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The Consequences of Tax Changes: The Evidence on Tax Multiplier in Russia

Sergei G. Belev[1, 2] ✉, **Evgenii O. Matveev**[2, 3]

[1] *Lomonosov Moscow State University, Moscow, Russian Federation*

[2] *Russian Presidential Academy of National Economy and Public Administration, Moscow, Russian Federation*

[3] *Financial University under the Government of the Russian Federation, Moscow, Russian Federation*

✉ *belev@ranepa.ru*

ABSTRACT

The information about tax changes' effects on aggregate output is highly important for economic policy, especially in times of economic contractions. Russian economy underwent the series of tax changes during 2003–2020. For better tax policy design, it is necessary to understand and to evaluate the effects of this changes on aggregate output, which is the purpose of this study. To solve the problem of endogeneity we use two methods – "narrative approach" and "classical" approach. The first one uses data on exogenous, not driven by economic conditions, tax changes from official documents and forecasts. The second one uses cyclical component of the aggregate tax receipts as tax shocks indicator. Using both methods we estimated a VAR model of Russian economy for period 2003–2020. The implementation of "narrative approach" did not provide any significant effect possibly due to vulnerability towards the measurement error. Based on the classic approach we found that tax changes affect output with a 1-year lag and a 1 percentage point shock of aggregate tax receipts to GDP ratio lowers output growth by 0.7–0.88 percentage points. This result is robust to inclusion of additional factors in the model. The results are mostly consistent with existing research. Implementation of "narrative approach" proved to be restricted in Russia. "Classical" approach allows to conclude that tax changes could serve as an appropriate tool of countercyclical policy in Russia. On the other hand, increasing tax burden in times of downturn could be highly harmful for recovery. These results should be interpreted taken into consideration the limitations of the VAR method used.

KEYWORDS

tax multiplier, Russian economy, vector autoregressions, fiscal foresight, narrative approach

JEL C32, E62, H20, H30

УДК 336.027

Последствия изменений в налоговой политике: оценка налогового мультипликатора для России

С.Г. Белев[1, 2] ✉, **Е.О. Матвеев**[2, 3]

[1] *Московский государственный университет имени М.В. Ломоносова, г. Москва, Россия*

[2] *Российская академия народного хозяйства и государственной службы, г. Москва, Россия*

[3] *Финансовый университет при Правительстве Российской Федерации, г. Москва, Россия*

✉ *belev@ranepa.ru*

АННОТАЦИЯ

Информация о влиянии изменений налоговой политики на совокупный выпуск необходима для осуществления грамотной экономической политики, особенно во времена экономического спада. Российская экономика претерпела

ряд изменений в налоговой политике в период 2003–2020 гг. Для повышения ее эффективности необходимо понять и оценить влияние этих изменений на совокупный выпуск, что и является целью данного исследования. Для решения проблемы эндогенности в работе используется два метода, так называемый, «нарративный подход» и «классический» подход. В рамках первого подхода используются данные об экзогенных, не обусловленных экономической конъюнктурой, налоговых шоках из официальных документов и прогнозов. Во втором методе в качестве индикатора налоговых шоков рассматривается циклическая составляющая совокупных налоговых поступлений. Используя оба метода, была проведена оценка VAR-модели российской экономики на данных за период 2003–2020 гг. Оценка в рамках «нарративного подхода» не выявила значимого эффекта налогового шока на изменение совокупного выпуска. Основной причиной такого результата видится высокая чувствительность метода к ошибке измерения. Оценка в рамках «классического» подхода позволяет сделать вывод, что налоговые изменения влияют на выпуск с лагом в 1 год, а шок отношения совокупных налоговых поступлений к ВВП в размере 1 п.п. снижает прирост совокупного выпуска на 0,7–0,88 п.п. Этот результат устойчив к включению в модель дополнительных факторов. Полученные оценки в основном согласуются с существующими исследованиями. В России реализация «нарративного подхода» имеет существенные ограничения. «Классический» подход позволяет сделать вывод, что налоговая политика может служить подходящим инструментом контрциклической политики в России. В то же время увеличение налогового бремени во времена спада может привести к существенному замедлению восстановления экономики. При использовании полученных результатов необходимо учитывать ограничения VAR моделирования.

КЛЮЧЕВЫЕ СЛОВА
налоговый мультипликатор, экономика России, векторная авторегрессия, бюджетный прогноз, нарративный подход

1. Introduction

The tax changes' effects on aggregate output are of central importance for economic policy. Are tax cuts an effective tool to stimulate GDP during economic downturns? How vulnerable is the aggregate output when the tax rates go up? These empirical questions refer to tax multiplier's calculation.

Russian economy underwent the series of tax changes during 2003–2020. Some of them were motivated by countercyclical policy reasons (like corporate tax rate cut from 24% to 20% in 2009).

Another purpose of tax change was to accumulate more fiscal revenues (typical examples were the limiting of loss carryforward from 100% to 50% of one-year corporate profit in 2017 and the VAT standard rate raise from 18% to 20% in 2019). Finally, there were changes in tax administration in order to make tax collection and compliance cheaper. For better tax policy design, it is necessary to understand and to evaluate the effects of all these changes on aggregate output.

But, surprisingly, the measurement of tax multiplier for Russian economy is quite rare in the research agenda. Evaluation of both spending and tax multipliers for Russian economy is presented in the study [1].

The papers generally focus on spending multiplier's evaluation (for instance, [2–4]). At the same time there is a vast empirical literature concerning the identification of tax shocks' results for other countries (although, it mainly concerns USA [5], the United Kingdom [6] and other OECD countries [7; 8]).

The purpose of this study is to evaluate the tax changes' effects on aggregate output growth in Russia.

The hypothesis is that effects are quite significant for Russian economy. Therefore, tax changes could serve as an appropriate tool of countercyclical policy.

To test the hypothesis, we estimate the vector-autoregressive model (VAR) for Russian economy for period 2003–2020. VARs have a number of empirical problems, which create certain restrictions to our analysis.

First, VARs are reduced form with little theoretical basis.

Second, residuals (or so-called innovations) in the model are not exactly shocks of variables in the model, because it's not exogenous in general.

Third, there is a "curse of dimensionality", which limits the number of variables in the model.

The paper is structured as follows: in the "literature review" section we present how to estimate tax effects on aggregate output; in the second section we describe specific methods and data used; in the "results and discussion" section we present the results of empirical estimation and interpret it; in the last section we make concluding remarks.

2. Literature review

The tax multiplier is the factor by which a change in tax revenues will alter aggregate output [9; 10]. The main difficulty in evaluating the tax multiplier is the potential endogeneity problem. Less tax burden stimulates the components of GDP (the demand-side of aggregate output). Negative effect on investment is mainly attributed to corporate taxation.

For instance, Brockmeyer [11] provided quasi-experimental evidence on negative impact of bigger corporate tax rate on firm investment in the United Kingdom.

Ohrn [12] exploited another quasi-experimental variation in corporate tax rates created by the Domestic Production Activities Deduction in the United States and has found this negative effect.

Liu & Mao [13] have shown the negative impact on investment could be caused additionally by value-added tax rate changes.

Negative effect on consumption due to labor tax rates is studied by Auten & Carroll [14] and due to consumption tax rates is presented by Benzarti & Carloni [15]. Benzarti & Tazhitdinova [16] suggested the modest negative effect of VAT on export.

Moreover, vast of empirical literature has demonstrated the negative effect on aggregate supply-side of GDP. Less tax burden causes rise in labor supply.

Bennmarker et al. [17] focused on how the payroll tax reductions boost employment.

Keane [18] provided the extensive survey of income tax rates' impact on labor supply. Thus, changes in tax revenues cause changes in aggregate output both on demand- and supply-sides.

On the other hand, factors, that drive economic downturns, make tax revenues fall as a result of tax bases' shrinkage (for example, less profit and consumption because of aggregate demand's fall, less wages because of additional unemployment). During the period of economic boom one can see the opposite situation: grown aggregate output is followed by gone up tax revenues. Falling to account for these factors in the model will make changes in aggregate output cause changes in tax revenues and lead to endogeneity problem (see Vegh & Vuletin [19]).

There are different ways of solving this reverse causality problem. One is to use another measure of tax change instead of tax revenues.

Riera-Crichton et al. [20] suggested to use tax rates as variable of interest. Unfortunately, this way is of limited practice if statutory tax rates differ from marginal effective tax rates. Changes in tax administration and in tax elements (for example, in deductions) effect tax burden and statutory tax rates stay the same.

Aizenman & Jinjarak [21] demonstrated how big this difference it could be considering VAT tax receipts.

Granda-Carvajal & García-Callejas [22] revealed the importance to consider informal sector for tax multiplier estimation.

According to Devereux & Fuest [23], changes in tax deductions and allowances are often the main source of marginal effective corporate tax rates' variation.

Belev et al. [24] provided evidence that in Russia the marginal effective corporate tax rates vary mainly because of tax loss carryforward. The following analysis of the significant changes in Russian Tax Code shows that there had been several tax changes apart from alterations in statutory tax rates).

Another way to solve this reverse causality problem is to find the instrumental variables which treat tax revenues and do not treat aggregate output directly (a possible example of an instrumental variable is provided in Barro & Redlick [25], motivation and limitations of such method use in Gechert & Rannenberg [26]).

The classical variants of potentially valid instruments are lags of tax revenues (used by Mountford & Uhlig [27]) and forecasted tax revenues – so called "fiscal foresight" (applied in Favero & Giavazzi [28]).

According to Blanchard & Perotti [29] and House & Shapiro [30], the first approach requests medium or high-frequent data (at least, on the quarterly basis) to accurate evaluation of timing of tax changes' effects.

The latter approach (so called "narrative approach") was suggested by Romer & Romer [31] and has become very popular among researchers (see, for example, Mertens & Ravn [32]).

But at the same time Mertens & Ravn [33] show how this approach is vulnerable to the measurement error. And Hebous & Zimmermann [34] found out the possible weak quality of narrative tax shocks as instrumental variable.

So, the problem of evaluation of the tax changes' effects on aggregate output is not novel. However, there is no unified approach to solve this problem. Moreover, the attention to this problem with respect to Russian data is quite rare and, to our awareness, the research implementing "narrative approach" to Russian data is absent. In this paper different approaches are implemented.

3. Methods and Data

The natural way to evaluate the tax changes' effects is to calculate tax multiplier. Following Romer & Romer [31] we will evaluate the effects of the tax changes on the log difference of real GDP (e.g., on output growth) throw estimating the cumulative impulse response functions with VAR model. Our VAR model is defined as follows:

$$Y_t = c + B_1 Y_{t-1} + B_2 Y_{t-2} + \ldots + B_p Y_{t-p} + \varepsilon_t, \quad (1)$$

where Y_t is a vector of variables used (e.g., output growth, tax policy shocks etc.) at moment t; c – constant vector; B_k – coefficient matrix for lag k; ε_t – vector of model errors, interpreted as a vector of innovations in the system at moment t. According to Ramey [35] these innovations are not shocks in general, because it could be correlated with other current and lagged endogenous variables in the model and with other exogenous shocks. This fact limits the interpretation of the results.

As already been mentioned, there could be an endogeneity problem if there are missed factors that influence both output and tax collections. We used two approaches to solve this problem:

1. "Narrative approach" – data on exogenous, not driven by economic conditions, tax changes (see below).

2. Cyclical component of tax collections as a percentage of GDP (the measure of changes in average tax rates), which is supposed to be much less driven by economic cycle, and its lags.

First approach is very data dependent. Following Romer & Romer [31] we use official documents to outline exogenous, not driven by economic cycle, tax policy changes. To measure the effect of these policy changes on tax collections we used changes in official forecasts of tax collections. Our main source of information was the federal budget law and its explanatory notes.

The main exogenous changes we identified are listed below:

1. Yearly regular increase of excise rates.

2. Oil and gas tax increases followed by lowering customs duty on mineral resources (so-called "tax maneuver").

3. Customs duty changes due to WTO requirements.

4. Changes in VAT rates (2004, 2019), specific VAT rates and tax benefits.

5. Introduction and changes in loss carry forward system when calculating corporate income tax (CIT), changes in CIT benefits.

6. Changes in definitions of tax bases and collection rates etc.

The diagram below represents the scope of the forecasted tax receipts chang-

es, driven by the exogenous tax policy incentives (Figure 1).

According to Figure 1, exogenous tax changes in first decade of 20th century were relatively small and often lowered tax burden. For example, there were major VAT changes: in 2004 VAT rate was reduced, which led to projected tax receipts loss of 100 billion rubles; in 2006 the process of providing VAT deductions for capital investments was reorganized and some preferential VAT rates were suspended, which led to projected tax receipts increase of 110,5 billion rubles; in 2007 and 2008 there were changes to the process of administration – transition to declarative process of acquiring VAT deductions by exporters and fixing tax administration period to a quarter for all tax payers – which led to projected tax receipts loss of 140 and 228,7 billion rubles respectively.

In 2010s period exogenous tax changes were much higher and in total led to a higher tax burden. Major tax shocks are due to changes in oil and gas income formation legislation. For example, in 2011 export duties on oil products were introduced which increased tax receipts forecasts in 2011 and 2012; in 2012 gas tax rates indexation began; starting from 2012 "tax maneuver" in oil and gas tax legislation has begun, followed by lowering customs duty on mineral resources and increases tax rates on its extractions, which in total lead to significant tax receipts increase in 2013–2017.

The new stage of "tax maneuver" in oil and gas tax legislation has begun in 2019 and led to moderate tax receipts increase in 2019 and 2020. Another significant tax change in second half of 2010s period is VAT general rate increase from 18% to 20%. The change occurred in 2019 and lead to a projected tax receipts increase of 525,4 billion rubles in the same year and of 64 billion rubles a year after.

The main problem with the data on exogenous tax changes is that it is available only on yearly bases, which is inadequate for the VAR modeling. That is why we divided the forecasted changes in tax receipts into quarters using average proportions of actual corresponding tax receipts for the period 2003–2020. Secondly, the information on forecasted tax changes is reported only for federal budget. It makes no problem for federal taxes, but it becomes important for CIT receipts, only part of which are federal. To estimate the consolidated effect of CIT policy changes we divided the corresponding receipts changes by the federal budget proportion (specific for different years).

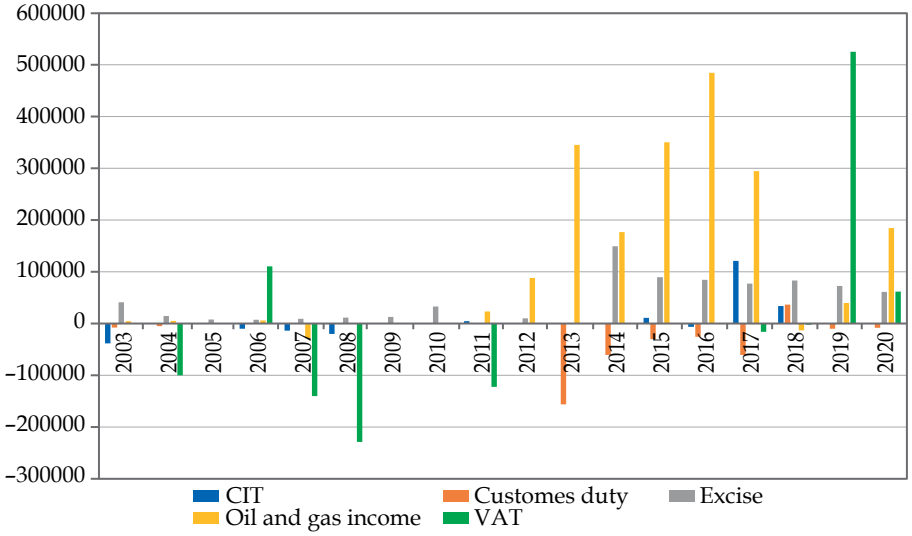

Figure 1. Forecasted change of tax receipts (mln rub.) due to exogenous tax policy incentives

The final base VAR model for the first approach uses data for two variables: seasonally adjusted log difference of real GDP (output growth) and forecasted change of tax receipts due to exogenous tax policy incentives as a percentage of nominal GDP. It is available on quarterly basis for the period 2003–2020.

To implement the second approach, we collected actual quarterly data on tax receipts from the Federal treasury[1] and Ministry of Finance[2]. To minimize the effect of economic cycle, we calculated actual tax receipts as a percentage of nominal GDP. We define tax shocks as cyclical component of seasonally adjusted tax receipts as a percentage of nominal GDP. Together with seasonally adjusted log difference of real GDP it forms data for the base VAR model for the second approach. The cyclical component is calculated using HP filter with quarterly lambda of 1600.

4. Results

The lag order for VAR models was chosen to be 6 as a compromise between data availability and identification of longer-term effects. For robustness check we tested different lag orders (including those predicted by information criteria), but it has not significantly influenced the results.

[1] Federal treasury of Russian Federation. Available at: https://roskazna.gov.ru/ispolnenie-byudzhetov/konsolidirovannyj-byudzhet/ (accessed: 04.07.2023).

[2] Ministry of Finance of Russian Federation. Available at: https://minfin.gov.ru/ru/opendata/ (accessed: 04.07.2023).

4.1. "Narrative approach"

The first approach base VAR model is stable. The orthogonal (variables order: tax changes > output growth) cumulative impulse response function (IRF) of output growth to the 1 s.d. shock of tax changes to GDP ratio is presented below (Figure 2).

According to the Figure 2, 95% of confidential interval covers zero for each period of calculation, so we have to conclude that there is no significant effect of tax changes on output growth. The reason for insignificant results could be high standard errors due to omitted important variables.

On the other hand, VAR framework does not allow us to use all possible factors, influencing output growth and legislative tax changes. The key factors identified in the literature are government spendings [31] and, what is of high relevance for Russian economy, oil prices [1].

That is why we estimated the second VAR model augmented with shocks of government spendings defined as cyclical component of seasonally adjusted aggregate government spendings (net of spendings on maintenance of government debt) as a percentage of nominal GDP and index of Urals oil prices (1q2016 = 1). The resulted VAR model is stable. The orthogonal cumulative IRF of output growth to the 1 s.d. shock of exogenous tax changes to GDP ratio is presented below. The process of orthogonalization is sensitive to variables ordering [36]. We supposed the following order: oil price index, exo-

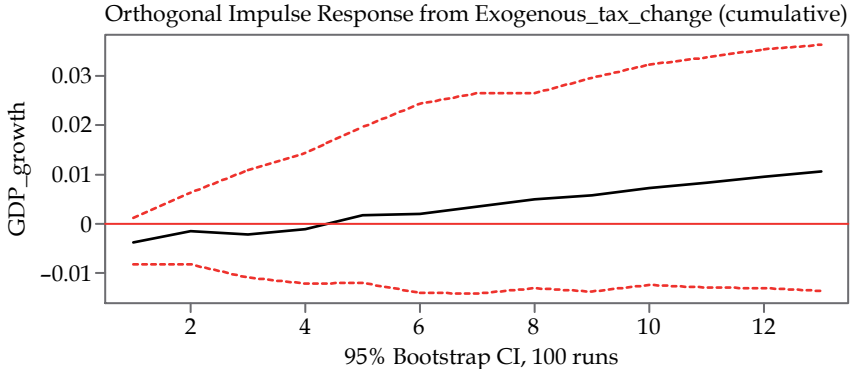

Figure 2. Orthogonal cumulative impulse response functions of output growth to the 1 s.d. shock of exogenous tax changes to GDP ratio

genous tax changes, government spending shocks, GDP growth (Figure 3).

According to Figure 3, additional factors have no significant influence on the result, so we have to conclude that "narrative approach" predicts no significant effect of tax changes on output growth.

4.2. "Classical approach"

The second approach base VAR model is stable too. The orthogonal cumulative IRF of output growth to the 1 s.d. shock of aggregate tax receipts to GDP ratio is presented below (Figure 4).

According to Figure 4, if more reliable data on actual tax receipts is used, there is a significant influence of tax receipts shocks on output growth. The cumulative influence becomes significant on the 4th quarter after shock, which means that tax shocks have a significant effect on output growth with a 1-year lag. Estimated standard deviation of shock of aggregate tax receipts to GDP ratio is 3.4 percentage points, which means that cumulative effect on the 4th quarter after shock of 1 percentage point shock of aggregate tax receipts to GDP ratio on output growth is –0.5 percentage points.

As Figure 5 shows, the cumulative response converges and the overall long-run (after 120 periods, 30 years) effect of 1 percentage point shock of aggregate tax receipts to GDP lowers output growth by 0.7 percentage points. Results are statistically significant, which means, that tax policy is not neutral, and its effects should be taken into consideration when conducted economic policy.

Of course, there are numerous other factors, that influence GDP or tax receipts. As we stated previously, using output growth and shocks of aggregate tax receipts as a ratio to GDP should minimize the number of factors, relevant for both variables in the model simultaneously, and therefor minimize endogeneity problem.

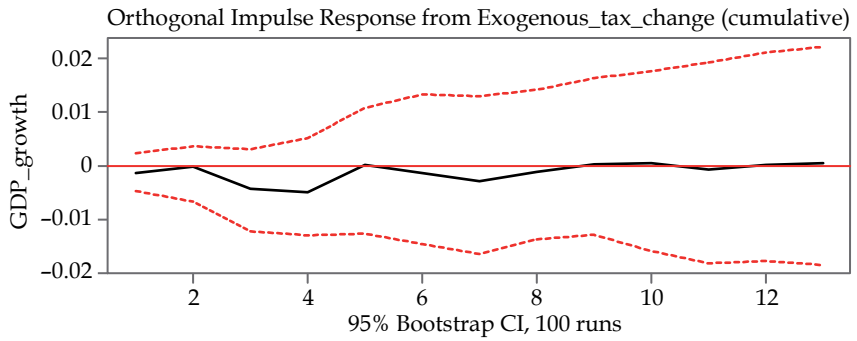

Figure 3. Orthogonal cumulative impulse response functions of output growth to the 1 s.d. shock of exogenous tax changes to GDP ratio (augmented VAR)

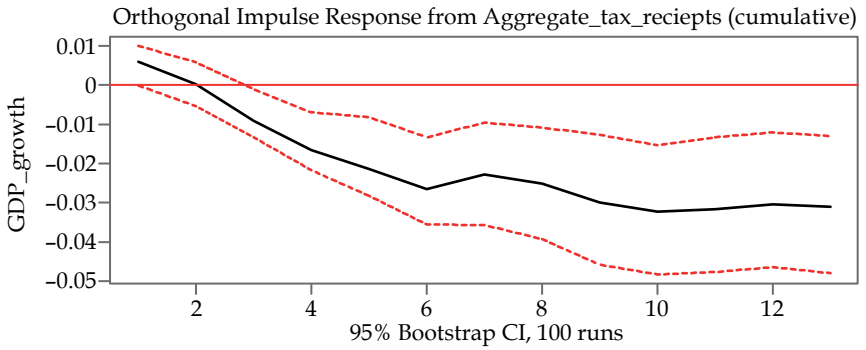

Figure 4. Orthogonal cumulative impulse response functions of output growth to the 1 s.d. shock of aggregate tax receipts to GDP ratio

However, to check the robustness of our result, we included additional key factors, identified earlier. Moreover, the inclusion of omitted significant variables could increase the accuracy of our results. We estimated augmented VAR model with oil price index and government spendings shocks.

The resulting VAR model is stable, long-run cumulative IRF of output growth to the 1 s.d. shock of aggregate tax receipts to GDP ratio is presented below (Figure 6).

As Figure 6 shows, our results are robust to including additional factors in the model, which may indicate, that the endogeneity problem is not significant in our model. The cumulative response converges again and the overall long-run effect of 1 percentage point shock of aggregate tax receipts to GDP ratio lowers output growth by 0.88 percentage points, which is slightly higher than in case of base model.

5. Discussion

"Narrative approach" estimation results show no significant effect of exogenous tax shocks on output growth. As already been mentioned above, this method is very sensitive to data quality, vulnerable to the measurement error and problem of weak instruments. For example, the problem could be the accuracy of official forecasts. We collected data on the official tax receipts forecasts and compared it with the actual data.

According to Table 1, 1-year forecast always underestimates the actual tax receipts, which cast doubt on its accuracy.

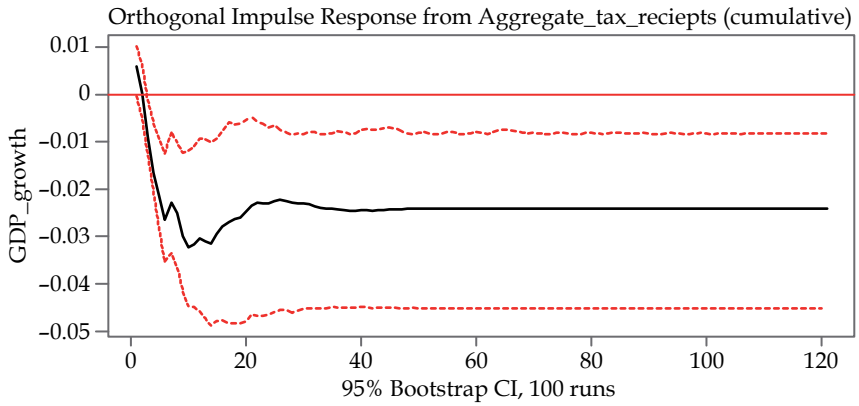

Figure 5. Orthogonal cumulative impulse response functions of output growth to the 1 s.d. shock of aggregate tax receipts to GDP ratio (120 periods ahead)

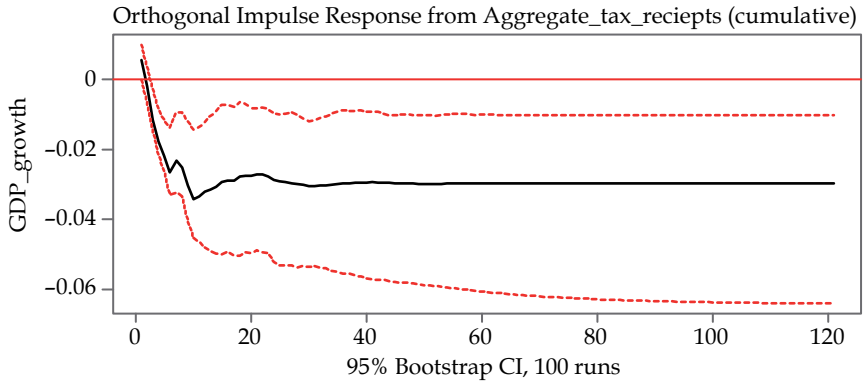

Figure 6. Orthogonal cumulative impulse response functions of output growth to the 1 s.d. shock of aggregate tax receipts to GDP ratio (augmented VAR, 120 periods ahead)

Table 1. The accuracy of official tax receipts 1-year forecast in Russia

2014	2015	2016	2017	2018	2019	2020	2021	2022	
The deviation of forecasts from actual data (%)									Mean deviation
0.3%	5.5%	10.7%	7.5%	6.3%	4.8%	4.3%	21.3%	3.4%	7.1%
The direction of deviation ("–" – underestimation, "+" – overestimation)									Mean square standard error (billions sq.)
–	–	–	–	–	–	–	–	–	1283.8[2]

Source: Authors calculations based on federal budget law of Russian Federation and its explanatory notes.

Sometimes the forecast differs systematically not only in size but also in its sign. For example, in 2010 the Ministry of Finance in Russia provided evaluation that the transition from permissive to declarative procedure of VAT refund would cost about 200 bln rub. (0,4% GDP). One year later the same tax change ex-post evaluation published by the Ministry of Finance demonstrated not fall but growth due to the transition from permissive to declarative procedure of VAT refund in Russia (not minus but plus 200 bln rub. in 2010).

"Classical" approach with more reliable data on actual tax receipts used predicts 0.7–0.88 percentage points decrease in output growth in response to 1 percentage point shock of aggregate tax receipts to GDP ratio. The results are consistent with the previous existing research. The most comparable to our results are research on the tax multipliers calculation. Foreign data findings mostly predict tax multipliers to be negative, with estimates ranging from –0.12 [37] to –0.78 and –1.33 [29].

Russian data research is scarce, for example, Zyablitskiy [1] estimated tax multiplier to be –0.38 and Vlasov & Derugina [38] found it to be –0.75. However, exact numbers are hard to compare, because there is no unified definition of VAR calculated multiplier.

Moreover, the definition of tax policy shocks used in our research differs from classical tax multiplier literature and is comparable to definition in Romer and Romer [31]. They found that a 1 percentage point shock of aggregate tax receipts to GDP ratio lowers output growth by 2.5 percentage points. This effect is considerably higher than our result, which first of all is explained by the difference in country under research and the data period used.

Our estimation results support the main hypothesis in general – tax shocks prove to be quite significant for output growth in Russia. And, as well as tax changes could serve as an appropriate tool of countercyclical policy, increasing tax burden in times of downturn could slow down the recovery significantly.

These results should be interpreted taken into consideration the limitations of the methods used.

First, innovations in VAR model are not shocks in general, and results may differ due to identification strategy.

Second, VAR model is built on historical data and obtained results could be less applicable in case of substantial change in economic situation and structure. Moreover, the accuracy of VAR estimates is sensitive to the length of time series used, which limits the number of control variables.

However, our results show that the problem of omitted variables bias is not significant.

6. Conclusion

In this paper we estimated the effect of tax changes on output growth. The main theoretical significance of this study is the implementation of two alternative approaches – "narrative approach" and "classic" one – to the Russian data. The "narrative approach" did not provide any significant effect of exogenous tax shocks on output growth. The reason could be that this method is very sensitive to data

quality, vulnerable to the measurement error and problem of weak instruments. This is a novel approach for Russian data and deserves further research, first of all, testing the quality of official tax receipts changes forecasts.

The classic approach assumes that tax shocks are deviations from trend. This method provides a significant effect of tax receipts shocks, which means, that tax policy is not neutral, and its effects should be taken into consideration when conducted economic policy, which confirms the hypothesis of the research.

The results show that the cumulative effect of the shock of aggregate tax receipts to GDP ratio on output growth becomes significant on the 4th quarter after shock. In total, a 1 percentage point shock of aggregate tax receipts to GDP ratio lowers output growth by 0.7–0.88 percentage points. This result is robust to inclusion of additional factors in the model.

So, the main practical significance of the research is that tax policy could serve as an appropriate countercyclical tool in Russia. On the other hand, increasing tax burden in times of downturn could be highly harmful for recovery. These results should be interpreted taken into consideration the limitations of the VAR method used.

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Information about the authors

Sergei G. Belev – Cand. Sci. (Econ.), Associate Professor, Economics Faculty, Lomonosov Moscow State University (GSP-1, Leninskie Gory, Moscow, 119991, Russian Federation); Senior Researcher of the Budget Policy Research Laboratory of the Applied Economic Research Institute, Russian Presidential Academy of National Economy and Public Administration (82/1 Vernadsky ave., Moscow, 119571, Russian Federation); ORCID: https://orcid.org/0000-0003-3962-7428; e-mail: belev@ranepa.ru

Evgenii O. Matveev – Researcher of the Budget Policy Research Laboratory of the Applied Economic Research Institute, Russian Presidential Academy of National Economy and Public Administration (82/1 Vernadsky ave., Moscow, 119571, Russian Federation); Junior Researcher of the Socio-Economic Transformations and Financial Policy Research Institute, Financial University under the Government of the Russian Federation (Leningradsky Prospekt 49/2, Moscow, 125167, Russian Federation); ORCID: https://orcid.org/0000-0002-4732-8818; e-mail: matveev-eo@ranepa.ru

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Информация об авторах

Белев Сергей Геннадьевич – кандидат экономических наук, доцент экономического факультета, Московский государственный университет имени М.В. Ломоносова (119991, г. Москва, Ленинские горы, д. 1); старший научный сотрудник Лаборатории исследования бюджетной политики Института прикладных экономических исследований, Российская академия народного хозяйства и государственной службы (119571, г. Москва, пр-т Вернадского, д. 82, стр. 1); ORCID: https://orcid.org/0000-0003-3962-7428; e-mail: belev@ranepa.ru

Матвеев Евгений Олегович – научный сотрудник Лаборатории исследования бюджетной политики Института прикладных экономических исследований РАНХиГС (119571, г. Москва, пр-т Вернадского, д. 82, стр. 1); младший научный сотрудник Института исследований социально-экономических трансформаций и финансовой политики, Финансовый университет при Правительстве Российской Федерации (125167, Москва, пр-т Ленинградский, д. 49/2); ORCID: https://orcid.org/0000-0002-4732-8818; e-mail: matveev-eo@ranepa.ru

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