National Research University Higher School of Economics

as a manuscript

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MODELING FISCAL POLICY AT THE REGIONAL LEVEL

PhD Dissertation Summary
for the purpose of obtaining academic degree
Doctor of Philosophy in Economics

Academic supervisor:
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JEL: C21, C23, H30, H72, H77

Moscow – 2024

Motivation

The priorities of a country's fiscal policy can be indirectly determined through the nature of the relationship between budget revenues and expenditures. Various studies on this topic appeared in the 1980s in connection with concerns about the growing budget deficit in the United States (Payne, 2003). The main idea of the research at that time was to determine the direction of the relationship between budget revenues and expenditures in the framework of choosing an approach to fiscal consolidation. Thus, if government revenues determine government spending, then the budget deficit can be eliminated by policies aimed at stimulating government revenues. In addition, the nature of the relationship between government revenue and expenditure provides insight into the causes of budget deficit formation, which is important in terms of practical application of the findings of the study. For example, if there is no two-way relationship between budget revenues and expenditures, this means that spending decisions are made in isolation from revenue decisions, which can lead to serious budget deficits, provided that government expenditures grow faster than government revenues (Narayan, 2005).

The nature of the relationship between budgetary revenues and expenditures has been fairly well studied at the national level, but there are significantly fewer empirical studies examining regional differences within a single country. This may be due to the fact that, compared to the federal government, regional authorities have much less capacity to conduct independent budgetary policy. At the same time, the study of the nature of the relationship between budget revenues and expenditures at the regional level also seems to be extremely important, as it allows us to identify the main causes of regional budget imbalance, specifically for the regions with chronically high budget deficit.

Another important property of the relationship between revenues and expenditures is its pro- or countercyclical nature. Broadly speaking, this is found primarily in the response of key fiscal indicators to fluctuations in the business cycle. Countercyclical fiscal policies can smooth out fluctuations in the business cycle, while pro-cyclical policies can increase macroeconomic volatility and thereby slowing economic growth (Fatás, Mihov, 2013; McManus, Ozkan, 2015). In a narrow sense, the nature of fiscal

policy can be assessed by the reaction of expenditures to changes in revenues. If the main reaction to the increase (decrease) of budget revenues consists in a corresponding increase or decrease in expenditures, it indicates procyclical fiscal policy, i.e. it fully transmits shocks experienced by the economy, intensifying output fluctuations within the business cycle. If, on the contrary, shocks to budget revenues lead to changes in net borrowing with relatively stable expenditures, then the budget has a stabilizing effect on the economy by extinguishing shocks.

The study of the mechanisms of forming the structure of budget expenditures is also of practical importance, both from the point of view of a more efficient allocation of public funds, and as a possible factor in accelerating economic growth. At the same time, taking into account the high heterogeneity of Russian regions, the assessment of average effects may be insufficient to analyze the formation of the structure of regional budget expenditures. Studying the heterogeneity of the dependence of regional budget expenditures on various factors will allow us to formulate more correct conclusions for different groups of Russian regions.

Brief literature review

The fiscal response

Recently, the sustainability of fiscal policy has been studied by assessing the fiscal response proposed in: Bohn, 2008. Based on data from Russian regions, such an analysis was carried out in Kreindel (2008), where it was shown that, according to the criterion of debt stationarity, the budget policy of the regions is generally stable, which is probably due to the active redistribution of federal budget funds between regions.

The relationship between budget revenues and expenditures

Researchers have formulated four main hypotheses about the direction of the causal relationship between budget revenues and expenditures: “tax-and-spend hypothesis” (Friedman, 1978; Buchanan, Wagner, 1977), “spend-and-tax hypothesis” (Peacock, Wiseman, 1961, 1979), "fiscal synchronization" (Musgrave, 1966; Meltzer, Richard, 1981) and "fiscal disunity" (Wildavsky, 1975; Baghestani, McNown, 1994).

Tax-and-spend hypothesis means that tax increases in the current period lead to

increased spending next year. On the contrary, spend-and-tax hypothesis suggests that an increase in spending (for example, during a crisis) forces the government to raise taxes and then such an increase from temporary becomes permanent.

Fiscal synchronization implies the coordinated formation of budget revenues and expenditures, based on a comparison of the marginal public benefits and costs of public policy measures. Within the framework of the hypothesis of "fiscal disunity", it is believed that government decisions on changes in revenues and expenditures do not depend on each other.

In the empirical literature there are many works that study the direction of causality between budget revenues and expenditures in developed countries (Kollias, Paleologou, 2006; Chang, Chiang, 2009; Vamvoukas, 2011; Owoye, Onafovora, 2011; Bolat, 2014; Esener et al., 2022) and developing countries (Narayan, Narayan, 2006; Narayan, 2005; Konukcu-Önal, Tosun, 2008; Magazzino, 2014; Phiri, 2019). Research results show that tax-and-spend hypothesis or fiscal synchronization predominates in developed countries, while tax-and-spend hypothesis or fiscal disunity prevails in developing countries.

The nature of the relationship between budget revenues and expenditures varies not only by country, but also by region within one country. The hypothesis of fiscal synchronization was confirmed for 26 Indian States in the period 1980/81–2014/15 (Akram, Rath, 2019) and for 31 provinces in China in the period 1999-2005 (Ho, Huang, 2009). In Spain, tax-and-spend hypothesis was characteristic at the regional level in the period 1987–2003 (Garcia, 2012). For the USA, tax-and-spend hypothesis was confirmed in the works (Marlow, Manage, 1987, 1988; Chowdhury, 1988; Joulfaian, Mookerjee, 1990), and spend-and-tax hypothesis in (Von Furstendurg et al., 1985; Ram, 1988). A number of studies have shown that different states tend to have different communication directions (Payne, 1998; Chowdhury, 2011). In particular, based on data from US state budgets for 1970–2009, it was shown that for 18% of states the relationship is directed from income to expenses, for 16% of states the most common direction of communication is from expenses to income, for 26% of states "fiscal synchronization" is characteristic, and for 40% of states there is no causal relationship (Chowdhury, 2011).

Budget revenues and expenditures are modeled using vector autoregression models

(VAR) (von Furstenberg et al., 1985; Holtz-Eakin et al, 1989; Joulfaian, Mookerjee, 1990; Konukcu-Önal, Tosun 2008; Garcia, 2012), error-correction models (Payne, 1998; Chang et al., 2002; Kollias, Paleologou, 2006; Narayan, 2005; Ho, Huang, 2009), and Granger causality test (Ram, 1988; Chowdhury, 1988; Narayan, Narayan, 2006, Akram, Rath, 2019).

Within a group of countries, the Granger bootstrapping test, originally proposed in the work, was repeatedly used (Kónya, 2006). Causality analysis between budget revenues and expenditures using the Granger test with bootstrapping was carried out in (Afonso, Rault, 2009; Bolat, 2014) for the countries of the European Union, in (Mutascu, 2015) for the countries of the PIIGS group (Portugal, Italy, Ireland, Greece, Spain), in (Tashevska et al., 2020) for six southern European countries (Albania, Bulgaria, Croatia, Serbia, Slovenia, Macedonia) and in (Chowdhury, 2011) for the US states.

Based on Russian data, the relationship between budget revenues and expenditures was investigated in (Konukcu-Önal, Tosun, 2008) at the country level, where it was concluded that Russia was characterized by tax-and-spend hypothesis in the period 1999–2006. However, the results obtained in this paper should be treated with caution due to the use of monthly rather than annual data (the decision-making step in fiscal policy is a year, in some cases — quarter), as well as due to the short time period chosen. At the regional level, the relationship between budget revenues and expenditures has not been sufficiently studied. The dependence of regional budget expenditures was mainly studied on the amount of transfers allocated from the federal center (Kadochnikov et al., 2002; Sinelnikov-Murylev et al., 2006; Idrisova, Freinkman, 2010).

Determinants of budget expenditure structure

The results of empirical studies show that the most important factor in the formation of budget expenditures is the level of income (Sanz, Velázquez, 2002). Among the structural factors, demographic characteristics, population density and the proportion of urban population are highlighted (Sanz, Velázquez, 2002). The most important conclusions of publications on the topic are listed below:

- Higher per capita incomes are associated with an increase in the share of social policy expenditures (Shelton, 2007, Sanz, Velázquez, 2002).

- An increase in the proportion of the population younger and older than working age leads to an increase in social and other types of expenses (Shelton, 2007, Sanz, Velázquez, 2002).
- High population density reduces the share of health care costs (Sanz, Velázquez, 2002).

Recently, the interest in using quantile regressions to identify heterogeneous effect in studying the formation of the structure of budget expenditures has increased significantly. For example, in Sousa, Monte (2021), using unconditional quantile regression, the influence of fiscal decentralization on the structure of budget expenditures of local authorities in Brazil is investigated. It was shown that the magnitude of the studied effect significantly depends on the level of local expenditures and on the method of fiscal decentralization. In relation to Russia, some studies (for example, Zubarevich and Safronov, 2023) contain useful analysis, but none attempted to build quantitative models of the structure of budget expenditures.

Objectives of the dissertation research

The purpose of the dissertation research is to evaluate the response of changes in expenditures to changes in revenues of regional budgets, to study the nature of the relationship between income and expenditure for both individual regions of Russia and for the total budget of the subjects of the Russian Federation, as well as to identify key factors determining the structure of budget expenditures of Russian regions. Research objectives include the following:

1. to study the fiscal response of Russian regions to the changes in revenues;
2. to study the nature of the relationship between revenues and expenditures of consolidated budgets of individual subjects of the Russian Federation and identify the main differences between regions;
3. to study the dependence of regional budget expenditures on budget revenues, demographic and economic indicators and measure the heterogeneity of their influence on budget expenditures in Russian regions.

Data

The dissertation research analyzes the annual indicators for Russian regions. The table below shows the main characteristics of the data used in the study.

Table 1. Key characteristics of the data used in the dissertation research

	[Gurvich, Krasnopeeva, 2020]	[Krasnopeeva, 2023]	[Gurvich, Krasnopeeva, 2024]
The study period	2000–2017	2002–2019	2011–2019
Number of Russian regions	80 regions	83 regions	82 regions
Indicators	budget revenues and expenditures (in constant 2017 prices); budget balance, debt of the previous period and GRP	budget revenues and expenditures (in 2019 prices), tax and non-tax revenues, transfers from other budgets (in 2019 prices)	Dependent variables: budget expenditures per capita adjusted for the cost of the minimum consumer set in seven areas: national economy, social policy, education, health, housing and communal services, culture and national issues. Independent variables: budget revenues per capita adjusted for the cost of the minimum consumer set; population density, proportion of urban population, proportion of the population younger than working age, proportion of the population of working age; density of highways.
The level of the budget system of the Russian Federation	budget of the subject of the Russian Federation[1]	consolidated budget of the subject of the Russian Federation (by Russian regions)	consolidated budget of the subject of the Russian Federation, except for health expenditures, where the consolidated budget of the subject of the Russian Federation and the territorial state extra-budgetary fund are used

Source: authors's own elaboration

[1] Budget of the subject of the Russian Federation does not include the budget of municipal entities.

The following data sources were used in the study:

- *Federal Treasury*: at the first stage of the study, data from annual reports on the execution of budgets of subjects of the Russian Federation (not including budgets of municipalities) were used for fiscal indicators, and at the second and third stages – consolidated budgets of subjects of the Russian Federation (with the exception of healthcare costs, where the consolidated budget of the subject the Russian Federation and the territorial state extra-budgetary fund is used);
- *The Ministry of Finance of the Russian Federation*: the volume of public debt of the subjects of the Russian Federation;
- *Rosstat*: GRP for all subjects of the Russian Federation, the dynamics of consumer price indices, the cost of a minimum consumer set, population density, the share of the urban population, the share of the population younger than working age, the share of the population not of working age; density of highways.

Methodology

1. At the first stage of the study, the fiscal response of regional budgets to changes in revenues was assessed. The fiscal response was studied using a panel data analysis model, which made it possible to increase the reliability of estimates and identify important characteristics of the process of adaptation to changes in revenues in conditions of limited time series length. The model also included the budget balance of the previous year or the debt at the end of the previous year.

In general, the model specification has the following form:

$$\Delta \ln(exp_{i,t}) = \alpha_0 + \alpha_i + \beta \Delta \ln(rev_{i,t}) + \gamma \, C_{i,t-1} + \omega T_t + \varepsilon_{i,t} \quad (1)$$

where $rev_{i,t}$, $exp_{i,t}$ — revenues and expenditures of the budget of region i at time t (measured in constant prices); $C_{i,t-1}$ is control variable, in the main specification (1a) — the budget balance of the previous year as a percentage of budget revenues ($\frac{bal_{i,t-1}}{rev_{i,t-1}}$), in specification (1b) — the debt of the previous year as a percentage of budget revenues ($\frac{debt_{i,t-1}}{rev_{i,t-1}}$); α_i — individual fixed effects; β is the coefficient of dependence of

changes in budget expenditures on changes in revenues; ωTt describes the time effect.

In this study, values of changes in expenditures elasticity were called "fiscal response coefficients". If β = 0, then changes in expenditures do not respond to changes in revenues, that is, fiscal policy is acyclic in nature. The value of β = 1 indicates that budget expenditures change in the same proportion as changes in revenues, that is, the policy is pro-cyclical.

Several estimation methods were used on the panel data: end-to-end least squares regression (pooled OLS), a fixed individual effects (FE) model and the generalized moments method (GMM; see: Arellano, Bover, 1995). The latter was used in two versions: in the first differences (GMM FD) and using the intra-group transformation (within) — GMM FE. As a test for robustness, alternative specifications were additionally evaluated, including structural shifts for both variants of the GMM model. To assess the quality of the constructed models, the Hansen test for over-identifying constraints was performed.

2. At the second stage of the dissertation research, the approach proposed in the work (Konya, 2006) is used to analyze the causality between budget revenues and expenditures of Russian regions and verify the validity of four hypotheses. This approach involves conducting a Granger causality test using a bootstrapping procedure to test statistical hypotheses based on critical values, valid in the presence of cross-sectional dependence between regions.

First, two systems of equations are evaluated:

- $y_{i,t}$ as a function of own lags and lags of x;
- $x_{i,t}$ as a function of own lags and y lags.

An example is an equation with y as a function of proper lags and lags of x. A similar method is used to check the causality from y to x. The formal record of the first system is as follows:

$$y_{i,t} = \alpha_i + \sum_{l=1}^{mly_i} \beta_{i,l} y_{i,t-l} + \sum_{l=1}^{mlx_i} \gamma_{i,l} x_{i,t-l} + \varepsilon_{i,t}, \quad i = 1,\dots,N;\ t = 1,\dots,T. \qquad (2)$$

where mly_i is the maximum autoregression lag in the i-th equation, mlx_i is the maximum lag x in the i-th equation.

Secondly, the causality from x to y is checked using the procedure proposed in the

work (Kónya, 2006). The approach to conducting the Granger test using bootstrapping is as follows. Equation (2) is initially evaluated with the null hypothesis consisting in the absence of a causal relationship from от x to y. The residuals are calculated, from which a matrix $[e_{H_{0,i,t}}]$ of size $N \times T$:is obtained.

$$e_{H_{0,i,t}} = y_{i,t} - \widehat{\alpha_i} - \sum_{l=1}^{mly_i} \widehat{\beta_{i,l}} y_{i,t-l} \qquad i = 1,\ldots,N; \quad t = 1,\ldots,T. \qquad (3)$$

The matrix of bootstrapped residuals $[e^*_{H_{0,i,t}}]$ is compiled according to columns corresponding to the vectors of residuals $[e_{H_{0,i,t}}]$ for all regions at time t, randomly typed with a return. If the null hypothesis about the absence of the influence of lags x on y is valid, the coefficients for lags x in the $y_t = f(y_{t-1}, y_{t-2}, \ldots, x_{t-1}, x_{t-2}, \ldots) + e_t$ will be zero. Using the obtained bootstrapped residues, a bootstrapped sample is formed from under the assumption that there is no causal relationship from x to y:

$$y^*_{i,t} = \widehat{\alpha_i} + \sum_{l=1}^{mly_i} \widehat{\beta_{i,l}}\, y^*_{i,t-l} + e^*_{H_{0,i.t}}, \qquad t = 1,\ldots,25. \qquad (4)$$

After replacing $y_{i,t}$ with $y^*_{i,t}$ equation (2) is evaluated and the Wald test is applied for each region, assuming the null hypothesis of the absence of Granger causality.

The empirical distribution of the coefficient is calculated by repeatedly repeating the described procedure. In this paper, a bootstrapped distribution for each test statistic was obtained using 1000 repetitions. The recursive algorithm begins by determining the first 2-5 values equivalent to $y^*_{i,t} = 0$, weakening the effect of this initiation on the results.

3. At the third stage of the study, quantile regression models are used (Koenker, Basset, 1978, Koenker, 2005), which allow us to analyze the influence of various regressors depending on the quantile value of the dependent variable for different groups of regions. The specification of the basic quantile model has the following form:

$$Q_Y(\tau|X_{it}) = X_{it}\beta(\tau), \qquad (5)$$

where β(τ) represents the effect of the regressor X on the quantiles of the level τ for the dependent variable Y, the so-called quantile regression coefficient.

Quantile regression models were specified for seven main types of expenditures of regional budgets, including several of the most important factors for each type of expenditure. In all cases, budget revenues are the main independent variable. Control variables, depending on the model, also include demographic and infrastructural

indicators.

The study considers the quantiles $\tau = 0.2$, $\tau = 0.5$ and $\tau = 0.8$. The hypothesis is that there are differences between regions with minimum ($\tau = 0.2$), medium and low ($\tau = 0.5$), and maximum ($\tau = 0.8$) budget expenditures by types of functional classification of expenditures.

The asymptotic theory for quantile regression requires large samples, long panels, and a small ratio of sample size n to panel length, otherwise the estimation in the quantile regression is biased (Besstremyannaya, Golovan, 2021). At the same time, this study uses a short panel, where the ratio $n/T = 9$, which imposes restrictions on the applicability of individual approaches. The article by Besstremyannaya, Golovan (2021) provides a detailed overview of methods for evaluating conditional quantile regression models for short panels. Taking into account the limitations typical for a short panel, in this paper, a model of the simplest conditional quantile regression with robust standard errors was constructed in accordance with Parente, Santos Silva (2016) for the analysis of heterogeneity. This approach is often used in the analysis of longitudinal data (see Besstremyannaya, Dasher, Golovan, 2022).

Statistically significant differences for the estimated coefficients on the explanatory variable for different values of the quantile index indicate the presence of a heterogeneous effect. To check the significance of the differences between the coefficient estimates, a bootstrapped 95% Efron confidence interval was constructed for each test statistic using 1000 repetitions according to the Hagemann (2017) methodology, which is resistant to cluster dependence of errors. This approach provides a consistent estimate of the distribution of quantile regression estimates, equivalent to the asymptotic result from Parente, Santos Silva, (2016).

Key findings

1. Fiscal policy at the regional level has clear pro-cyclical nature. The assessment of the short-term response of changes in expenditures to changes in revenues of regional budgets (depending on model) varies in the range from 0.72 to 0.78 (Gurvich, Krasnopeeva, 2020). At the same time, the fiscal response to an increase in budgetary

revenues is slightly higher than to a decrease in budgetary revenues. Combined with significant revenue shocks, this leads to high volatility in regional budget expenditures.

2. The largest sensitivity of expenditure to changes in revenues is found for the expenditures on national economy, implying marked adverse implications for economic growth (Gurvich, Krasnopeeva, 2020). Such adaptation represents a typical mechanism of the negative impact of pro-cyclical fiscal policy on economic growth.

3. The hypothesis that the procyclical policy of the regions is determined by limited access to sources of financing for their budget deficit has not been confirmed. The results showed that regions with higher debt levels adapt to changes in revenues mainly through new borrowing (Gurvich, Krasnopeeva, 2020).

4. In the paper (Gurvich, Krasnopeeva, 2020), it was shown that there is a two-way causality ("fiscal synchronization") between the revenues and expenditures of the total budgets of the subjects of the Russian Federation. At the same time, changes in revenues determine changes in expenditures, but not vice versa. The results obtained give a general idea of the nature of the relationship for all regions, while the fiscal behavior of individual regions may differ significantly from each other.

5. For each individual region was implemented the Granger-causality test with the calculation of critical values using the bootstrapping procedure. It has been shown that 25% of Russian regions fulfill the "tax-spend" hypothesis, 7% — "spend-tax" hypothesis, 47% — "fiscal synchronization" hypothesis, and 20% —" fiscal disunity " hypothesis (Krasnopeeva, 2023). Regions in the "fiscal disunity" group are characterized by a high level of public debt, which for one-third of them may create risks for their fiscal sustainability, and subsequently risks for the federal budget.

6. In the paper Krasnopeeva (2023), it was revealed that in most cases, when there is a significant impact of previous expenditures on budget revenues, the sign of the coefficient in the regression is negative, which inconsistent with the hypothesis of a positive direction of the relationship from expenses to income. Such results may be partially related to the planning of financing budget expenditures by attracting loans. For Russian regions, this situation may also indicate the influence of expenditure obligations due to federal acts, while revenues grew slower than budget expenditures.

7. In the paper Gurvich, Krasnopeeva (2024) it was shown that regional budget expenditures on social policy, health care and education have a relatively low elasticity with respect to budget revenues (0.6–0.7), expenditures on culture and public issues occupy an intermediate position with an elasticity of 0.8–0.9, and expenditures on the national economy and housing and communal services are characterized by the highest elasticity (1.3–1.7). An important conclusion is that as the budget revenues grow, the national economy and housing and utilities sector, rather than social areas, is the main direction of spending of additional budget funds remaining in the regions after the fulfillment of mandatory requirements of the federal government. Thus, it is these areas of expenditure that are a priority for regional authorities, including the more financially secure regions.

8. Using models of the conditional quantile regression in the paper (Gurvich, Krasnopeeva, 2024), an analysis of the heterogeneity of the influence of various factors on budget expenditures of Russian regions was carried out. The dependence of fiscal revenues is homogenous only for social security, health and housing, while for other types of expenditure this relationship differs between regions with high and low fiscal revenue.

Contribution

1. The elasticity of changes in expenditures from changes in revenues of regional budgets was estimated for the first time on the basis of Russian data, which made it possible to quantitatively establish the nature of budgetary policy at the regional level. To check the robustness of the results obtained, the estimation results of the six model specifications were reported and compared.

2. For the first time, the direction of the relationship between revenues and expenditures of consolidated budgets was determined for each individual Russian region. Based on the analysis, a typology of regions by four types of fiscal behavior was compiled.

3. The relationship between regional budget expenditures and individual components of revenues, namely, tax and non-tax revenues and inter-budget transfers, was analyzed separately, while in most empirical studies for regions of different

countries, the analysis was carried out only for total budget revenues.

4. For the first time, econometric models of the formation of the structure of budget expenditures were built for the Russian regions. For seven main types of budget expenditures, the most important factors affecting the level of budget expenditures according to the functional classification were identified.

5. Using unconditional quantile regression, the heterogeneous influence of various factors on seven main types of budget expenditures of Russian regions is investigated for the first time.

Scientific and Practical Significance

The scientific significance of the empirical part of the dissertation research lies in the use of modern econometric tools for studying regional finance in Russia. The following empirical approaches have been tested on Russian data: a model with fixed individual effects (FE), the generalized moments method (GMM), the Granger causality test using the bootstrapping procedure, as well as the simplest conditional quantile regression. It should be emphasized that in recent years, interest in using the quantile regression method to study heterogeneity has increased significantly in academic science, which makes research in this area especially relevant.

The practical significance of the dissertation consists in the development of specific recommendations and conclusions that can be used by federal authorities to improve fiscal federalism, including:

1. Practical recommendations have been formulated to stimulate regions to pursue countercyclical policies. First, it was proposed to introduce fiscal rules[2] for Russian regions that would allow taking into account the phases of the business cycle when limiting the budget deficit and debt. This approach increases the flexibility of current restrictions on debt and budget deficits, while ensuring budgetary discipline and the ability to counteract external and internal shocks. Second, a set of measures to enhance countercyclicality of fiscal policy is proposed at the same time. In particular, it is

[2] Fiscal rules imply quantitative limits on key budgetary indicators set at the legislative level. At the regional level, fiscal rules typically capped the budget deficit or debt level.

proposed to include the degree of expenditure volatility among the criteria for assessing the quality of fiscal policy of the regions, which would encourage the regions to pursue a more stable macroeconomic policy.

2. Regions from the "fiscal disunity" group have been identified, whose fiscal behavior carries risks for their fiscal sustainability, and subsequently risks for the federal budget. This information can be used in the development of the federal center's policy aimed at improving the sustainability of regional finances.

3. The presented results show that after meeting the minimum requirements of the federal center, both less and more financially secure regions have little interest in further increasing the volume and improving the quality of free services in education, health care, and social support programs even with additional budgetary funds. Therefore, the federal government should pay special attention to the development of incentives for regional authorities aimed at increasing social spending. In particular, a system of financial incentives for the achievement of target indicators contained in strategic planning documents in the field of education, health care and social policy can be introduced.

Approbation of Research Results

The results of the thesis research were presented by the author and discussed at seven conferences:

5th Russian Economic Congress (Ekaterinburg, September 11–15, 2023). Topic: «Factor analysis of the structure of regional budget expenditures».

VIII International Conference «Modern Econometrics Tools and Applications – META2021» (Nizhny Novgorod, September 23–25, 2021). Topic: «Revenues and expenditures of Russian regional budgets: Granger analysis of causal relationship».

XIIth International Academic Conference for Students and Graduate Students «Statistical methods for analysis of the economy and society» (Moscow, May 11–14, 2021). Topic: «Revenues and expenditures of Russian regional budgets: Granger analysis of causal relationships».

Scientific conference of the Moscow State University «Lomonosov Readings» (Moscow, April 28, 2021) with a report «Mechanisms of formation of budget expenditures in Russian regions».

4th Russian Economic Congress (Moscow, December 21–25, 2020). Topic: «Revenues and expenditures of Russian regional budgets: Granger analysis of causal relationships».

VI International Conference «Modern Econometric Tools and Applications – META2019» (Nizhny Novgorod, September 19–21, 2019). Topic: «Adjustment of the Russian budget system to revenue shocks».

XX April International Academic Conference (Moscow, April 9–12, 2019). Topic: «Adjustment of the Russian budget system to revenue shocks».

List of the author's original papers

Gurvich E.T., Krasnopeeva N.A. (2020). Analysis of tax-spend nexus for Russian regional budgets. *Voprosy Ekonomiki*, 2, 5–29.

Krasnopeeva, N. (2023). Revenues and expenditures of Russian regional budgets: Granger causality analysis. *Applied Econometrics*, 70, 5–33.

Gurvich E.T., Krasnopeeva N.A. (2024). Determinants of public spending composition in the Russian regions. *Voprosy Ekonomiki*, 1, 5–32.

References

Afonso, A., Rault, C. (2009). Spend-and-tax: A panel data investigation for the EU. *Economics Bulletin*, 29 (4), 1–32.

Akram, V., Rath, B.N. (2019). Is there any evidence of tax-and-spend, spend-and-tax or fiscal synchronization from panel of Indian state? *Applied Economics Letters*, 26, 1544–1547.

Arellano M., Bover O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics*, 68, 29–51.

Baghestani H., McNown R. (1994). Do revenues or expenditures respond to budgetary disequilibria? Southern Economic Journal, 61 (2), 311–322.

Besstremyannaya G., Golovan S. (2021). Measuring heterogeneity with fixed effect quantile regression: Long panels and short panels. *Applied Econometrics*, 64, 70–82.

Besstremyannaya G., Dasher R., Golovan S. (2022). Quantifying heterogeneity in the relationship between R&D intensity and growth at innovative Japanese firms: A quantile regression approach. *Applied Econometrics*, 67, 27–45.

Bohn H. (2008). The sustainability of fiscal policy in the United States. In: R. Neck, J.-E. Sturm (eds.). Sustainability of public debt. Cambridge, MA: The MIT Press, 15–49.

Bolat S. (2014). The relationship between government revenues and expenditures: bootstrap panel granger causality analysis on European countries. *Economic Research Guardian*, 4, 58–73.

Buchanan J. M., Wagner R. W. (1977). Democracy in deficit: The political legacy of lord Keynes. New York: Academic Press.

Chang T., Liu W. R., Caudill S. B. (2002). Tax-and-spend, spend-and-tax, or fiscal synchronization: New evidence for ten countries. *Applied Economics*, 34, 1553–1561.

Chang T., Chiang G. (2009). Revisiting the government revenue-expenditure nexus: Evidence from 15 OECD countries based on the panel data approach. *Czech Journal of Economics and Finance*, 59, 165–172.

Chowdhury, A. R. (1988). Expenditures and receipts in state and local government finances: Comment. *Public Choice*, 59, 277–85.

Chowdhury A. (2011). State government revenue and expenditures: A boot-strap panel analysis. Unpublished manuscript, Marquette University, Wisconsin.

Esener C., Granville B., Matousek R. (2022). Choosing the optimal tool for fiscal adjustment or living under fiscal constraints: Panel evidence from selected OECD countries. *Economic Research Guardian*, 12 (1), 2–29.

Fatás A., Mihov I. (2013). Policy volatility, institutions and economic growth. *Review of Economics and Statistics*, 95 (2), 362–376.

Friedman M. (1978). The limitations of tax limitation. *Policy Review*, 5, 7–14.

Garcia, M. J. (2012). The Revenues-Expenditures Nexus: a Panel Data Analysis of Spain's Regions, *International Journal of Academic Research in Economics and Management Sciences*, 1 (1), 24–38.

Joulfaian, D., Mookerjee R. (1990). The intertemporal relationship between state and local government revenues and expenditures: Evidence from OECD countries. *Public Finance*, 45 (1), 109–117.

Hagemann A. (2017). Cluster-Robust Bootstrap Inference in Quantile Regression Models. *Journal of the American Statistical Association*, 112 (517), 446–456.

Ho Y., Huang C. (2009). Tax-spend, spend-tax, or fiscal synchronization: A panel analysis of the Chinese provincial real data. *Journal of Economics and Management*, 5 (2), 257–272.

Holtz-Eakin, D., W. Newey, Rosen H. S. (1989). The revenues-expenditures nexus: Evidence from local government data. *International Economic Review*, 30 (2), 415–429.

Idrisova V., Frejnkman L. (2010). Vliyanie federal'nyh transfertov na fiskal'noe povedenie regional'nyhvlastej. Nauchnye trudy № 137R. M.: IEPP (in Russian).

Kadochnikov P., Sinel'nikov- Murylev S., Trunin I. (2002). Sistema federal'noj finansovoj pomoshchi sub"ektam RF i fiskal'noe povedenie regional'nyh vlastej v 1994–2000 godah. *Voprosy ekonomiki*,8, 31–50 (in Russian).

Koenker, R.W., Bassett Jr., G.S. (1978). Regression Quantiles. *Econometrica*, 46, 33–50.

Koenker, R.W. (2005). Quantile Regression. New York: Cambridge University Press.

Konukcu-Önal D., Tosun A. (2008). Government revenue-expenditure nexus: Evidence from several transitional economies. *Economic Annals*, 53, 145–156.

Kollias C., Paleologou S.-M. (2006). Fiscal policy in the European Union: Tax and spend, spend and tax, fiscal synchronisation or institutional separation? *Journal of Economic Studies*, 33 (2), 108–120.

Kónya L. (2006) Exports and growth: Granger causality analysis on OECD countries with a panel data approach. *Economic Modelling*, 23, 978–992.

Kreindel V. (2008). Diagnostics of the dominating regime of the subjects of Russian Federation budget policy. *Ekonomicheskaya Politika*, 1, 141–151. (In Russian)

Narayan, P. K., & Narayan, S. (2006). Government revenue and government expenditure nexus: evidence from developing countries. *Applied Economics*, 38 (3), 285–291.

Narayan, P.K. (2005). The Government Revenue and Government Expenditure Nexus: Empirical Evidence from Nine Asian Countries. *Journal of Asian Economics*, 15, 1203–1216.

Magazzino C. (2014). The relationship between revenue and expenditure in the ASEAN countries. *East Asia*, 31, 203–221.

Marlow, M. L., Manage N. (1987). Expenditures and receipts: Testing for causality in state and local government finances. *Public Choice*, 53, 243–255.

Marlow, M. L., Manage N. (1988). Expenditures and receipts in state and local government finances: Reply. *Public Choice*, 59, 287–290.

McManus R., Ozkan G. (2015). On the consequences of procyclical fiscal policy. *Fiscal Studies*, 36 (1), 29–50.

Meltzer A., Richard S. (1981). A rational theory of the size of government. *Journal of Political Economy*, 89 (5), 914–927.

Musgrave R. (1966). Principles of budget determination. In: H. Cameron, W. Henderson (eds.). Public finance: Selected readings. New York: Random House, 15–27.

Mutascu, M. (2015). A bootstrap panel granger causality analysis of government revenues and expenditures in the PIIGS Countries. *Economics Bulletin*, 35 (3), 2000–2004.

Owoye O., Onafovora O. (2011). The relationship between tax revenues and government expenditures in European Union and non-European Union OECD countries. *Public Finance Review*, 39 (3), 429–461.

Parente P. M., Santos Silva J. M. C. (2016). Quantile regression with clustered data. *Journal of Econometric Methods*, 5 (1), 1–15.

Payne, J. E. (1998). The tax-spend debate: Time series evidence from state budgets. *Public Choice*, 95 (3-4), 307–320.

Payne J. (2003). A survey of the international empirical evidence on the tax-spend debate. *Public Finance Review*, 31 (3), 302–323.

Peacock A., Wiseman J. (1961). The growth of public expenditures in the United Kingdom. Princeton, NJ: Princeton University Press.

Peacock A., Wiseman J. (1979). Approaches to the analysis of government expenditure growth. *Public Finance Quarterly*, 7 (1), 3–23.

Phiri, A. (2019). Asymmetries in the revenue–expenditure nexus: new evidence from South Africa. *Empirical Economics*, 56, 1515–1547.

Ram, R. (1988). Additional evidence on causality between government revenue and government expenditure. *Southern Economic Journal*, 54, 763–769.

Sanz I., Velázquez F. (2002). Determinants of the Composition of Government Expenditure by Functions. European Economy Group, Working Paper 13/2002.

Shelton C. (2007). The size and composition of government expenditure. *Journal of Public Economics*, 91 (11–12), 2230–2260.

Sinelnikov-Murylev S., Kadochnikov P., Trunin I. et al. (2006). The problem of soft budget constraints of Russian regional governments. Moscow: IET. (In Russian).

Sousa, K., Monte, P. (2021). Public expenditure composition and fiscal decentralization in Brazilian local governments: an analysis through unconditional quantile regression with longitudinal data. *Revista de Administração Pública*, 55, 1333–1354.

Tashevska B., Trenovski B., Trpkova - Nestorovska M. (2020). The government revenue–expenditure nexus in Southeast Europe: A bootstrap panel granger-causality approach. *Eastern European Economics*, 58 (4), 309–326.

Vamvoukas G. (2011). The tax-spend debate with an application to the EU. *Economic Issues*, 16 (1), 65–88.

von Furstenberg, G. M., Green R. J., Jeong J. (1985). Have taxes led government expenditures? The United States as a test case. *Journal of Public Policy*, 5 (3), 321–348.

Wildavsky A. (1975). The politics of the budgetary process. Boston: Little, Brown &Company.

Zubarevich N. V., Safronov S. G. (2023). Regional inequality and its changes: Budget projection. *Regionalnye Issledovaniya*, 1(79), 31–41. (In Russian).