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The structure of public spending and economic growth in Russia

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Abstract

This paper examines how Russia's GDP growth responds to changes in the structure of general government spending. We consider models with expenditures as a percentage of total spending and expenditures as a percentage of GDP. Each model is constructed as a structural vector autoregression (SVAR). We show that redistribution in favor of productive expenditures (national economy, education, healthcare) increases the rate of economic growth, and an increase in the share of unproductive expenditures (national defense, social policy) reduces it. The maximum positive effect comes from expenditures on the national economy: their increase by 1% of GDP with constant total expenditures increases the growth rate of GDP by 1.1 p.p. An increase in expenditures on education by 1% of GDP with constant total expenses contributes +0.8 p.p. to the growth rate of GDP. The corresponding effect of healthcare expenditures is +0.1 p.p. Defense and social spending make negative contributions: –2.1 and –0.7 p.p. respectively. These results are consistent with existing estimates of fiscal multipliers for Russia and calculations based on data from other countries and cross-country data.

Keywords: public expenditures, expenditures structure, productive expenditures, economic growth, econometric model.
JEL classification: C51, C52, H50, H59.

1. Introduction

The task of optimizing government spending allocation became the focus of attention in many countries around the world in the aftermath of the 2008 financial crisis. The unexpected deceleration of economic growth and limited opportunities for financing deficits triggered the need to carry out large-scale budget consolidations in most developed and in some developing countries. The protracted

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stagnation forced governments to look for new sources of growth, and more active investment in infrastructure became one of the options. Thus, the international community (G20, IMF, World Bank, OECD) and leading world economies focused their attention on adjusting the allocation of government spending. Discussions and the respective empirical research on the general approaches to these adjustments have picked up momentum.

Optimizing the allocation of budget expenditures is an important task for Russia as well, since resolving it would make a considerable contribution. First, it would help to raise GDP growth rate to be at least on par with the world economy, and second, in restoring the long-term balance in the budget system which was disrupted by the crash in oil prices. The Strategy-2020 plan developed per instruction by the Russian Government, proposed a "budget maneuver," i.e. adjusting the budget system's expenditure allocation by 2% to 4% of the GDP (Mau and Kuzminov, 2013). The economic program of the Center for Strategic Research also proposes a "budget maneuver" (Kudrin and Sokolov, 2017). It is primarily aimed at optimizing "unproductive" expenditures that have no effect on the accumulation of physical and human capital after exceeding minimum required levels (security and law enforcement, defense, utilities, government machinery), and, secondly, at increasing "productive" expenditures that encourage long-term economic growth by accumulating physical and human capital (construction, infrastructure, healthcare, science, education). Such a maneuver requires a preliminary quantitative assessment of its consequences. Therefore, analyzing the dependence of economic growth on the allocation of government spending in Russia is currently a topical issue.

The optimal level and allocation of government spending have been discussed in literature for a long time. A consensus opinion can only be seen with respect to certain aspects. Empirical papers show that there is a certain level of government spending (as a percentage of GDP) below which an increase encourages economic growth, while exceeding that level has an adverse impact on growth (Lucas, 1988; Aschauer, 1989; Barro, 1996; Barro and Sala-i-Martin 1995; Feldstein, 1996; Alesina et al., 1999; Devarajan et al., 1997). However, this threshold level of spending may vary significantly between countries. All the more so, the optimal allocation of government spending cannot be determined with certainty. For some expenditure categories, the effect on the economy can be measured as soon as the current period (e.g., social expenditures) or with a certain lag (e.g., healthcare, law enforcement); whereas, for other categories such as national security and defense, there are no decisive indicators to quantify spending efficiency (Barro, 1991; Dicle and Dicle, 2010). Most empirical papers (see Section 3) conclude that government spending on education, healthcare, science, transportation, and communications has a positive effect on economic growth. The dominant opinion of late has been that increasing defense spending has a negative or non-existent impact on economic growth.

This paper examines how the allocation of general government spending impacts Russia's GDP growth rate. It uses models that show the correlations between GDP growth rate and the proportion of expenditures on defense, social policy, national economy, healthcare, and education. It also applies the well-proven empirical structural vector autoregression (SVAR) methodology.

Section 2 presents an overview of the empirical studies on the effect of government spending allocation on economic growth, using both foreign and Russian data. Sections 3 to 5 estimate the impact of budget expenditure allocation on Russia's GDP growth rate. The conclusion contains our findings and suggests recommendations for optimizing the budget spending allocation given the Russian economy's current development stage.

2. Government spending allocation and economic growth

One of the key concepts in modern theories of economic growth is associated with classifying budget expenditures into productive and unproductive. Productive expenditures generally include investments in human capital (primarily education and healthcare) and in physical capital, including infrastructure expenditures (European Commission, 2012). Unproductive expenditures include financing non-market services (including government administration, defense, etc.) required by the state to perform its basic functions, as well as all types of social transfers.

Gemmell et al. (2007) divided government spending into productive and unproductive categories, to find that increasing the former boosts economic growth in OECD countries, but the effect is held back by simultaneous tax increases which negatively affect growth. This result points to the importance of taking taxes into account when evaluating the effect of spending changes. Researchers also note that the approach used in the evaluation should take into account possible changes in the government system of accounts.

Magazzino (2012) analyzes relationships between components of government spending and GDP trends in the eurozone from the 1990s to the 2010s. The analysis was disaggregated using econometric models based on time series. Correlation with the GDP was evaluated with respect to ten specific government expenditures, in accordance with the Classification of the Functions of Government (COFOG)[1]. The authors performed co-integration tests, taking cross-sectional dependencies and group heteroscedasticity into consideration, which indicate the presence of a long-term positive correlation between real GDP per capita and real expenditures on defense, utilities, recreation, culture, and religion. At the same time, Granger causality tests contradict the Keynesian point of view that increased expenditures cause GDP to grow. Using the Hodrick-Prescott filter decomposition of GDP for Estonia, Luxembourg, Ireland, and Greece, the authors found the estimates to be widely dispersed.

Based on panel data from OECD countries, Barbiero and Cournède (2013) studied how changes in government spending on education, healthcare, and other sectors impact economic growth. According to their findings, increasing spending on healthcare, education, and transportation will increase GDP growth rate if total spending remains unchanged. At the same time, increasing government spending on utilities has an adverse impact on economic growth. The error correction model constructed in the paper evaluated the speed of adjustment, which proves to be rather slow as intuition had suggested. The author's econometric

[1] See the definition of the classification in UN (2000).

analysis demonstrates that the effect of changes in the allocation of government spending on GDP growth is fully manifested only after at least 5 years.

Gemmell et al. (2016) analyzes the dependence of economic growth on total government spending and the proportion of various expenditure items. The analysis studies a sample of OECD countries during the 1970s, taking into account the methods for financing spending changes and the potential endogenous correlations between them. The authors present compelling empirical evidence that redistributing government spending in favor of infrastructure and education has a long-term positive impact on household income. The paper also shows that increasing the share of expenditures on social security with a proportionate decrease in all other items usually has a moderately negative effect on the long-term GDP level.

Fournier and Johansson (2016) used cross-country data to run simulations that illustrated the effect on long-term growth from changes in the allocation of government spending. The simulations also intended to estimate the effect on the long-term GDP level from government spending on investments, pensions, and subsidies. Other simulations were used to estimate the impact on GDP growth rate. On the whole, calculations indicated that GDP trends were strongly dependent on changes in the allocation of government spending. The strength of this dependency relies on specific country factors and, in particular, initial conditions. For example, a simulated increase in educational expenditures will raise the average per capita GDP by 7% on average. At the same time, the effect is considerably greater in a number of countries (e.g., Chile, Mexico and Turkey) where the potential increase is up to 25%. The same paper demonstrates that cutting the proportion of expenditures on pensions and subsidies relative to total budget spending will increase potential GDP per capita by 5% to 9% on average. Moreover, indexing the retirement age to life expectancy may potentially save 5% to 10% of pension expenditures by 2060.

There is a comparatively small number of studies on the effect of government spending allocations on economic growth rate in Russia. Ivanova and Kamenskikh (2011) isolated a category called the "social sphere' which includes spending on social policy, healthcare, and education. According to the authors' estimates, increasing social expenditures by 1% of GDP makes a contribution of 0.2 p.p. to GDP growth, with a lag of four quarters. In Gromov (2015), the multiplier of social spending on output is 0.03, with a one-year lag. However, in 2009, the contribution of social spending to GDP growth was 0.73 p.p., which was incomparably higher than pre-crisis effects and points to the significance of social spending during crises.

Empirical estimates of the effect of defense spending on output for Russia are controversial. For example, in Ivanova and Kamenskikh (2011), the corresponding fiscal multiplier is 0.29, Gromov (2015) obtained 0.15, while Drobyshevsky and Nazarov (2012) found that defense expenditures have a statistically insignificant impact on economic growth. It should be noted that Ivanova and Kamenskikh (2011) and Gromov (2015) also considered the "power" expenditures, which also include law enforcement spending. A detailed benchmarking of the efficiency of government spending on defense and security in Russia was carried out in Knobel et al. (2015). This study built a number of two- and three-variable SVAR models. In the case with two variables, the defense spending multiplier was found to be

insignificant, while the security spending multiplier varied between 0.18 and 0.22. In models with three variables, including oil prices, the defense spending multiplier was between 0.19 and 0.25, while the security spending multiplier was between 0.17 and 0.25, depending on the type of model and the magnitude of lag.

Empirical works show that expenditures on the national economy have the greatest multiplying effect on Russia's GDP growth: 0.55 with a lag of three to four quarters (Ivanova and Kamenskikh, 2011) or 0.32 with a one-year lag (Gromov, 2015). In addition, according to the estimates presented in the first article, the fiscal multiplier for government spending on the national economy was 0.8 p.p. during the 2009 crisis (almost double the pre-crisis period), indicating the importance of this expenditure item for economic recovery.

It should especially be noted that Ivanova and Kamenskikh (2011) discovered a negative impact from general government spending on economic growth (–0.07 p.p.), whereas in Gromov (2015) the fiscal multiplier for this type of expenditure is 0.08. Empirical papers studying the effect of spending allocation on economic growth classify general government spending as unproductive, i.e. not encouraging economic growth (Idrisov and Sinelnikov-Murylev, 2013). Thus, the results showing a negative or an extremely low influence on economic growth rate are seen as quite logical.

Kudrin and Knobel (2017) estimated the multipliers for extended government budget expenditures in Russia across various functional groups. According to the authors' calculations, an increase in national defense spending by 1% of GDP results in a 0.29 decrease in GDP growth rate; whereas a 1% increase in national security and law enforcement, in education, in healthcare and sports, and in road infrastructure and transportation, correspond to 0.26 p.p., 0.18 p.p., 0.09 p.p. and 0.26 p.p. increases in GDP growth rate, respectively. They estimated the potential impact of a budget maneuver in favor of productive expenditures on economic growth, as well as the resulting effect of changes in the allocation of government spending in recent years. The paper shows that a redistribution of resources from unproductive to productive expenditures could increase long-term economic growth rate by approximately 0.8 p.p. And vice-versa, the changes in budget spending between 2011 and 2017 had an adverse effect on annual average economic growth rate of around 0.3 p.p. per year.

It should be noted that in all of the above studies based on Russian data, the effects of changes in the government spending allocation were calculated without fixing their total amount. The effect of growth in total spending is partly adjusted due to the fact that spending is measured as a percentage of the GDP. However, this is not a complete adjustment. In this paper, we calculate the effects of changes in the general government spending allocation, while fixing its total amount.

3. Data

Our models use annual GDP data published by Rosstat and Federal Treasury reports on the execution of budgets for the Russian Federation[2] in terms of ex-

[2] GDP data are available at: http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/ru/statistics/accounts/; Federal Treasury budget execution reports are available at: http://www.roskazna.ru/ispolnenie-byudzhetov/konsolidirovannyj-byudzhet/

penditures during the period from 2000 (data are not available for all series from that year) to 2017.

The time series used include the following indicators:

- GDP level in constant 2016 prices (RUB billion) — GDP;
- GDP level in current prices (RUB billion) — GDPN;
- general government expenditures (RUB billion) — EXT;
- general government expenditures on national defense and security (RUB billion) — DEF;
- general government expenditures on social policy (RUB billion) — SOC;
- general government expenditures on the national economy (RUB billion) — ECO;
- general government expenditures on healthcare (RUB billion) — HEA;
- general government expenditures on education (RUB billion) — EDU;
- Urals price (USD/bbl annual average) — URALS.

Notably, this paper does not isolate expenditures on national security and law enforcement but combines them with national defense. Security and law enforcement expenditures, as well as defense expenditures, are classified as unproductive. In 2017 and 2018, both defense and security and law enforcement expenditures declined (as a percentage of GDP) in Russia. Judging by the budget plans, this trend will continue in the near future. Therefore, from the standpoint of the reality of Russia's current fiscal policy, it is reasonable to combine defense, security, and law enforcement expenditures, rather than separate them.

Table 1 contains descriptive statistics for the data used. Fig. 1 shows the trends for the expenditure items studied in the paper. Both as a percentage of total spending and as a percentage of GDP, the most volatile expenditures are those on social policy and the national economy. Therefore, the models incorporating these expenditures are more difficult to estimate, since the statistical significance of their estimated parameters is lower (as the sample is rather small) and, accordingly, this significance should be interpreted less categorically than in other cases. One should take into account the very values of the estimates, their adequacy from an economic standpoint, and not just their statistical significance.

Below we analyze various expenditures as a percentage of total general government spending and as a percentage of GDP to identify correlations between

Table 1
Descriptive statistics.

	DEF/ EXT × 100	SOC/ EXT × 100	ECO/ EXT × 100	HEA/ EXT × 100	EDU/ EXT × 100
Average	8.310	31.144	13.780	9.851	11.089
Maximum	12.060	35.236	17.336	11.387	12.209
Minimum	7.264	25.061	11.204	9.042	9.907
Standard deviation	1.314	3.444	1.938	0.712	0.657
Observations	17	12	13	12	12
	DEF/ GDPN × 100	SOC/ GDPN × 100	ECO/ GDPN × 100	HEA/ GDPN × 100	EDU/ GDPN × 100
Average	2.794	10.763	4.713	3.379	3.805
Maximum	4.390	12.591	6.721	3.714	4.261
Minimum	2.352	8.041	3.305	3.147	3.561
Standard deviation	0.568	1.713	0.924	0.204	0.204
Observations	17	12	13	12	12

Source: Author's calculations.

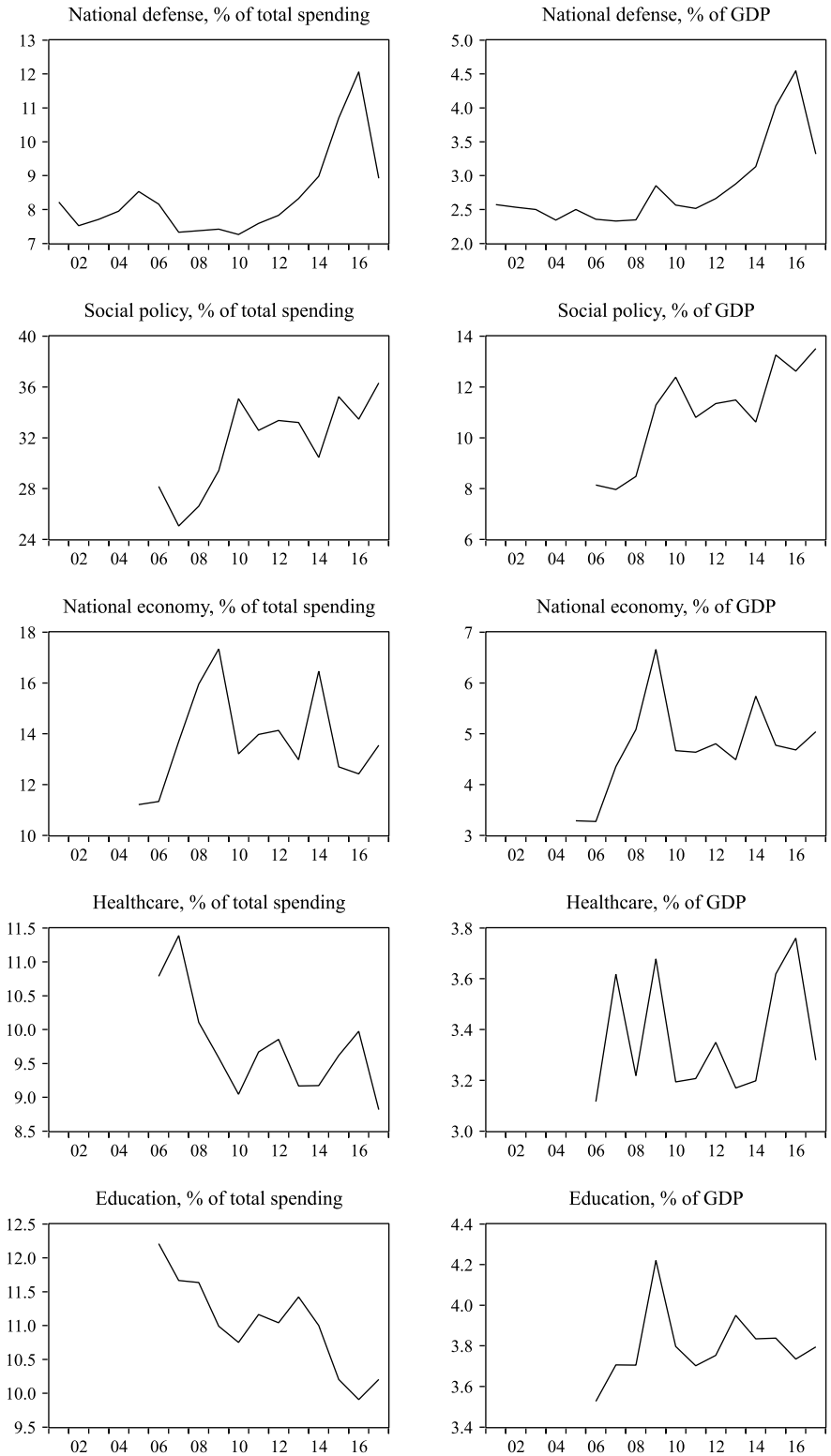

Fig. 1. Dynamics of the main general government expenditure items (% of total spending and % of GDP).

Sources: Rosstat; Federal Treasury; author's calculations.

them, GDP growth rate and oil price changes. The corresponding correlations are provided in Table 2.

Negative correlations between percentages are of no interest, as they are largely attributable to the fact that whenever an expenditure item is increased while total spending remains constant, some other expenditure item is bound to decrease. Positive correlations can be observed between the shares of social (SOC/EXT) and defense expenditures (DEF/EXT), as well as between education (EDU/EXT) and healthcare (HEA/EXT) expenditures. The GDP growth rate is negatively correlated with the percent shares of defense, social policy and national economy expenditures. Intuitively, the latter expenditure item should rather have a positive correlation with economic growth. As demonstrated by the models in the next section, correlation does not reflect causality in this case, and expenditures on the national economy have a positive impact on GDP growth. The table above also shows that GDP growth rates are positively correlated with the percent shares of healthcare and education expenditures. Correlations between the proportion of expenditures and oil price changes are generally similar to the respective correlations with the GDP, which is evidently attributable to the high correlation between the GDP and the oil price. For example, the share of defense expenditures demonstrates a clear negative correlation with oil price changes, more largely reflecting the trends in recent years, e.g. growing defense expenditures against a backdrop of falling oil prices. The distinctly positive correlation between the percent share of educational expenditures with oil price changes is largely attributable to the fact that, since 2013, it has been falling against a falling price.

Table 3 contains correlations between expenditures as a percentage of GDP with each other, with GDP growth rate, and with oil price changes. Unlike the previous table, expenditures here are not bound by any restrictions and the correlations between their levels as percentages of GDP could vary.

Table 2
Correlations between expenditures as a percentage of total spending, GDP growth rate, and oil price changes.

	DEF/EXT	SOC/EXT	ECO/EXT	HEA/EXT	EDU/EXT	DLOG(GDP)
SOC/EXT	0.446	1				
ECO/EXT	–0.372	–0.323	1			
HEA/EXT	–0.110	–0.729	–0.273	1		
EDU/EXT	–0.723	–0.711	0.025	0.481	1	
DLOG(GDP)	–0.361	–0.366	–0.454	0.531	0.607	1
DLOG(URALS)	–0.596	–0.332	–0.117	0.233	0.609	0.831

Source: Author's calculations.

Table 3
Correlations between expenditures as a percentage of the GDP, GDP growth rate, and oil price changes.

	DEF/GDPN	SOC/GDPN	ECO/GDPN	HEA/GDPN	EDU/GDPN	DLOG(GDP)
SOC/GDPN	0.633	1				
ECO/GDPN	0.067	0.281	1			
HEA/GDPN	0.379	0.128	0.365	1		
EDU/GDPN	0.168	0.280	0.765	0.267	1	
DLOG(GDP)	–0.575	–0.629	–0.722	–0.480	–0.572	1
DLOG(URALS)	–0.709	–0.517	–0.372	–0.545	–0.240	0.831

Source: Author's calculations.

As shown in the table, expenditures as percentages of GDP are positively correlated with each other, except for education expenditures, which were found to be negatively, albeit insignificantly, correlated with defense expenditures. Notably, all expenditures as percentages of GDP are negatively correlated with GDP growth rate and oil price changes. This is also not quite consistent with the intuitive notion of correlation between expenditures and GDP growth, but the econometric models constructed in the next section help identify the causality, addressing the problem.

4. Methodology

Our models use the empirical methodology for estimating the structural vector autoregression (SVAR) from (Corsetti et al., 2012). The difference between this and traditional vector autoregression (VAR) is that it includes restrictions on parameter matrices (Corsetti et al., 2012; Clarida, Gali, 1994; Blanchard, Perotti, 2002; Mountford, Uhlig, 2008). These limitations help the researcher to isolate certain desirable parameters of the response of endogenous variables to unexpected shocks.

To measure the effect of the general government spending allocation on GDP growth rate, we considered the following models:

$$\begin{pmatrix} EXP_{i,t}/EXT_t \\ \Delta\log GDP_t \end{pmatrix} = \begin{pmatrix} \alpha_{EXP_i} \\ \alpha_{GDP} \end{pmatrix} + \sum_{J=1}^{n} A_j \begin{pmatrix} EXP_{i,t-j}/EXT_{t-j} \\ \Delta\log GDP_{t-j} \end{pmatrix} + \\ + \begin{pmatrix} \beta_{EXP_i} \\ \beta_{GDP} \end{pmatrix} \Delta\log URALS_t + \begin{pmatrix} e_{1,t} \\ e_{2,t} \end{pmatrix} \quad (1)$$

$$\begin{pmatrix} EXP_{i,t}/GDP_t \\ \Delta\log GDP_t \end{pmatrix} = \begin{pmatrix} \alpha_{EXP_i} \\ \alpha_{GDP} \end{pmatrix} + \sum_{J=1}^{n} A_j \begin{pmatrix} EXP_{i,t-j}/GDP_{t-j} \\ \Delta\log GDP_{t-j} \end{pmatrix} + \\ + \begin{pmatrix} \beta_{EXP_i} \\ \beta_{GDP} \end{pmatrix} \Delta\log URALS_t + \begin{pmatrix} e_{1,t} \\ e_{2,t} \end{pmatrix} \quad (2)$$

where *URALS* is the annual average oil price in USD, EXP_i is expenditures in the *i*-th expenditure category, *GDP* is the GDP in constant prices, and *e* is a shock variable. Model (1) describes the impact on GDP growth rate from changes in the percent share of the *i*-th category in general government spending—EXP_i/EXT, while model (2) describes the impact of expenditures in the *i*-th category as a percentage of GDP—EXP_i/GDP. At the same time, since we are constructing structural VAR models, shocks are determined by the following restriction:

$$\begin{pmatrix} e_{1,t} \\ e_{2,t} \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ b & 1 \end{pmatrix} \begin{pmatrix} \sigma e_{EXP_i} & 0 \\ 0 & \sigma e_{GDP} \end{pmatrix} \begin{pmatrix} u_{1,t} \\ u_{2,t} \end{pmatrix} = \begin{pmatrix} \sigma e_{EXP_i} & 0 \\ b\sigma e_{EXP_i} & \sigma e_{GDP} \end{pmatrix} \begin{pmatrix} u_{1,t} \\ u_{2,t} \end{pmatrix} \quad (3)$$

where *u* shocks are independent and identically distributed, with average zero and dispersion one. Thus, to measure structural VAR models, we use a restriction with the following description:

$Ae = Bu$, where

$$A = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}, \; B = \begin{pmatrix} C_1 & 0 \\ C_2 & C_3 \end{pmatrix}$$

and with $b = C_2/C_1$ we estimate parameter b which reflects the response of GDP growth rate to an unexpected shock in the percent share of expenditures in model (1) or their level as a percentage of GDP in model (2). In the event of an unexpected increase in the share of expenditures by 1 p.p. in model (1) or by 1% of the GDP in model (2), GDP growth rate (roughly equal to its logarithm difference) will change by b p.p.

The magnitude of lag n in the models under review was chosen based on Akaike, Schwartz, and Hannan–Quinn information criteria. Out of the models in favor of which these criteria speak, we chose the one with the minimum lag. Table 4 contains an example of lag choice (3 in this case) for models with defense expenditures.

It should be separately noted that in some cases, we use models in levels, i.e. equations (1) and (2) are considered without a transition to differences Δ. This is dictated by statistical (including information) criteria. At the same time, the interpretation of b remains the same.

We also note an important aspect of model (2). Since we are seeking the effect of changes in the spending allocation, their sum *EXT* should remain constant within the model (2). Therefore, in type (2) models, the series of expenditures in the particular categories EXP_i are scaled so that the sum of the expenditures *EXT* remains constant across the entire sample used to estimate the model.

5. Modeling results

This section contains estimates for the main equation of models (1) and (2) for various expenditure categories, as well as the corresponding estimates of matrix B, defined above.

In model (1), defense and social expenditures produce negative values for b. Increasing the share of defense expenditures in total general government spending by 1% reduces GDP growth rate by 0.8 p.p. (Tables 5 and 6).

Table 4
Example of lag choice in the VAR model (for the share of defense expenditures).

Endogenous variables: *DEF*/*EXT DLOG*(*GDP*)
Exogenous variables: *C DLOG*(*URALS*)
Sample: 2001–2017

Lags	LogL	LR	FPE	AIC	SC	HQ
0	64.031	–	1.56e^{-07}	–10.005	–9.843	–10.065
1	76.818	17.049*	3.77e^{-08}*	–11.469	–11.146	–11.589
2	78.692	1.873	6.21e^{-08}	–11.115	–10.630*	–11.294
3	87.165	5.649	4.20e^{-08}	–11.860	–11.214	–12.100
4	91.509	1.447	9.87e^{-08}	–11.918*	–11.110	–12.217*

Notes: * Reflects the lag chosen by the criteria. *LogL* is the log-likelihood in the optimum; *LR* is the statistic for the consecutive modified LR test; *FPE* is the final projection error; *AIC* is the Akaike information criterion; *SC* is the Schwarz information criterion; *HQ* is the Hannan–Quinn information criterion.
Source: Author's calculations.

Table 5
VAR model of the percent share of defense expenditures.

	Sample: 2003–2017	
	DEF/*EXT*	*DLOG*(*GDP*)
DEF(–1)/*EXT*(–1)	1.338 (0.302)	–0.006 (1.512)
DEF(–2)/*EXT*(–2)	–0.221 (0.475)	2.637 (2.378)
DLOG(*GDP*(–1))	–0.002 (0.038)	0.069 (0.190)
DLOG(GDP(–2))	–0.049 (0.038)	0.051 (0.188)
C	–0.004 (0.024)	–0.185 (0.119)
DLOG(*URALS*)	–0.009 (0.006)	0.137 (0.028)
R^2	0.910	0.795
F-statistic	16.272	6.205
Log-likelihood	57.382	34.842
Akaike criterion	–7.340	–4.120
Schwarz criterion	–7.066	–3.846
Log-likelihood		92.403
Akaike information criterion		–11.486
Schwarz information criterion		–10.938

Source: Author's calculations.

Table 6
SVAR model of the percent share of defense expenditures.

	Sample: 2003–2017			
	Coefficient	Standard error	*z*–statistic	*P*–value
C(1)	0.005	0.001	5.292	0.000
C(2)	–0.004	0.007	–0.599	0.549
C(3)	0.026	0.005	5.292	0.000
Log-likelihood	84.568			
Estimated matrix *B*:				
0.005	0.000			
–0.004	0.026			

Source: Author's calculations.

Increasing the percent share of social policy expenditures by 1% reduces GDP growth rate by 0.3 p.p. (Tables 7 and 8). Thus, redistributing the general government budget in favor of unproductive expenditures has a negative effect on economic growth. This effect is quite pronounced for defense expenditures.

For expenditures on the national economy, *b* was estimated at 0.2 p.p. (Tables 9 and 10). Increasing the percent share of expenditures on the national economy in the general government budget by 1% results in an increase in GDP growth rate of 0.2 p.p. These types of expenditures are classified as productive, which is why their effect on economic growth is consistent with the previously obtained results. However, the value of the effect is rather low which could be attributed, in particular, to the low efficiency of government investments, which are a major component in expenditures on the national economy.

Table 7
VAR model of the percent share of social policy expenditures.

	Sample: 2008–2017	
	SOC/*EXT*	*LOG*(*GDP*)
SOC(–1)/*EXT*(–1)	0.234 (0.383)	0.077 (0.170)
SOC(–2)/*EXT*(–2)	0.692 (0.788)	0.037 (0.349)
LOG(*GDP*(–1))	–0.639 (0.481)	0.654 (0.213)
LOG(*GDP*(–2))	0.386 (0.287)	–0.081 (0.127)
C	2.897 (5.048)	4.565 (2.239)
LOG(*URALS*)	–0.017 (0.046)	0.025 (0.021)
*D*09	0.031 (0.053)	–0.094 (0.024)
R^2	0.758	0.983
F-statistic	1.045	19.721
Log-likelihood	26.261	33.577
Akaike criterion	–4.280	–5.906
Schwarz criterion	–4.127	–5.753
Log-likelihood		63.784
Akaike information criterion		–11.063
Schwarz information criterion		–10.756

Source: Author's calculations.

Table 8
SVAR model of the percent share of social policy expenditures.

	Sample: 2008–2017			
	Coefficient	Standard error	*z*-statistic	*P*-value
C(1)	0.028	0.007	4.243	0.000
C(2)	–0.009	0.003	–2.725	0.006
C(3)	0.008	0.002	4.243	0.000
Log-likelihood	50.247			
Estimated matrix *B*:				
0.028	0.000			
–0.009	0.008			

Source: Author's calculations.

Healthcare expenditures have the most notable positive impact on economic growth, as increasing their share in the total general government budget by 1 p.p. adds 2.7 p.p. to GDP growth rate (Tables 11 and 12). This seems quite high, which could be a result of significant variation in the percent share of healthcare expenditures throughout the period under review.

An increase in the proportion of education expenditures results in a 0.3 p.p. increase in GDP growth rate (Tables 13 and 14). Education expenditures are considerably less volatile than healthcare expenditures, which is why this estimate is more reliable from a statistical standpoint.

Table 15 presents estimates for *b* corresponding to type (1) models.

Table 9
VAR model of the percent share of expenditures on the national economy.

	Sample: 2006–2017	
	ECO/*EXT*	*LOG*(*GDP*)
ECO(–1)/*EXT*(–1)	–0.134 (0.266)	–0.277 (0.180)
LOG(*GDP*(–1))	0.063 (0.058)	0.667 (0.039)
C	–0.645 (0.617)	3.571 (0.417)
LOG(*URALS*)	0.026 (0.014)	0.034 (0.009)
*D*09	0.044 (0.016)	–0.089 (0.011)
R^2	0.647	0.986
F-statistic	2.755	107.198
Log-likelihood	34.561	38.872
Akaike criterion	–5.375	–6.159
Schwarz criterion	–5.194	–5.978
Log-likelihood		74.071
Akaike information criterion		–11.649
Schwarz information criterion		–11.288

Source: Author's calculations.

Table 10
SVAR model for the percent share of national economy expenditures.

	Sample: 2006–2017			
	Coefficient	Standard error	*z*-statistic	*P*-value
C(1)	0.014	0.003	4.690	0.000
C(2)	0.003	0.003	1.130	0.259
C(3)	0.009	0.002	4.690	0.000
Log-likelihood	67.404			
Estimated matrix *B*:				
0.014	0.000			
0.003	0.009			

Source: Author's calculations.

Thus, the results obtained are consistent with the hypothesis that increasing the share of productive expenditures (national economy, education, healthcare) has a positive effect on economic growth rate, whereas increasing the share of unproductive expenditures (national defense and social policy) has an adverse impact on GDP growth rate. At the same time, the highest positive effect among productive expenditures results from healthcare expenditures, while the highest negative effect among unproductive expenditures results from national defense expenditures.

Below are tables containing estimates for the main equation of model (2) for various expenditure categories, as well as the corresponding estimates for matrix *B*.

For defense and social expenditures, model (2) produces negative values for *b*: –2.1 p.p. and –0.7 p.p. respectively. Increasing defense expenditures by 1% of

Table 11
VAR model for the percent share of healthcare expenditures.

	Sample: 2007–2017	
	HEA/*EXT*	*LOG*(*GDP*)
HEA(–1)/*EXT*(–1)	0.326 (0.304)	–0.217 (2.005)
LOG(*GDP*(–1))	–0.044 (0.035)	0.560 (0.234)
C	0.579 (0.411)	4.647 (2.714)
LOG(*URALS*)	–0.006 (0.006)	0.051 (0.037)
R^2	0.536	0.622
F-statistic	2.308	3.292
Log-likelihood	40.160	21.280
Akaike criterion	–7.232	–3.456
Schwarz criterion	–7.111	–3.335
Log-likelihood		62.359
Akaike information criterion		–10.872
Schwarz information criterion		–10.630

Source: Author's calculations.

Table 12
SVAR model for the percent share of healthcare expenditures.

	Sample: 2007–2017			
	Coefficient	Standard error	*z*-statistic	*P*-value
C(1)	0.006	0.001	4.472	0.000
C(2)	0.015	0.011	1.353	0.176
C(3)	0.034	0.008	4.472	0.000
Log-likelihood	57.251			
Estimated matrix *B*:				
0.006	0.000			
0.015	0.034			

Source: Author's calculations.

the GDP while keeping total spending constant reduces GDP growth rate by 2.1 p.p. (see Tables 16 and 17).

Increasing the share of social policy expenditures by 1% of the GDP while keeping total spending constant reduces GDP growth rate by 0.7 p.p. (see Tables 18 and 19). These estimates also confirm that redistribution in favor of unproductive expenditures has a negative impact on economic growth, and this effect is most pronounced for defense expenditures.

In model (2), as in model (1), the highest positive effect among productive expenditures is associated with expenditures on the national economy: an increase of 1% of the GDP while keeping total spending constant results in an increase in GDP growth rate by 1.1 p.p. (Tables 20 and 21).

At the same time, the results for healthcare and education expenditures in model (2) differ from the corresponding results in model (1). In model (2), healthcare expenditures have the lowest positive impact on economic

Table 13
VAR model for the percent share of education expenditures.

	Sample: 2007–2017	
	EDU/*EXT*	*LOG*(*GDP*)
EDU(–1)/*EXT*(–1)	0.520 (0.162)	–2.240 (2.484)
LOG(*GDP*(–1))	–0.018 (0.014)	0.481 (0.209)
C	0.211 (0.160)	5.725 (2.454)
LOG(*URALS*)	0.009 (0.002)	0.057 (0.035)
R^2	0.894	0.667
F-statistic	16.909	3.998
Log-likelihood	49.219	21.906
Akaike criterion	–9.044	–3.581
Schwarz criterion	–8.923	–3.460
Log-likelihood		71.127
Akaike information criterion		–12.625
Schwarz information criterion		–12.383

Source: Author's calculations.

Table 14
SVAR model for the percent share of education expenditures.

	Sample: 2007–2017			
	Coefficient	Standard error	*z*-statistic	*P*-value
C(1)	0.002	0.001	4.472	0.000
C(2)	0.001	0.011	0.067	0.947
C(3)	0.035	0.008	4.472	0.000
Log-likelihood	66.019			
Estimated matrix *B*:				
0.002	0.000			
0.001	0.035			

Source: Author's calculations.

Table 15
Sensitivity of GDP growth rate to shocks in shares of various categories of expenditures.

Category of expenditures	Estimated *b*
National defense expenditures	–0.795
Social policy expenditures	–0.339
National economy expenditures	0.224
Healthcare expenditures	2.706
Education expenditures	0.323

Source: Author's calculations.

growth: the effect from their increase is estimated at a 0.1 p.p. increase in GDP growth rate (Tables 22 and 23).

Education expenditures have the second highest effect in model (2). Increasing these expenditures by 1% of the GDP while keeping total spending constant produces additional GDP growth of 0.8 p.p. (Tables 24 and 25). Thus, according to

Table 16
VAR model for defense expenditures as a percentage of GDP.

	Sample: 2002–2017	
	DEF/*GDPN*	*LOG*(*GDP*)
DEF(–1)/*GDPN*(–1)	0.692 (0.147)	6.786 (2.615)
LOG(*GDP*(–1))	0.029 (0.005)	0.519 (0.088)
C	–0.277 (0.045)	4.581 (0.801)
LOG(*URALS*)	–0.008 (0.002)	0.122 (0.028)
R^2	0.959	0.981
F-statistic	85.593	192.147
Log-likelihood	80.282	37.085
Akaike criterion	–10.171	–4.411
Schwarz criterion	–9.982	–4.223
Log-likelihood		117.473
Akaike information criterion		–14.596
Schwarz information criterion		–14.219

Source: Author's calculations.

Table 17
SVAR model for defense expenditures as a percentage of GDP.

	Sample: 2002–2017			
	Coefficient	Standard error	*z*-statistic	*P*-value
C(1)	0.001	0.000	5.477	0.000
C(2)	–0.003	0.006	–0.460	0.645
C(3)	0.024	0.004	5.477	0.000
Log-likelihood	112.820			
Estimated matrix *B*:				
0.001	0.000			
–0.003	0.024			

Source: Author's calculations.

model (2), education expenditures are substantially more productive than healthcare expenditures.

Table 26 presents estimates of *b* corresponding to type (2) models. For ease of comparison, the table also contains estimates for *b* in type (1) models.

It should be noted that the signs for *b* estimates obtained with model (2) coincide with the signs of corresponding estimates of this parameter from model (1). This also speaks in favor of the hypothesis that increasing the share of productive expenditures has a positive impact on GDP growth rate, while increasing the share of unproductive expenditures has a negative impact. In model (2), as in model (1), we find that the highest positive effect on GDP growth is produced by expenditures on the national economy, while the highest negative effect is produced by defense expenditures.

We obtained a rather high estimate for the effect of expenditures on the national economy on Russia's GDP growth rate, which is attributable to three causes. First, a considerable portion of this effect originates from increased expenditures

Table 18
VAR model for social policy expenditures as a percentage of GDP.

	Sample: 2008–2017	
	SOC/*GDPN*	*DLOG*(*GDP*)
SOC(–1)/*GDPN*(–1)	0.086 (0.587)	–1.321 (1.191)
SOC(–2)/*GDPN*(–2)	0.095 (0.368)	1.789 (0.746)
DLOG(*GDP*(–1))	–0.160 (0.123)	–0.360 (0.250)
DLOG(*GDP*(–2))	–0.021 (0.116)	0.026 (0.236)
C	0.097 (0.049)	–0.019 (0.100)
DLOG(*URALS*)	–0.018 (0.012)	0.139 (0.024)
R^2	0.786	0.925
F-statistic	2.208	7.437
Log-likelihood	34.185	27.813
Akaike criterion	–6.263	–4.847
Schwarz criterion	–6.132	–4.716
Log-likelihood		62.657
Akaike information criterion		–11.257
Schwarz information criterion		–10.994

Source: Author's calculations.

Table 19
SVAR model for social policy expenditures as a percentage of GDP.

	Sample: 2008–2017			
	Coefficient	Standard error	*z*-statistic	*P*-value
C(1)	0.009	0.002	4.243	0.000
C(2)	–0.007	0.006	–1.147	0.251
C(3)	0.018	0.004	4.243	0.000
Log-likelihood	52.769			
Estimated matrix *B*:				
0.009	0.000			
–0.007	0.018			

Source: Author's calculations.

on infrastructure and developing various industries (the fuel and energy complex, agriculture, water and forestry, transportation, roads, and communications) from 2005 to 2008, driven by high oil prices. During those years, the economy grew at a high rate, in particular thanks to fiscal stimulus through increased spending on the national economy. Second, expenditures on the national economy include government subsidies, which were also allocated in large volumes to companies in the real sector during the 2009 crisis (a corresponding peak of expenditures on the national economy is apparent in Fig. 1). These were countercyclical fiscal measures which eased the GDP reduction in 2009. Third, the second peak of expenditures on the national economy was in 2014, when considerable resources were allocated to support and develop the Crimean economy. In 2014,

Table 20
VAR model for expenditures on the national economy as a percentage of GDP.

	Sample: 2006–2017	
	ECO/*GDPN*	*LOG*(*GDP*)
ECO(–1)/*GDPN*(–1)	0.025 (0.169)	–0.542 (0.361)
LOG(*GDP*(–1))	0.042 (0.019)	0.670 (0.040)
C	–0.450 (0.202)	3.526 (0.434)
LOG(*URALS*)	0.008 (0.004)	0.034 (0.009)
*D*09	0.021 (0.005)	–0.093 (0.011)
R^2	0.833	0.986
F-statistic	7.479	105.419
Log-likelihood	47.168	38.782
Akaike criterion	–7.667	–6.142
Schwarz criterion	–7.486	–5.961
Log-likelihood		87.519
Akaike information criterion		–14.094
Schwarz information criterion		–13.733

Source: Author's calculations.

Table 21
SVAR model for expenditures on the national economy as a percentage of GDP.

	Sample: 2006–2017			
	Coefficient	Standard error	*z*-statistic	*P*-value
C(1)	0.004	0.001	4.690	0.000
C(2)	0.005	0.003	1.765	0.077
C(3)	0.008	0.002	4.690	0.000
Log-likelihood	80.851			
Estimated matrix *B*:				
0.004	0.000			
0.005	0.008			

Source: Author's calculations.

the Russian economy decelerated relative to 2013. However, this deceleration would have been more pronounced if not for the additional expenditures to support the new Russian region.

We could also ask which specific subsections of expenditures on the national economy made the greatest contribution to the high value of their corresponding GDP expenditure multiplier. To answer this question, we need to build similar type (1) and (2) models for all subsections of expenditures on the national economy and calculate their respective multipliers. This paper is not concerned with this task; however, it appears to be a promising direction for further research.

The estimated response of economic growth to changes in the spending allocation appears to be more adequate from an economic point of view for models where expenditures are represented as percentages of GDP, than for models where expenditures are represented as shares of total spending. Moreover, the values

Table 22
VAR model for healthcare expenditures as a percentage of GDP.

	Sample: 2007–2017	
	HEA/*GDPN*	*DLOG*(*GDP*)
HEA(–1)/*GDPN*(–1)	–0.160 (0.455)	–5.106 (6.917)
DLOG(*GDP*(–1))	0.006 (0.016)	–0.063 (0.248)
C	0.039 (0.016)	0.195 (0.236)
DLOG(*URALS*)	–0.003 (0.003)	0.135 (0.038)
R^2	0.328	0.714
F-statistic	0.978	4.986
Log-likelihood	50.516	23.310
Akaike criterion	–9.303	–3.862
Schwarz criterion	–9.182	–3.741
Log-likelihood		73.827
Akaike information criterion		–13.165
Schwarz information criterion		–12.923

Source: Author's calculations.

Table 23
SVAR model for healthcare expenditures as a percentage of GDP.

	Sample: 2007–2017			
	Coefficient	Standard error	*z*-statistic	*P*-value
C(1)	0.002	0.000	4.472	0.000
C(2)	0.000	0.010	0.021	0.983
C(3)	0.030	0.007	4.472	0.000
Log-likelihood	68.719			
Estimated matrix *B*:				
0.002	0.000			
0.000	0.030			

Source: Author's calculations.

of the information criteria presented in the tables above also speak in favor of type (2) models with expenditures as percentages of GDP.

7. Conclusions

This study estimated the effects of changes in the allocation of general government spending on economic growth in Russia. Our econometric analysis shows the following.

Increasing the share of productive expenditures (national economy, education, healthcare) has a positive effect on economic growth rate, whereas increasing the share of unproductive expenditures (national defense and social policy) has an adverse impact on GDP growth rate.

The impact of particular categories of government spending on economic growth in Russia has previously been studied only through a multiplier indicator,

Table 24
VAR model for education expenditures as a percentage of GDP.

	Sample: 2008–2017	
	EDU/*GDPN*	*DLOG*(*GDP*)
EDU(–1)/*GDPN*(–1)	0.497 (0.693)	–3.311 (0.668)
EDU(–2)/*GDPN*(–2)	–0.574 (1.558)	10.840 (1.502)
DLOG(*GDP*(–1))	0.016 (0.024)	–0.060 (0.023)
DLOG(*GDP*(–2))	–0.018 (0.070)	0.562 (0.068)
C	0.041 (0.050)	–0.281 (0.048)
DLOG(*URALS*)	–0.001 (0.005)	0.109 (0.004)
*D*09	0.005 (0.003)	–0.078 (0.003)
R^2	0.737	0.999
F-statistic	0.936	583.179
Log-likelihood	49.411	49.741
Akaike criterion	–9.425	–9.498
Schwarz criterion	–9.271	–9.345
Log-likelihood		103.889
Akaike information criterion		–19.975
Schwarz information criterion		–19.669

Source: Author's calculations.

Table 25
SVAR model for education expenditures as a percentage of GDP.

	Sample: 2008–2017			
	Coefficient	Standard error	*z*-statistic	*P*-value
C(1)	0.002	0.000	4.243	0.000
C(2)	0.002	0.001	2.947	0.003
C(3)	0.001	0.000	4.243	0.000
Log-likelihood	90.352			
Estimated matrix *B*:				
0.002	0.000			
0.002	0.001			

Source: Author's calculations.

i.e. without keeping total spending constant. Nevertheless, the results obtained in this paper are generally consistent with the results of previous empirical papers based on multipliers, and based on Russian data. More specifically, productive expenditures — and first of all expenditures on the national economy (including government investments) — have a positive effect on GDP growth rate, whereas unproductive expenditures have a negative effect, with the highest negative effect being produced by national defense expenditures. The results obtained are also generally similar to the results of empirical works based on data from other countries and international data.

Table 26
Sensitivity of GDP growth rate to shocks in various expenditure categories as a percentage of GDP.

Category of expenditures	Estimated *b* in type (2) models	Estimated *b* in type (1) models
National defense expenditures	–2.110	–0.795
Social policy expenditures	–0.749	–0.339
National economy expenditures	1.068	0.224
Healthcare expenditures	0.103	2.706
Education expenditures	0.778	0.323

Source: Author's calculations.

The highest positive effect among productive expenditures is produced by expenditures on the national economy: increasing them by 1% of the GDP while keeping total spending constant increases GDP growth rate by 1.1 p.p. The next highest effect is produced by education expenditures. Increasing these expenditures by 1% of the GDP while keeping total spending constant produces additional GDP growth of 0.8 p.p. Healthcare expenditures have the lowest positive impact on growth: the effect of increasing them is estimated at a 0.1 p.p. increase in GDP growth rate. For defense and social expenditures, the effect is negative: –2.1 p.p. and –0.7 p.p. respectively.

If expenditures are measured as percent shares of total general government spending rather than as percentages of GDP, the results produced are slightly different, although similar in essence. Healthcare expenditures have the most notable positive impact, as increasing their share of total general government spending by 1 p.p. adds 2.7 p.p. to GDP growth rate. An equal increase in the share of education expenditures results in a 0.3 p.p. increase in GDP growth rate. For expenditures on the national economy, the corresponding effect is 0.2 p.p. For defense and social expenditures, the effect is negative: –0.8 p.p. and –0.3 p.p. respectively.

Given the statistical properties of our models, we prioritize the estimates with expenditures expressed as percentages of the GDP.

The correlation analysis has shown that Russia is characterized by a stable, co-directional change in expenditures on the national economy, healthcare, and education. At the same time, these expenditures in real terms are found to be in a stable positive correlation with the real GDP and oil prices. Thus, productive government spending on physical and human capital is pro-cyclical. At the same time, according to the analysis, unproductive expenditures on defense in Russia are independent of the business cycle phase.

The allocation of Russia's government spending is currently characterized by a high proportion of unproductive expenditures, which accounted for 70% of total spending in 2017. However, as shown in previous empirical papers and in this paper, it is productive budget expenditures (investments in human and physical capital) that encourage economic growth in Russia. Throughout the past 10 years, the level of productive budget expenditures has consistently been as low as 10.5% to 11.0% of the GDP (or 28% to 30% of total spending). Thus, in order to accelerate Russia's economic growth, the allocation of government spending should be shifted in favor of productive expenditures by optimizing unproductive expenditures.

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