

# Decomposition of growth rates for the Russian economy

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## Abstract

In this paper, we present a methodology of GDP growth rate decomposition adapted for the Russian economy. We calculated the indicators for structural unemployment (NAWRU) and total factor productivity in Russia. We estimated the structural, foreign trade and cyclical components of GDP growth rates under various macroeconomic scenarios for the period from 2018 through 2024. The study shows that a significant contribution to growth rates for the period 2018 through 2024 will be made by the sum of the business cycle and random shock component, which, combined with the revitalization of investments in 2017, may indicate the beginning of a new cycle of economic growth in Russia. In the scenarios reviewed, the contribution from the foreign trade component will be negative from 2018 to 2024. The calculations indicate further stagnation of structural growth rates in the Russian economy from 2018 to 2024 at the level of approximately 1.5 p.p. in all of the basic macroeconomic scenarios reviewed. This points to the in expediency in postponing structural reforms to create conditions for Russia's economy to achieve growth rates that exceed world averages.

*Keywords:* economic growth, total factor productivity, NAWRU, terms of trade, business cycle.

*JEL classification:* E32, O47.

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## 1. Introduction

This paper elaborates on the studies examining the decomposition of growth rates for the Russian economy, which rely on isolating the contributions by fundamental factors of production. The paper is based on the approaches used in the OECD output gap estimation methodology (Giorno et al., 1995) and on

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the methodology for decomposing GDP growth rates, adapted for the case of Russia (Sinelnikov-Murylev et al., 2014).

Several concepts are usually identified in literature related to measuring and estimating an economy's output: actual, potential, structural and long-term average annual output (smoothed output). Each concept is clarified below and the concepts of potential and structural output are key for purposes of the following material.

The terms for potential output are defined differently in different studies. Solow (1962) noted that, under full employment, an increase in aggregate demand leads to higher wages (the price of engaging an additional unit of labor), rather than to higher employment (and, accordingly, higher output). Romer (1996) noted that, when an economy reaches its level of potential output, the long run aggregate supply (LRAS) curve is vertical, while short-run disturbances on the demand side of the economy only result in a change in prices under conditions of constant output. According to the definition by Razin (2004), potential output is a hypothetical production level achieved under conditions of fully flexible prices and wages (price-flexible output).

Potential output is generally considered in concert with the concept of the natural rate of unemployment. Romer (1996) defines potential output as a level of production observed at full employment, also calling potential output natural, meaning that it corresponds to the natural unemployment rate. A similar definition is given in Blanchard and Johnson (2013), who stressed that it is more reasonable to consider the unemployment rate corresponding to potential output as the structural rate of unemployment, rather than natural rate of unemployment, as it is determined by the economy's structural characteristics.

Based on this approach, we can determine the economy's *structural output* as the level of production of products and services corresponding to the structural (natural) rate of unemployment. In turn, the term *potential output* would best be described with a definition that is most consistent with its connotation: *potential output* is the output of goods and services corresponding to the production possibility frontier of a given economy,<sup>1</sup> or the maximum output level that can be achieved in the current period given the current technological, institutional and resource constraints.

The trajectory of an economy's structural output is determined by the trends in fundamental production factors, i.e. labor, capital and total factor productivity (TFP) and represents the trajectory for the maximum output level of goods and services that can be maintained *sustainably in the long run*. The trajectory of actual output relative to potential output is determined by the combined effects of fundamental and cyclical (short-term) factors. An economy tends to approach its potential output level during periods of "overheating": potential output corresponds to the maximum possible (for a given economy) proximity to the full utilization of production possibilities<sup>2</sup> and full employment of available labor resources.<sup>3</sup>

<sup>1</sup> The global production possibility frontier corresponds to the output in technologically advanced countries, given the optimal organization of the production process.

<sup>2</sup> The utilization of production possibilities in an economy is usually below 100% due to economic in expediency. Under resource constraint conditions, a less-than-full degree of utilization helps to solve the task of maximizing economic agent profits. Moreover, a deviation from full utilization may be caused by the need to create reserve capacity to withstand demand spikes, e.g. seasonal.

<sup>3</sup> As an economy moves towards its potential output level, unemployment may also be below its natural level, while employment may, in the short run, exceed full employment with a corresponding "overheating" effect in the labor market.

The *long-term average annual (smoothed)* output is a series of trend values statistically isolated in a given manner (e.g. with a filter) from a series of actual output values. At a glance, smoothed output trends correspond to structural output trends adjusted for deviations that, essentially, represent short-term or medium-term output gaps. If the output gap associated with the business cycle phase and favorable or unfavorable foreign trade conditions is zero over a certain interval, then the series of structural output values may align with the series of long-term average annual (smoothed) output values.

*Actual output* is the observable output of goods and services recorded in statistics by public authorities. At any point in time, it differs from the structural output by the size of the output gap. In this paper, we also assume that the output gap is the sum of the contributions from the cyclical and foreign trade components.

## 2. Output structure of the Russian economy

An economy's aggregate output can be expressed as the sum of business-sector and public-sector output. The public sector usually encompasses economic activities corresponding to the following types:<sup>4</sup> government administration; military security; social security; education; healthcare; social services; recreation, entertainment, culture and sports (this includes mass media<sup>5</sup>). Further calculations of public-sector output do not include the last component<sup>6</sup> because, firstly, its trends differ substantially from that of other public-sector components: from 2003 to 2009, it was closer to the trends in the Russian economy's business sector than to other public-sector components (considered in aggregate); and secondly, the share of that component relative to the size of the public sector in the extended interpretation (including culture, sports and mass media) is not high, around 6%–7%. We will define the business sector as the aggregation of economic sectors not included in the public sector, even where it involves state-owned enterprises. We should note an additional factor that distinguishes between the public and business sectors, which is the applicability of public or civil laws to the regulation of their activities.

In the System of National Accounts (SNA), the GDP indicator is calculated in market prices and includes the sum of indicators of the gross value added (GVA) produced by the business-sector and public-sector industries in basic prices (including product subsidies, but excluding taxes thereon), as well as the sum of net product taxes. The SNA considers product taxes in aggregate, while their analytical distribution amongst the economy's industries does not take place in official statistics due to the specific aspects of indirect tax (VAT, import taxes) assessment. When isolating the components of public-sector and business-sector output in the GDP structure based on official statistics (SNA), it should be noted that net product taxes indicator follows the same trend as business-sector real output index (Fig. 1).

<sup>4</sup> Types of economic activities are specified according to OKVED, which is the Russian Classification of Economic Activities developed on the basis of harmonization with Statistical Classification of Economic Activities in the European Community (NACE Rev. 1).

<sup>5</sup> Mass media covers the following OKVED subclasses: 92.2 Radio and TV Broadcasting and 92.4 News Agencies.

<sup>6</sup> 92. Recreation and Entertainment, Culture and Sports.

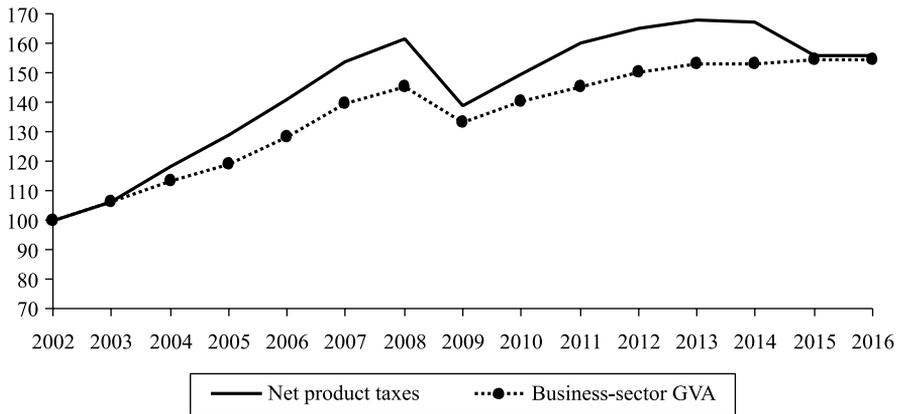


Fig. 1. Business-sector real output and net product tax indices (2002 = 100).

Source: Authors' calculations based on Federal State Statistics Service (Rosstat) data.

The components of business-sector and public-sector output can be isolated within the GDP structure, taking into account the above aspects of the SNA and patterns in the joint output and tax trends, as follows:

$$Y = Y^b + Y^{pub} \quad (1)$$

where:  $Y$ —gross domestic product;  $Y^b$ —business-sector output: sum of GVA in the business-sector industries + net product taxes (in this case, the economy's business sector is viewed as the payer of the majority of product taxes);  $Y^{pub}$ —public-sector output: sum of GVA of the public-sector industries (this approach is arbitrary to some extent, as a certain portion of market services involving the payment of product taxes is produced by the public sector).

It should be added that public-sector output is calculated mostly based on budget expenditure for financing the production of services in education, healthcare, culture, sports, government administration, national security, social security and social services (thus, most of the public-sector output is calculated using the cost method). In addition, its output also includes the added value corresponding to extra-budgetary revenues from budget-funded, autonomous, and public institutions and to the revenues of business-sector organizations providing services in education, healthcare, culture, sports, mass media etc.

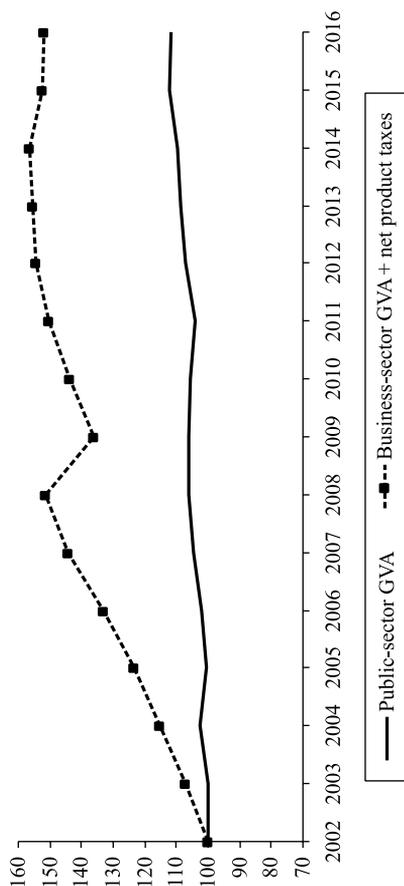
As shown in Figure 2, the output growth rates for the business sector exceed those of the public sector. At the same time, formal tests suggest that business-sector output is not stationary, while public-sector output is stationary around the trend (Table 1).

The deviation in output growth rates from period-average values is substantially lower in the public sector than in the business sector (this is true for both individual intervals and for the period as a whole). In addition, public-sector output was not subjected to sharp changes during the period under review. The empirical facts, cited above, enable us, for purposes of this paper, to adopt one of the assumptions from the original OECD methodology: public-sector output is always considered to be structural. In this case, we used the assumption that the values of actual, structural and potential output in the public sector are equal.

**Table 1**  
Results of unit root tests (period: 2002–2016).

Time series	Real output index for Russia's public sector			Real output index for Russia's business sector		
	DF-GLS (Elliott–Rothenberg–Stock)	KPSS (LM-Stat.)		DF-GLS (Elliott–Rothenberg–Stock)	KPSS (LM-Stat.)	
Test statistic value	-0.556	0.579	0.074	-1.675	0.530	0.153
1% significance level	-2.741	0.739	0.216	-2.741	0.739	0.216
5% significance level	-1.968	0.463	0.146	-1.968	0.463	0.146
10% significance level	-1.604	0.347	0.119	-1.604	0.347	0.119
Constant	+	+	+	+	+	+
Constant and linear trend						
Null hypothesis	Unit root	Series is stationary	Series is stationary	Unit root	Series is stationary	Series is stationary
Test result at 5% significance level	Hypothesis is not rejected	Hypothesis is rejected	Hypothesis is not rejected	Hypothesis is not rejected	Hypothesis is rejected	Hypothesis is rejected

Source: Authors' calculations.



**Fig. 2.** Business-sector and public-sector real output indices (2002 = 100).

Source: Authors' calculations based on Rosstat data.

At the same time, certain segments may experience noticeable fluctuations in the level of added value produced (e.g. in education). However, historical data on actual government expenditure indicate that the overall public-sector output changes to a significantly lesser degree than business-sector output, i.e. there is mostly a redistribution of funding between government expenditure. Under this assumption, the size of output gap for an economy equals the size of the output gap in the business sector. It should be noted that, in going from analyzing indicator levels to analyzing their growth rates, the deviation in actual output growth rates from structural growth rates becomes a similar indicator to the *output gap*.

### 3. Methodology for decomposing Russian GDP growth rates

The methodology for decomposing GDP growth rates, adapted for the case of Russia's economy in Sinelnikov-Murylev et al. (2014), examines the aggregate output indicator, i.e. Russia's GDP. The following are isolated in GDP growth rates: the structural component, determining long-term sustainable (structural) GDP growth rates; the foreign trade component, depending on fluctuations in the terms of trade; and the cyclical component, including the business cycle and random shocks.

In this study, we suggest a number of additions and changes to the methodology, which can improve the quality of decomposition for Russian GDP growth rates. First, due to distinctive features of the dynamics, business-sector output and public-sector output will be considered separately:<sup>7</sup> structural output in the public sector will be treated as actual, while structural output in the business sector will be modeled based on the Cobb–Douglas production function.<sup>8</sup> Second, when modeling structural output in the business sector, we will use the structural unemployment indicator NAWRU. Third, the new methodology requires using various scenarios for Russia's socioeconomic development in the medium term, which allows different possible GDP growth rate decompositions to be matched with different macroeconomic scenarios (forecasts), and improves the sustainability of the resulting estimates of actual economic growth rate components. The user of this methodology can choose an estimate of the economic growth rate components corresponding to the macroeconomic scenario which either takes into account the specific aspects of the task at hand (in fiscal planning, it is more advisable to consider the pessimistic scenario) or that better suits its intuitive forecasts of the situation.

The proposed methodology of GDP growth rate decomposition is an algorithm consisting of three main steps (as in Sinelnikov-Murylev et al., 2014): calculating structural GDP growth rates; calculating the effect of the terms of trade (foreign trade component of growth rates); and calculating the cyclical component of GDP growth rates. Let us consider the contents of those steps more closely.

*A. The calculation of structural GDP growth rates* consists of the following steps.

1. Expressing aggregate output  $Y$  as the sum of business-sector output  $Y^b$  and public-sector output  $Y^{pub}$  — see equation (1).

<sup>7</sup> This is consistent with the approach used in the original OECD methodology.

<sup>8</sup> It has a standard output elasticity with respect to capital equal to 0.3.

2. Modeling business-sector output based on the Cobb–Douglas production function in a logarithmic expression:

$$\ln Y^b = \ln E^b + \alpha \ln K^b + (1 - \alpha) \ln L^b \quad (2)$$

where:  $E^b$ —business-sector total factor productivity level;  $K^b$ —business-sector capital stock;<sup>9</sup>  $L^b$ —size of employment in the business sector;  $\alpha$ —output elasticity of the business sector with respect to capital.

3. Calculation of the Solow residual series for business-sector output (in a logarithmic expression):

$$\ln E^b = \ln Y^b - \alpha \ln K^b - (1 - \alpha) \ln L^b \quad (3)$$

4. Smoothing the Solow residual series with the Hodrick–Prescott filter. The suitability of this filter for smoothing the Solow residual series, from which growth rates are interpreted as an indicator of TFP trends, is based on the fact that, due to the nature of this indicator’s calculation, its composition includes more than just trends in technological progress: the Solow residual series also reflects supply and demand fluctuations, the utilization rate of production factors and the impact of sharp changes in oil prices. The smoothing procedure is aimed at reducing the impact of these non-technological factors on TFP growth rates.

5. The calculation of the business-sector potential employment level, provided that actual rate of unemployment equals to structural rate of unemployment  $NAWRU$ ,  $L^{b*}$  is made according to the following equation (4):

$$L^{b*} = LFS(1 - NAWRU) - L^{pub} \quad (4)$$

where:  $LFS$ —size of economy’s labour force;  $NAWRU$ —non-accelerating wage rate of unemployment (structural rate of unemployment);  $L^{pub}$ —size of employment in the public sector.

The structural rate of unemployment is calculated using the methodology proposed in Elmeskov and MacFarlan (1993) and Elmeskov (1993)<sup>10</sup>:

$$NAWRU = U - \left( \frac{DU}{D^3 \log W} \right) \times D^2 \log W \quad (5)$$

where:  $U$ —rate of unemployment;  $W$ —average monthly nominal wage; and  $D$  is the first-difference operator.

<sup>9</sup> We adopted the assumption that, during period  $t$ , production activity uses capital existing at the beginning of period  $t$ . Since the calculations used the indicator “Fixed Funds in the Russian Federation by Type of Economic Activity Based on Full End-of-Year Book Value,” we used the value of that indicator for period  $t - 1$  to model growth during period  $t$ .

<sup>10</sup> In this case, it is assumed that the rate of change in wage inflation is proportional to the gap between actual and structural rate of unemployment ( $NAWRU$ ):  $D^2 \log W = -a(U - NAWRU)$ , where  $a < 0$ . Assuming that the rate of change in structural unemployment should approach zero for two consecutive periods, the  $a$  parameter can be expressed as  $a = -D^3 \log W / DU$ . Substituting this expression for the  $a$  parameter in the  $D^2 \log W = -a(U - NAWRU)$  equation allows the structural rate of unemployment ( $NAWRU$ ) to be expressed (see equation (5)).

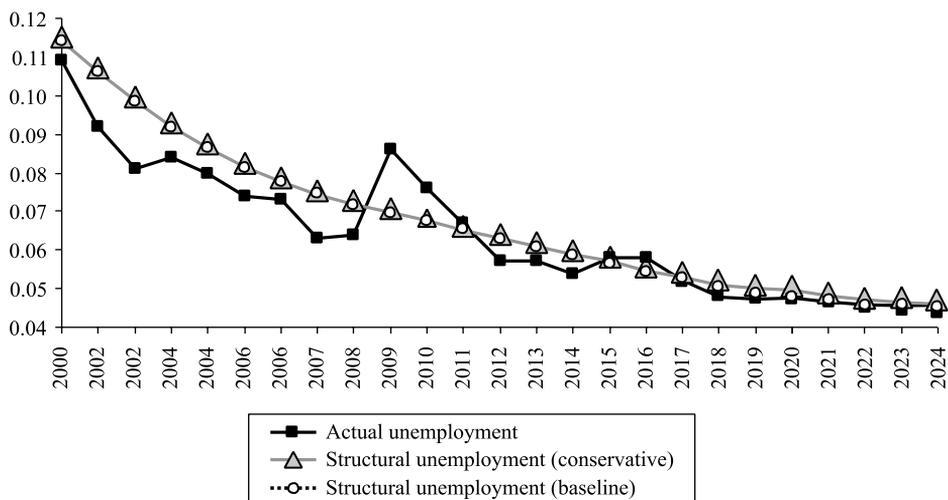


Fig. 3. Actual and structural unemployment in Russia under various macroeconomic scenarios.

Source: Authors' calculations.

In this paper we use the structural unemployment indicator smoothed by the Hodrick–Prescott filter. Thus, expression (4) was transformed into:

$$L^{b*} = LFS(1 - NAWRU^{HP}) - L^{pub} \quad (6)$$

6. The final expression (6) was used to calculate the employment level in the business sector (at the level of structural unemployment  $NAWRU^{HP}$ ). The trend in the smoothed structural unemployment  $NAWRU^{HP}$  indicator is represented in Fig. 3, taking into account the various macroeconomic forecasts by the Russian Ministry of Economic Development for 2018 to 2024.<sup>11</sup> This method enables a considerably more accurate (by 1 to 2 p.p.) estimate of the structural unemployment level compared with the approach where the average unemployment level during a period of stable inflation is treated as the structural rate of unemployment (Sinelnikov-Murylev et al., 2014).

7. Modeling structural output for the business sector:

$$\ln Y^{b*} = \ln E^{b,HP} + \alpha \ln K^b + (1 - \alpha) \ln L^{b*} \quad (7)$$

where:  $Y^{b*}$ —business-sector structural output;  $E^{b,HP}$ —Solow residual smoothed by the Hodrick–Prescott filter;  $K^b$ —business-sector capital stock, taken with a 1-year lag;<sup>12</sup>  $L^{b*}$ —size of employment in the business sector provided that actual rate of unemployment equals  $NAWRU$ .

8. Calculation of structural GDP level,<sup>13</sup>  $Y^*$ :

$$Y^* = Y^{b*} + Y^{pub} \quad (8)$$

<sup>11</sup> For more on macroeconomic trend scenarios, see below.

<sup>12</sup> Similarly to Sinelnikov-Murylev et al. (2014), the potential capital stock is treated as equal to the actual. To avoid “overweight” formulas, we did not use a subscript for time period  $t$ .

<sup>13</sup> We exponentiate the value  $Y^{b*}$  obtained from equation (7).

9. Calculation of structural GDP growth rates,  $g_t^s$ :

$$g_t^s = \frac{Y_t^*}{Y_{t-1}^*} \quad (9)$$

## 10. Smoothing structural GDP growth rates.

B. The algorithm for calculating the effect of *the terms of trade* on GDP growth rates (the foreign trade component of the growth rates) consists of the following steps.

1. We calculated the difference between actual and structural GDP growth rates,  $g_t^{res}$ :

$$g_t^{res} = g_t - g_t^s \quad (10)$$

where:  $g_t$ —actual GDP growth rates at time  $t$ ;  $g_t^s$ —structural GDP growth rates at time  $t$ .

2. “Residual” growth rates not attributable to the fundamental factors are modeled based on the equation:<sup>14</sup>

$$g_t^{res} = \gamma_0 + \gamma_1 tot_t + \tau_t, \quad (11)$$

where:  $tot_t$ —terms of trade index for the Russian economy at time  $t$ ; and  $\tau_t$  is the free term.

Terms of trade index series is calculated by the World Bank and the OECD.<sup>15</sup> Since the series of this index are updated with a certain lag and there are no terms of trade forecasts for 2018 to 2024, we approximate terms of trade index with the ratio of the actual and long-term average annual Urals oil prices:<sup>16</sup>

$$tot_t = \frac{P_t^{oil}}{\overline{P_t^{oil}}} \quad (12)$$

where:  $P_t^{oil}$ —actual level of the Urals oil price at time  $t$ ;  $\overline{P_t^{oil}}$ —long-term average annual Urals oil price at time  $t$ .

3. The theoretical value of the equation for  $g_t^{res}$  is considered to be the foreign trade component of GDP growth rates.

C. The value of the residuals  $\tau_t$ , obtained through an econometric evaluation of equation (11), is considered to be the *cyclical component* of economic growth rates.

<sup>14</sup> For derivation of an equation, see Sinelnikov-Murylev et al. (2014). It should be noted that the result of isolating the foreign trade component may not be invariable in relation to the sequence of calculation stages, e.g. where the first stage involves modeling the foreign trade component of the growth rates and the second stage, that of the structural component. In this paper, in accordance with the OECD methodology, we isolated the structural component of the growth rates at the first stage.

<sup>15</sup> At the time of publication, data were available for the World Bank’s terms of trade index from 2000 to 2016 and for the OECD’s terms of trade index from 1995 to 2016, whereas data for 1995 to 2009 are estimates.

<sup>16</sup> The correlation coefficient between the terms of trade index (according to OECD) and the oil price index is 0.6 for the period from 1999 to 2016 and 0.9 from 2010 to 2016.

#### 4. Decomposition of GDP growth rates for the Russian economy from 2000 through 2017

According to the GDP decomposition methodology described above for the period from 2000 to 2017, the TFP series were calculated for the business sector and for the Russian economy as a whole (Fig. 4).

To obtain the trend values for TFP growth rates, we used the procedure for smoothing dynamic series with the Hodrick–Prescott filter, characterized first by inertia and second by sensitivity to adding new observations to the initial time series. Adding new observations may cause a retrospective revaluation of the results of smoothing the dynamic series, especially near the most recent values (the so-called “end-point bias” effect; see Bessonov, 2003). At the same time, the most substantial revaluation can take place only around the local maximum or local minimum points in the dynamic series.

According to the calculations, a local minimum for the unsmoothed series of TFP growth rates for the Russian economy can be identified approximately around 2015 (see Fig. 4). Due to the technicalities of using the Hodrick–Prescott filter, in this case there is a high probability of underestimating the trend in TFP growth rates, provided that they will not decline considerably or will even continue to rise after 2017.<sup>17</sup>

It should be noted that the varying estimates of TFP growth rate trends (as well as varying estimates of smoothed Solow residuals series, caused by similar reasons) may lead to a change in the estimate of the level and growth rates of

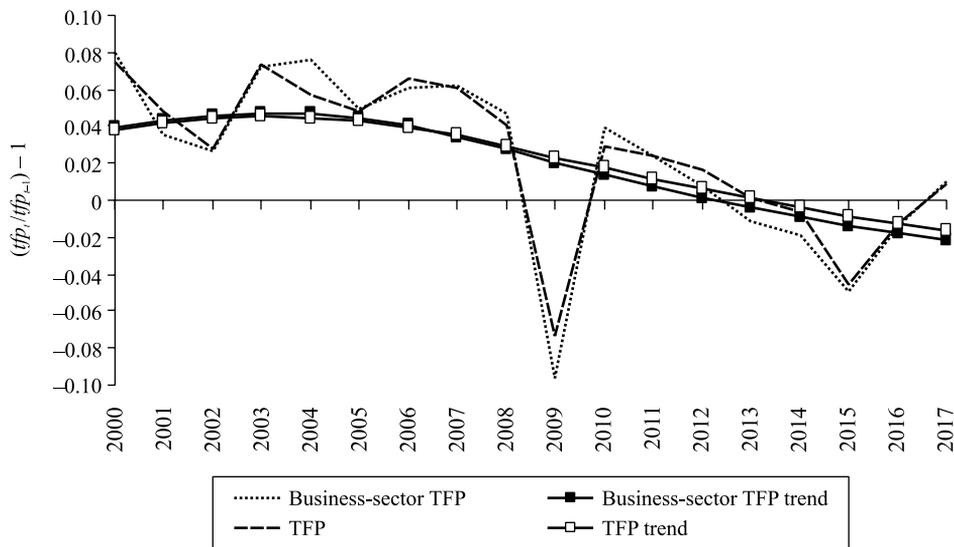


Fig. 4. Estimates of TFP growth rates in the business sector and in the Russian economy using actual data (without forecasts).

Source: Authors' calculations.

<sup>17</sup> The negative values for the TFP growth rate trend from 2013 to 2017, obtained using this approach, should not be attributed to the impact of fundamental (technical) factors alone, e.g. by a reduction in aggregate demand in the Russian economy etc.

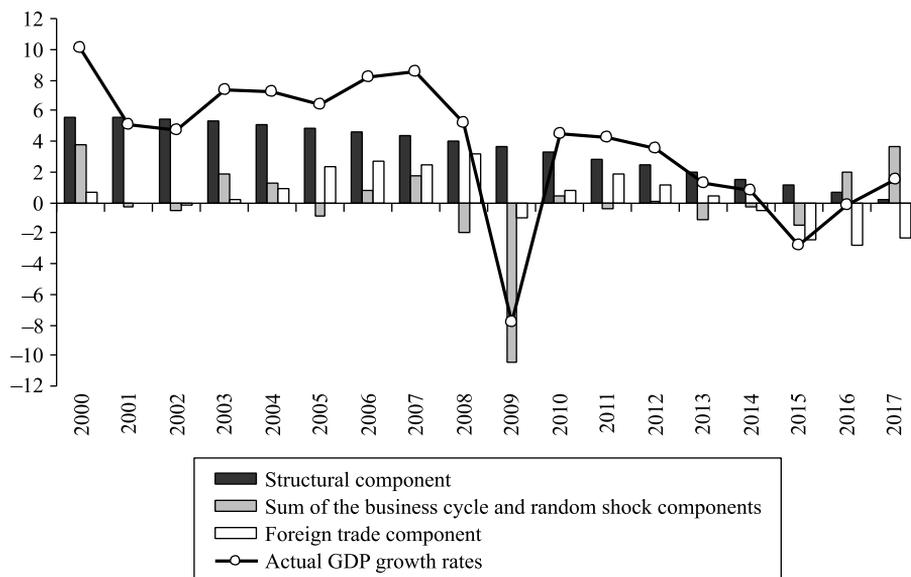


Fig. 5. Decomposition of growth rates of Russia's GDP from 2000 to 2017 (%).

Source: Authors' calculations.

the structural GDP indicator (see equations (7)–(9)). Along with the scheme of algorithm described above, a disturbance appearing at this stage will also apply to the estimates for the foreign trade and cyclical components of output growth rates. In other words, the estimates for the contributions of various components to the growth rates in the Russian economy are largely dependent on the data used and, more precisely, on the period of estimation selected.

Fig. 5 presents the estimates of the Russian GDP growth rate components using actual data from 2000 to 2017. In the resulting decomposition of output growth rates, there is a high probability of underestimating the structural component of economic growth rates between 2015 and 2017.<sup>18</sup>

The value of the change in the TFP growth rate trend estimates and the structural component of GDP growth rates, in the general case, will be less the further the observation is from the end-point of the time series to be smoothed. In other words, adding new observations enables us to move potential changes associated with the “wagging” effect closer to the end of the extended time series and produces alternative retrospective estimates of the TFP growth rates and the value of individual GDP growth rate components. This problem was reflected in the OECD papers: as a solution, it was proposed to use updated estimates of the output gap as new statistics emerged to enable a more accurate calculation (Turner et al., 2016; Grigoli et al., 2015; European Central Bank, 2005).

The problem associated with the sustainability of the GDP growth rate decomposition results can be illustrated as follows. We built estimates of the structural, foreign trade and cyclical components of economic growth rates for the period

<sup>18</sup> And the cyclical component may be overestimated: this effect is attributable to the nature of the GDP growth rate decomposition algorithm.

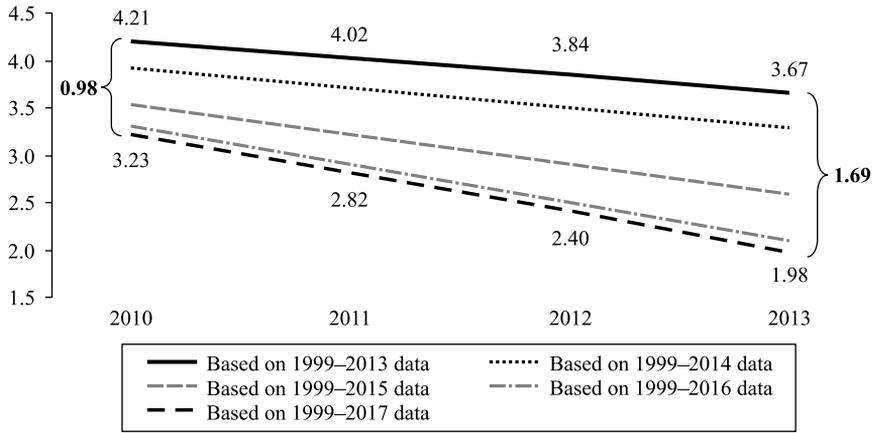


Fig. 6. Range of estimates for the structural component of growth rates, 2010–2013 (%).

Source: Authors' calculations.

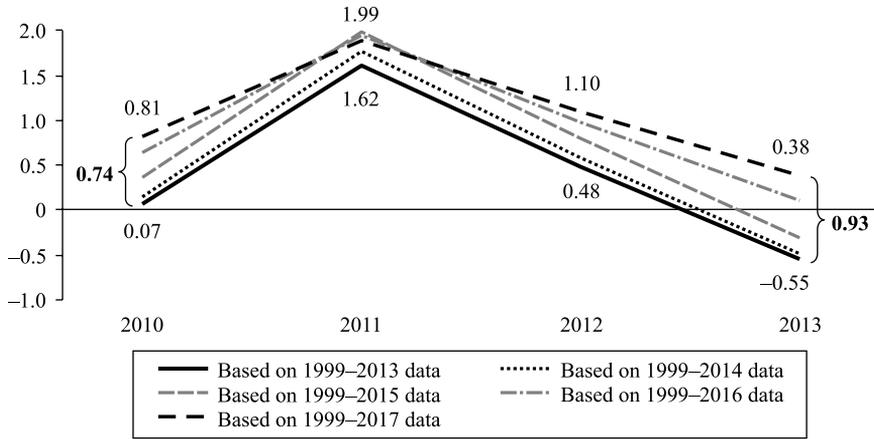


Fig. 7. Range of estimates for the foreign trade component of growth rates, 2010–2013 (%).

Source: Authors' calculations.

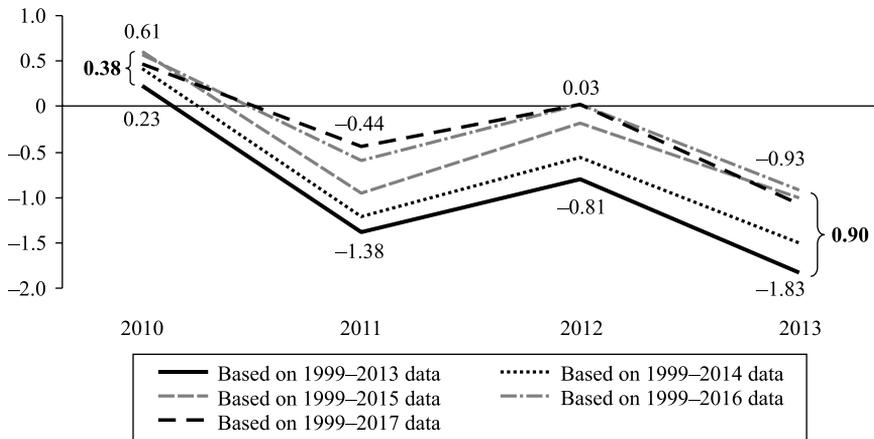


Fig. 8. Range of estimates for the cyclical component of growth rates, 2010–2013 (%).

Source: Authors' calculations.

from 2010 to 2013, based on the data available as of the end of 2013, 2014, 2015, 2016 and 2017 (Figs. 6–8).

As we can see, adding new observations (2014–2017 data) causes a retrospective revaluation of all growth rate components. The range of estimates for the structural component of growth rates varied between 0.98 and 1.69 p.p., foreign trade, between 0.74 and 0.93 p.p. and cyclical, between 0.38 and 0.90 p.p. Estimates of the economic growth components for earlier periods (2010) are usually revised to a significantly lower degree than for the more recent ones (2013). The estimate for the structural component of growth rates is the most sensitive to adding new observations; the estimate for the foreign trade component is the least sensitive.

Thus, the estimated contributions of various components to GDP growth rates may become distorted closer to the end of the time series, especially in the case of further trend reversal. Due to the equivalence between actual GDP growth rates and the sum of the structural, foreign trade and cyclical components, any error in the estimate of any one of them will cause errors in the estimates of the others. For example, if Russia's economy begins to grow faster in the future with the same cyclical component, part of that growth can be attributed to the accelerated TFP, while the local minimum point in its trend will be associated with the current period. If the growth rates are low, they will correspond to a stagnation of TFP trend values and structural growth rates.

The contribution of the various components to GDP growth rates can be modeled taking these aspects into account, using the hypotheses regarding the anticipated macroeconomic scenarios. The parameters for the economic development scenarios can be borrowed from the official forecast by the Russian Ministry of Economic Development.<sup>19</sup> This approach produces a range of estimates for GDP growth rate components corresponding to the various scenarios, which would be a better form of presentation and interpretation of the results as compared with estimates based on an actual data series alone. At the same time, as new statistics emerge, estimates will become more accurate, while their range of values will become narrower.

## 5. Scenarios for Russia's socioeconomic development

The parameters for the official macroeconomic scenarios (baseline and conservative) for 2018 to 2024 are given in Table 2.

The conservative scenario involves lower oil prices and lower GDP growth rates combined with higher unemployment and inflation rates. GDP trend scenarios, according to forecasts by the Russian Ministry of Economic Development, are shown in Fig. 9.

These scenarios for 2018 to 2024 are accompanied below by a decomposition of Russian GDP growth rates during the period from 2007 to 2017. The decomposition of growth rates from 2007 through 2017, based on actual data for economic trends from 2018 to 2024, will obviously differ from those obtained below, if it differs from the forecast.

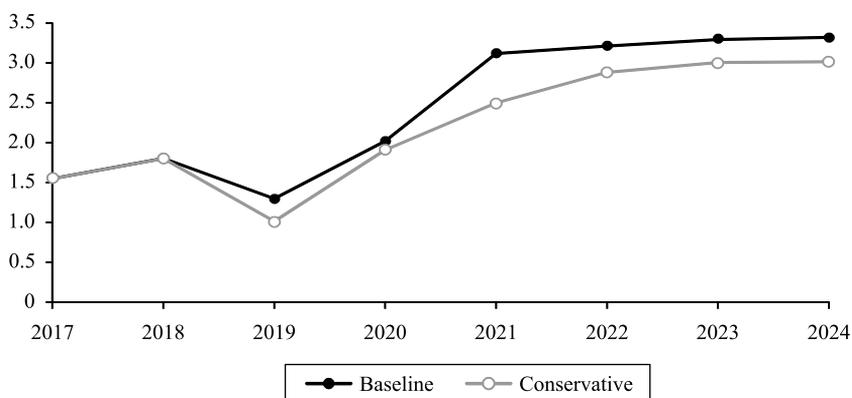
<sup>19</sup> Forecast of the social and economic development of the Russian Federation for the period until 2024. <http://economy.gov.ru/minec/activity/sections/macro/201801101>

**Table 2**  
Macroeconomic scenarios from 2018 to 2024

Indicator	2018	2019	2020	2021	2022	2023	2024
<i>Baseline Scenario</i>							
Real GDP growth rate, %	1.8	1.3	2.0	3.1	3.2	3.3	3.3
Workforce population, millions	75.8	75.8	75.9	76.0	75.9	76.2	76.3
Unemployment rate, %	4.8	4.8	4.7	4.7	4.6	4.6	4.6
Consumer price index, year end	103.4	104.3	103.8	104.0	104.0	104.0	104.0
Nominal accrued average monthly wages of employees in organizations, RUB/month	43,008	45,639	48,099	51,256	54,801	58,543	62,617
Fixed capital volume index*	102.3	102.4	102.8	103.2	103.5	103.7	104.0
Urals oil prices (global), USD/bbl	69.6	63.4	59.7	57.9	56.4	55.1	53.5
<i>Conservative Scenario</i>							
Real GDP growth rate, %	1.8	1.0	1.9	2.5	2.9	3.0	3.0
Workforce population, millions	75.8	75.8	75.9	76.0	75.9	76.2	76.3
Unemployment rate, %	4.8	4.9	4.8	4.8	4.7	4.7	4.7
Consumer price index, year end	103.4	104.6	104.0	104.0	104.0	104.0	104.0
Nominal accrued average monthly wages of employees in organizations, RUB/month	43,008	45,631	48,138	51,066	54,413	57,946	61,840
Fixed capital volume index*	102.3	102.3	102.7	102.9	103.1	103.3	103.4
Urals oil prices (global), USD/bbl	69.6	56.0	42.5	43.3	44.2	45.0	45.9

\* The indicator was calculated by the authors based on forecast data.

Source: Russian Federation Ministry of Economic Development.



**Fig. 9.** Real GDP growth rates under various macroeconomic scenarios for 2018 to 2024 (%).

Source: Russian Federation Ministry of Economic Development.

## 6. Decomposition of Russian GDP growth rates for the period through 2024 and interpretation of the results

### 6.1. Structural component

The estimates for structural growth rates under various macroeconomic scenarios at the end of 2017 are 1.4 to 1.5 p.p. The deceleration between 2007 and 2017 (Fig. 10) is attributable to the sum of effects caused by trends in fundamental production factors, i.e. total factor productivity, capital and labor.

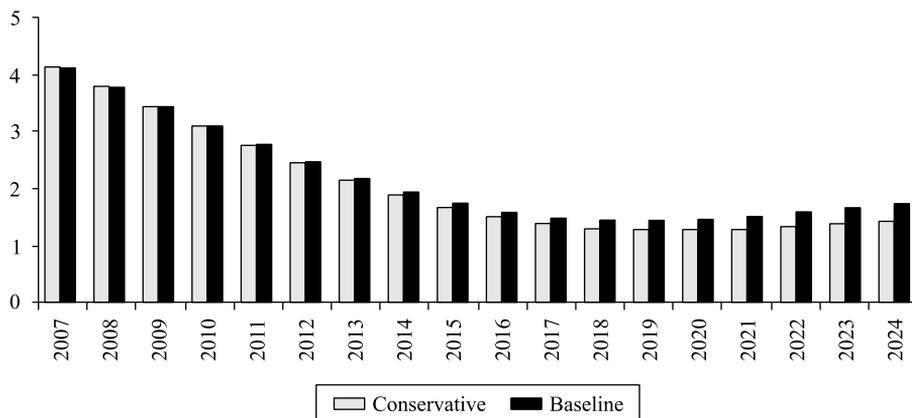


Fig. 10. Structural growth rates under various macroeconomic scenarios (%).

Source: Authors' calculations.

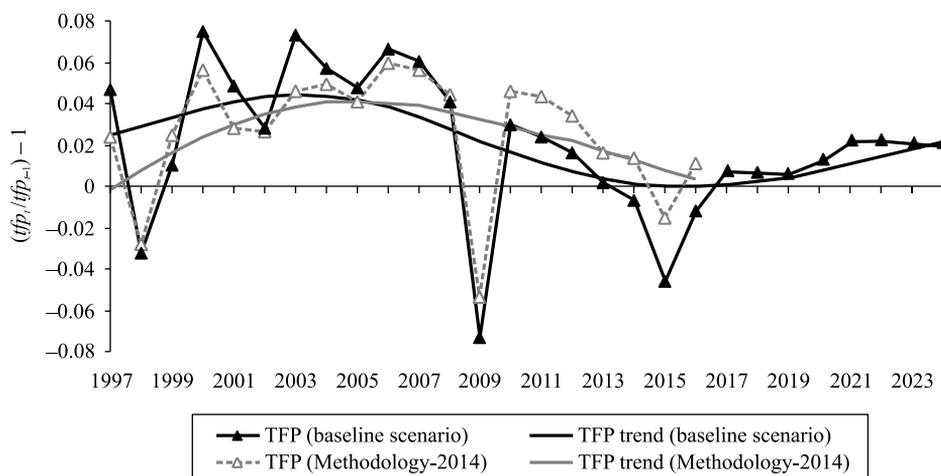


Fig. 11. TFP growth rates in the Russian economy based on various decomposition methodologies.

Source: Authors' calculations.

The consistent deceleration of smoothed TFP growth rates, observed since the early- and mid-2000s (Fig. 11<sup>20</sup>), was caused, first, by completion of the post-transformational recovery growth which took place between the late 1990s and the mid-2000s and, second, by the deterioration in the business climate: the increased role of the government in the economy, its increased interference in it and the lack of progress with institutional reforms. In addition, as the economy passes through the negative phase of the business cycle, this also contributes to decelerating the TFP dynamics.<sup>21</sup>

<sup>20</sup> The use of the proposed methodology for GDP growth rate decomposition made the estimates of total factor productivity in the Russian economy considerably more accurate. Fig. 11 represents a comparison of the TFP estimates obtained using the proposed methodology and methodology-2014 (see Sinelnikov-Murylev et al., 2014).

<sup>21</sup> At the same time, the TFP trend (Solow residual) is affected not only by the pace of technological progress in the economy, but also by fluctuations in aggregate demand, including those dependent on global economic conditions.

The local minimum point for the smoothed TFP growth rates (TFP trend) falls during the period from 2014 through 2017. An additional factor in the decelerating TFP trend since 2014 has been sectoral<sup>22</sup> and financial sanctions imposed on Russian companies and banks. In response, Russia adopted agri-food counter sanctions.<sup>23</sup>

In the short and medium term, those events helped to shape negative expectations by economic agents. The latter, combined with the increased costs to raise capital due to credit rationing and increased interest rates for Russian companies, as well as the higher costs of imported investment goods caused by the ruble devaluation in December 2014, led to lower investments. The first protracted “investment pause” since 1999, observed between 2013 and 2016,<sup>24</sup> caused a local deceleration of fixed capital renewal and contributed to decelerated TFP growth rates and structural growth rates.

At the end of 2017, the growth in fixed capital investments at comparable prices was 4.4%, which may indicate the end of the “investment pause”. With a certain lag, this could be helped by the import substitution programs which were activated in response to the sectoral sanctions in 2015 and also in the capital goods segment (see more in Pavlov and Kaukin, 2017).

In case of the conservative economic development scenario, recovery of the TFP trend is expected to be slower than in the baseline scenario with a corresponding impact on GDP structural growth rates (Fig. 12).

From 2013 through 2017, the amount of retired fixed capital did not exceed the amount of new fixed capital, but deceleration of the growth rates trend for

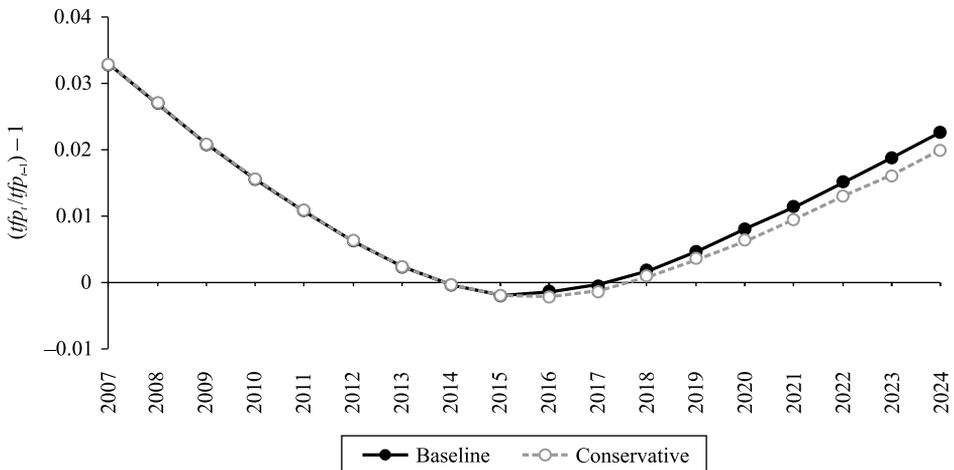


Fig. 12. TFP growth rates in the Russian economy under various macroeconomic scenarios.

Source: Authors' calculations.

<sup>22</sup> The introduction of sectoral sanctions which affect the supply of modern oil-and-gas, telecommunications and other equipment to Russia slows down the diffusion of technology and has a direct adverse impact on the long-term technological development trend. Against the background of globalization, the effectiveness of such sanctions is limited to the extent to which the lost supplies of capital goods can be offset by producers from countries which did not join the embargo. However, this is often impossible, as the global supply of certain types of capital goods is highly concentrated.

<sup>23</sup> See Russian Federation Presidential Decree No. 560, dated 8/6/2014, “On the implementation of certain special economic measures to ensure the security of the Russian Federation.”

<sup>24</sup> The “investment pause” phenomenon is discussed in Buklemishev (2016); Zamaraev et al. (2014).

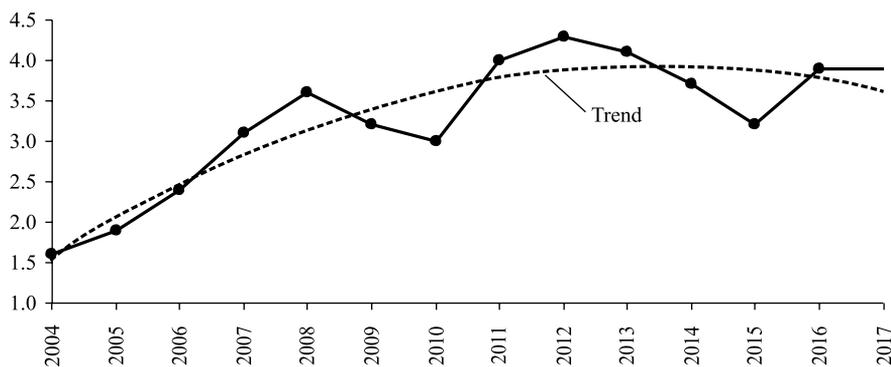


Fig. 13. Fixed capital growth rates (%).

Source: Authors' calculations.

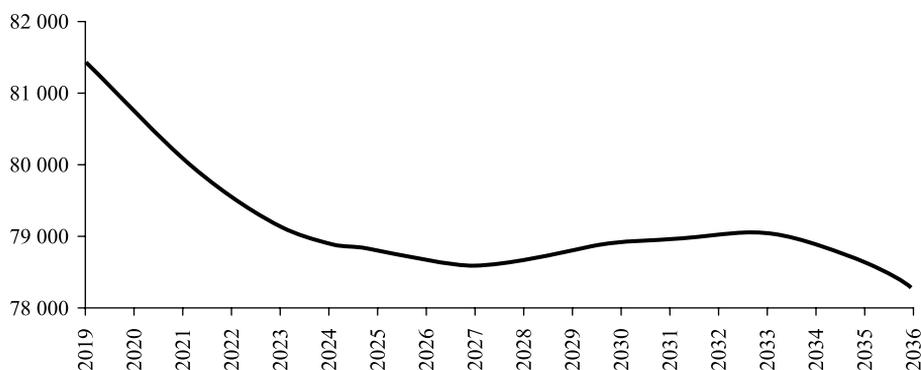


Fig. 14. Working-age population in the “medium case” long-term demographic forecast (thousands of people).

Note: This forecast does not take into account a scenario for increasing the retirement age.

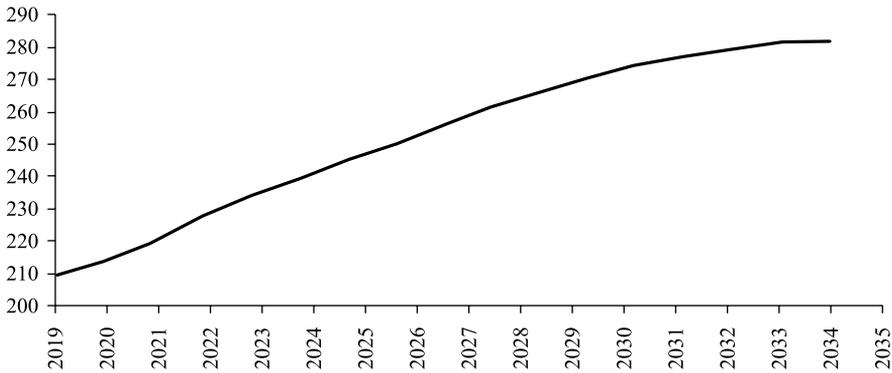
Source: Rosstat.

the capital stock in the Russian economy provided an additional reason for deceleration of the structural GDP growth rates in recent years (Fig. 13).

The economy's structural growth rate is under considerable influence from unfavorable demographic conditions. According to the “medium case” demographic forecast by Rosstat in the period from 2019 to 2035, the working-age population will decrease by 3.10 million.<sup>25</sup> At the same time, this indicator takes into account the replenishment of labor resources due to increased migration gain (Fig. 14).

The gradual decrease in the working-age population under particular conditions can be viewed as an incentive for businesses to renew capital to preserve output levels or growth rates and to invest in labor-saving technologies including automation and robotics. Capital renewal enables a non-contradictory combination of reduced labor resources, increased capital stock and TFP growth within a single macroeconomic scenario.

<sup>25</sup> The indicator is calculated as of the beginning of the year; the value at the beginning of 2036 is more or less consistent with the indicators at the end of 2035.



**Fig. 15.** Migration-related population increase in the “medium case” long-term demographic forecast (thousands of people).

Source: Rosstat.

At the same time, with no capital renewal or TFP growth, ensuring predicted structural growth rates in the economy’s output will require greater migration. Currently, the increase in migration forecast by Rosstat for 2019 to 2035 is around 208,000 to 282,000 people per year (Fig. 15).

## 6.2. Foreign trade component

The foreign trade component trend was determined based on the Urals oil price forecast by the Russian Ministry of Economic Development (Figs. 16–17).

From 2007 to 2014 (except for 2009), high oil prices contributed to a positive foreign trade component in GDP growth rates. Following a short period of stabilization at around USD 100/bbl from 2011 to 2014, oil prices began to fall sharply.

The drop in oil prices in 2015 below long-term average annual values caused the foreign trade component to fall below zero. The signing of a cartel agreement to limit oil production by OPEC countries and 11 oil-exporting countries, including Russia, interrupted the price decline in 2016. In 2017, the agreement to limit production was renewed until the end of 2018, which supported oil prices. In addition, on May 8, 2018, the United States declared their exit from the Iranian nuclear program treaty and in August, they declared the renewal of sanctions to restrict, amongst other things, supplies of Iranian oil to the global market. In June 2018, as part of the OPEC+ deal, it was decided to increase oil production by 1 million bbl per day for the purposes of limiting prices for energy resources and deceleration in the development of shale oil and gas production around the world. However, in December 2018, in view of a growing imbalance between global oil supply and demand, and weakening oil prices, the cartel participants agreed to cut oil production by 1.2 million bbl per day since the beginning of 2019, which means a restoration of 2016 quotas.

According to the forecast under review, oil prices will remain below long-term average annual prices in the near future, which will correspond with a negative value for the foreign trade component. Under various macroeconomic scenarios, losses from deteriorating terms of trade will be around 1 p.p. of GDP growth rates per year.

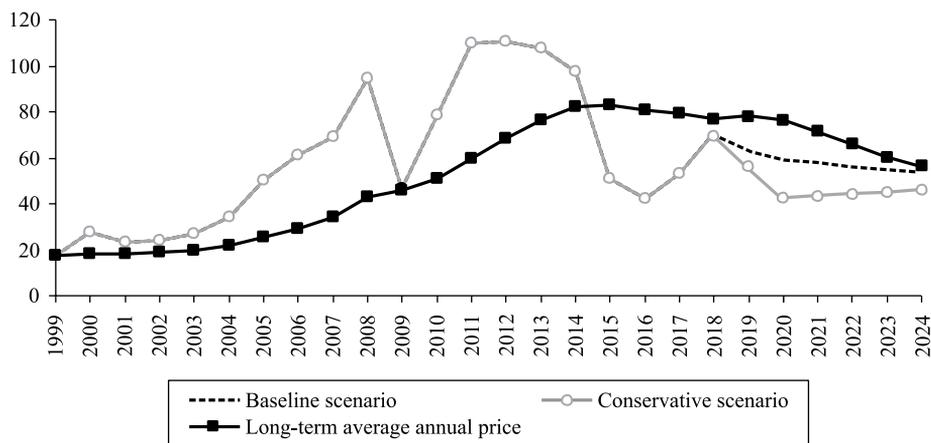


Fig. 16. Oil prices: actual values and forecasts for 2018 to 2024 (Urals, USD/bbl).

Note: According to assumptions by the Russian Ministry of Economic Development, pressure on the oil market will be exerted by increased production of the OPEC+ deal countries, as well as by an increase in shale oil production in the United States. Yet in the short term, a further rise in oil prices is possible under the influence of declining supply from some large oil-producers, such as Iran, due to the influence of USA sanctions. The long-term average annual price is calculated for the baseline scenario.

Source: Authors’ calculations.

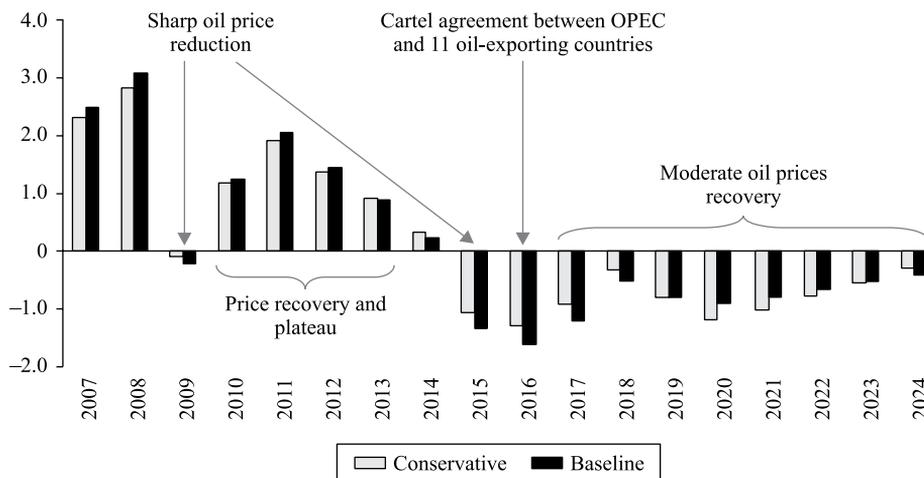


Fig. 17. Foreign trade component of GDP growth rates from 2007 to 2024 under various macroeconomic scenarios (%).

Source: Authors’ calculations.

### 6.3. The cyclical component

The trends in the cyclical component are shown in Fig. 18. In 2007, as oil prices and capital expenses increased, Russia’s economy was apparently “overheated.” The actual unemployment rate was lower than the structural unemployment rate (see Fig. 3).

Affected by the global financial crisis of 2008 and 2009, the cyclical component of GDP growth rates dropped below zero. At the end of 2008, a transition

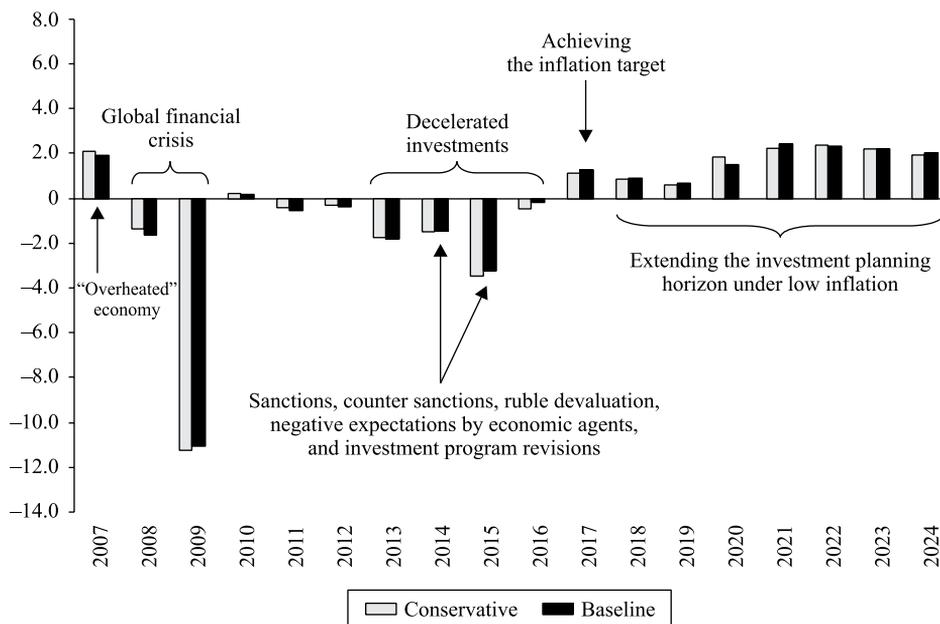


Fig. 18. Cyclical component of Russian GDP growth rates (%).

Source: Authors' calculations.

began towards the downward phase of the business cycle. In 2009, the cyclical component was reduced by a random shock caused by a number of overlapping adverse factors, including changing expectations by economic agents (investor pessimism contributed to a 13.5% reduction in investment due to passing the lowest point of the global financial crisis in 2009), as well as by the decline in demand for Russia's main exports.

The post-crisis period was characterized by a transition to recovery growth. A slight increase in positive expectations by economic agents also occurred (e.g. between March and October 2012, the business confidence level in the manufacturing sector (according to Rosstat) hit positive territory for the first time since the 2008–2009 crisis). Nevertheless, these trends were unstable due to the gradual reduction of the cyclical growth rate component into negative values.

From 2013 to 2015, the cyclical recession deepened, aggravated by a number of random shocks. The “investment pause” in the Russian economy began in 2013. In 2014, the intensified sanction and counter sanction policy heightened the risks associated with economic activity in Russia, both for domestic and, especially, for foreign investors (read more in Idrisov et al., 2016). Additionally, at the end of 2014, due to a significant decline in both the nominal and actual ruble exchange rate, import supplies dropped, driven by higher ruble prices for imported goods. To mitigate devaluation and inflation risks, the RF Central Bank decided to raise the key rate from 10.5% to 17.0% on December 16, 2014. This prevented further aggravation of inflation expectations, but caused a rise in the real interest rate<sup>26</sup> and a deceleration of lending in the real sector. Thus, the effect of random shocks observed in the 4th quarter of 2014, led to nega-

<sup>26</sup> If calculated based on actual inflation.

tive expectations by economic agents with respect to near-term development prospects for the Russian economy, which was reflected in the negative values of the cyclical component of GDP growth rates in 2015. This reduction was partially associated with the beginning of Russia's military operation in Syria in September 2015.

Although the RF Central Bank had pursued the key rate reduction policy since Q1, 2015, real interest rates on loans in 2016, calculated based on the actual inflation rate, remained at their highest levels since 2007. Despite the fact that the real interest rates, calculated based on the expected inflation rate, were rather low during the same period, under conditions of high uncertainty, including with respect to the effectiveness of inflation targeting policy, investments continued to decline.

In 2017, for the first time in Russia's modern history, the target inflation rate was achieved. Its decrease encouraged the "anchoring" of inflation expectations and a lowering in the level of uncertainty, offsetting the adverse impact of high real interest rates. Investments and the economy as a whole responded positively to the disinflation policy. Investments increased in 2017 and the growth component related to the business cycle moved into positive territory.

The cyclical component of GDP growth rates is expected to trend positively from 2018 to 2024. At the same time, the economic situation remains uncertain due to the potential for new sanctions against Russian economic agents, including personal sanctions and visa restrictions that affect the interests of Russian entrepreneurs.<sup>27</sup> Russia's ongoing military operation in Syria is another risk factor. The realization of these types of risk could have an adverse effect on the cyclical component of GDP growth rates, as in 2014 and 2015.

Thus, the decomposition of GDP growth rates shows that, under different macroeconomic scenarios, there is a high probability of stabilization of structural growth rates component of Russia's economy at the level of approximately 1.5 p.p. per annum. A significant source of growth will also be a component of business cycle, which is expected to be around 2.0 p.p. per annum (through the period 2020–2024). Thus, in the baseline and conservative scenarios prepared by the Russian Ministry of Economic Development, economic growth rates will be positive due to the combination of the structural and cyclical components. Meanwhile, if the unfavorable foreign trade situation persists, which has a negative impact on growth rates (around –1 p.p. per annum) and, given the likelihood of new sanctions that may negatively impact business conditions in Russia, there is potential to shift from slow growth to stagnation or even recession.

## 7. Conclusion

During the late 1990s and early 2000s, the structural growth rates for the Russian economy were around 5.0–5.5 p.p., driven by the post-transformation recovery growth and improved terms of trade. The lack of institutional transformations, or their slow pace, caused a gradual deceleration in structural growth rates to 1.5 p.p. by 2017.

<sup>27</sup> See, e.g.: <http://tass.ru/obschestvo/5216575>

The positive contribution by foreign trade conditions, which was up to 3.1 p.p. of the GDP growth rate during the period from 2000 to 2014 (except for 2009), factored into the slow pace of institutional transformation in Russia during that time. Creating obstacles for developing social institutions during the periods of favorable commodity market conditions is the basic mechanism of the resource curse, which results in lower long-term output growth rates in the economy (see Auty, 2002; Humphreys et al., 2007; Guriev and Sonin, 2008; Knobel, 2013; Mau, 2010).

From 2015 to 2017, for the first time in quite a long period, the foreign trade component of economic growth rates became negative due to falling global oil prices. It remains at around 1 p.p. per year since 2019.

The cyclical component of Russia's economic growth rate over the period under review was highly variable, caused by different random and sometimes overlapping (as in 2008 and 2009 or in 2014) shocks. On the whole, in developing economies, the business cycle has the properties of a stochastic process, which complicates its identification and periodization. Nevertheless, an analysis of the decomposition of Russia's GDP growth rates enables us to propose the following periodization of the business cycle phases during the time under review:

- 2008—business cycle peak;
- 2008–2015—recession phase;
- 2015—business cycle “bottom”;
- 2015–now—beginning of the revitalization phase.

In the absence of the random shocks of 2014, the business cycle could have reached the bottom in 2013, while the period of reduced investment might have lasted only 1 or 2 years. Then, the cyclical component could have shifted into positive territory in 2015 or 2016. In fact, the sum of the business cycle and random shock components only achieved positive values in 2017, reaching between 1.1 p.p. and 1.2 p.p.

The actual growth rate of the Russian economy of 1.5% in 2017, according to our estimates, resulted from the negative impact of global prices for Russia's basic exported goods on the one hand and from the positive impact of the structural and cyclical components of GDP growth rates on the other. The fact that a significant impact on growth rates in 2017 was exerted by the sum of the business cycle and random shock components, combined with increasing investment, may support the statement that this is the beginning of a new economic growth cycle in the Russian economy. However, it may be unstable under the effect of random shocks, including those caused by new sanctions.

The decomposition indicates stagnation in Russia's structural GDP growth rates from 2019 to 2024 for the macroeconomic scenarios under review.<sup>28</sup> Under these conditions, their increase serves as the most important means for the Russian economy to achieve growth rates above global averages.

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<sup>28</sup> If we assume that macroeconomic conditions have deteriorated as compared with the conservative scenario, assuming that growth rates will be around 0.7 p.p. (equal to average growth rates in 2016 and 2017) from 2018 to 2024, this scenario will correspond to further decrease in the structural component of the GDP growth rate (declining to slightly negative values in 2024), while the foreign trade and cyclical components will not change substantially.

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