increases in commodity importers. The prior distributions for all standard deviations are inverse gamma distributions. The standard deviations of ε_t^{UNGAP} and $\varepsilon_t^{CAPUGAP}$ are set as the OLS standard errors of equations (5) and (9) based on Hodrick-Prescott-filtered data. Steady state values of growth, unemployment, and capacity utilization are calibrated to the sample mean of their corresponding HP-filtered series. Confidence bands are constructed based on the variance matrix of the smoothed (filtered) estimates of the state variables provided by the Kalman filter algorithm. The

[7] See Borio (2013, 2014) and Summers (2014) for advanced economies, Jesus et al. (2015) for Latin America and the Caribbean, Rudi et al. (2014) for South Africa, and Enrique et al. (2016) for East Asia and the Pacific. The cyclical component of copper prices helps explain mining sector output gaps in Chile (Blagrave and Santoro 2016).

[8] The output gap is highly persistent in the data and in some cases estimation results yield a unit root ($\beta_1 = 1$). To prevent the persistence parameter β_1 hitting the upper bound 1, the prior means are chosen such that the beta distribution is centered on 0.8 as in Borio et al (2013).

variance of the state variable is computed at the posterior mode of the parameters and does not reflect uncertainty related to model parameters.