The Heterogeneous Impact of Fiscal Policy on Russian Regions

Ilya Gulenkov

International Laboratory for Macroeconomic Analysis
Department of Theoretical Economics
FES HSE

April 2025

Motivation

- ▶ High regional differentiation in Russia

- ▶ Monetary policy transmission depends on regional characteristics (Напалков, Новак, and Шульгин 2021; Зверева et al. 2024; Зверева and Скуратова 2024):
    - ▶ GRP size and structure
    - ▶ Local market size
    - ▶ Trade geography and intensity
    - ▶ Income inequality
    - ▶ Employment structure
    - ▶ . . .

- ▶ Fiscal policy in a monetary union: countercyclican and redistributive role

- ▶ The reaction of Russian regions to fiscal policy shocks has not been extensively studied

Aim & Contribution

- ▶ Aim: estimate the impact of regional government expenditures on Russian regions' economy

- ▶ Methodology: global vector autoregression (GVAR), sample period - 2009 - 2024, 79 regions

- ▶ Contribution:
  - ▶ Fiscal policy effects in Russia: we estimate region-specific multipliers instead of a single national one
  - ▶ Heterogeneous effects of macroeconomic policy in a monetary union: multipliers depend on economy size, income inequality and employment structure
  - ▶ Cross-regional spillover effects: the size of the effects depends on the size of the source economy and its trade patterns

Literature: Fiscal Multiplier

▶ Fiscal multiplier in the U.S. lies between 0.8 and 1.5 (Ramey 2011)

▶ The size of the multiplier depends on the business cycle phase (Auerbach and Gorodnichenko 2011), the source of economic shocks (Ghassibe and Zanetti 2022), monetary policy reaction and income distribution patterns (Broer, Krusell, and Öberg 2023)

▶ For Russia estimates vary between 0.1 - 0.9 and depend on the methodology, sample period, budget level and expenditure category (Кудрин and Кнобель 2017; Власов and Дерюгина 2018; Зяблицкий 2020)

Literature: Local Multiplier and Spatial Effects

- ▶ Subnational data allows to estimate local fiscal multipliers (Nakamura and Steinsson 2014; Chodorow-Reich 2019):
  - ▶ Controls for common country-level factors
  - ▶ Higher estimation efficiency due to cross-sectional variation
  - ▶ Spatial effects can be studiedd
- ▶ Omission of spatial effects can bias regional multiplier estimates downwards (Auerbach, Gorodnichenko, and Murphy 2020)
- ▶ Spatial links between regions and region clusters in Russia have been extensively documented in the literature (Демидова, Каяшева, and Демьяненко 2021; Демидова and Иванов 2016)
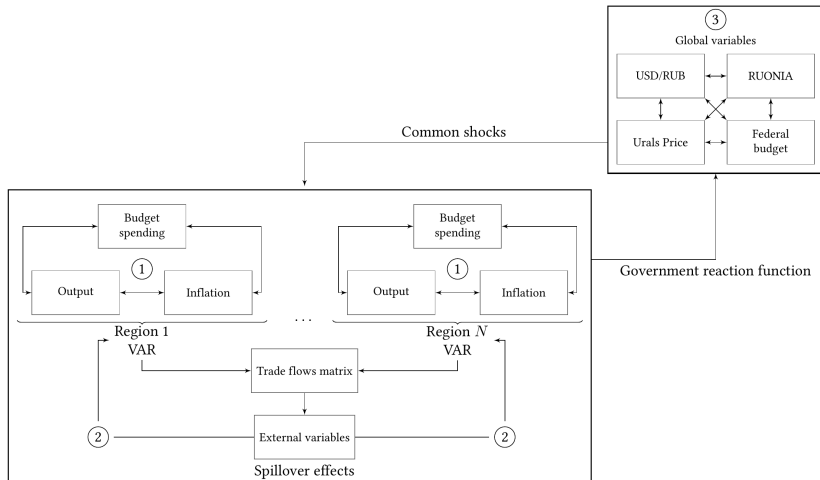
Model Structure

Figure 1: GVAR Model Structure

Data

- ▶ Monthly data for 79 Russian regions:
  - ▶ Reflects short outside lag of fiscal transmission
  - ▶ Allows to justify the identification strategy
- ▶ Three variable blocks:
  1. Regional variables: logs of output index and expenditures of the consolidated regional budget in per capita terms, log-difference of the regional CPI
  2. External variables: weighted combination of regional variables for neighbouring regions. Weight matrix is constructed based on interregional trade for 2016
  3. Global variables: RUONIA rate, logs of Urals price, USD/RUB exchange rate, per capita revenue and expenditure of the federal budget

GVAR Specification

Endogenous variables in region i evolve according to a VAR:

$$x_{it} = a_{i0} + a_{i1}t + \sum_{l=1}^{p_i} \Phi_{il}x_{i,t-l} + \sum_{l=0}^{q_i} \Lambda_{il}x_{i,t-l}^* + \sum_{l=0}^{s_i} D_{il}\omega_{t-l} + \varepsilon_{it}$$

- ▶ x_{it} - vector of endogenous variables
- ▶ $x_{i,t}^*$ - vector of external variables
- ▶ ω_t - vector of global variables
- ▶ p_i, q_i and s_i determine the lag order (1 in the baseline specification)

Global variables are modelled in a separaet dominant-unit VAR and react to regional economic dynamics:

- ▶ Interest rate is determined according to a Taylor rule variant which includes weighted regional output and inflation
- ▶ Federal budget revenues depend on weighted regional output, oil prices and the exchange rate

Estimation

- ▶ Each regional model has 39 coefficients and 9 covariance matrix elements → "curse of dimensionality"

- ▶ We opt for a Bayesian estimation using the Minnesota prior. The prior assumes that the explanatory power is higher:
  - ▶ For own lags compared to other variable lags
  - ▶ For more recent lags than for more distant lags

- ▶ Important assumption: each region is a small open economy (Pesaran, Schuermann, and Weiner 2004):
  - ▶ External variables are treated as weakly exogenous
  - ▶ Regional models are estimated separately
  - ▶ Global model solution is obtained algebraically using the weighting matrix

- ▶ The model is estimated with stochastic volatility to capture periods of markedly high volatility (2014-2015 and 2022)

Identification Strategy

- ▶ Reduced-form VAR residuals cannot be interpreted in a structural manner since they are correlated with each other

- ▶ One needs to impose restrictions on the covariance matrix and perform orthogonalization

- ▶ Baseline identification strategy is recursive:
  - ▶ Regional supply and demand shocks do not influence government expenditure within one month
  - ▶ Regional budget expenditure can have a contemporaneous impact on output and inflation

- ▶ Main results are qualitatively robust to using sign restrictions as an alternative identification strategy

- ▶ N.B. Identification in GVAR models is local: the shock is orthogonal to other regional shocks, but might be correlated with shocks in other regions

 - ▶ In practice this correlation is small

Government Spending Multiplier

▶ Regions are very different in their size and budget spending → IRFs have to be transformed for comparability

▶ The government spending multiplier is defined as a percentage change in output after a government spending shock equivalent to 1% of the regional per capita GRP:

$$\text{mult}_{ijh}^{y} = \text{IRF}_{ijh}^{y,g} \times \frac{1}{\bar{g}_j} \times \overline{\text{GRP}}_j \times 0.01$$

▶ $\text{IRF}_{ijh}^{y,g}$ - IRF of output in region i to a government spending shock in region j at horizon h

▶ $\bar{g}_j$ - average per capita government expenditure in region j

▶ $\overline{\text{GRP}}_j$ - average per capita GRP

Regional Government Spending Multiplier
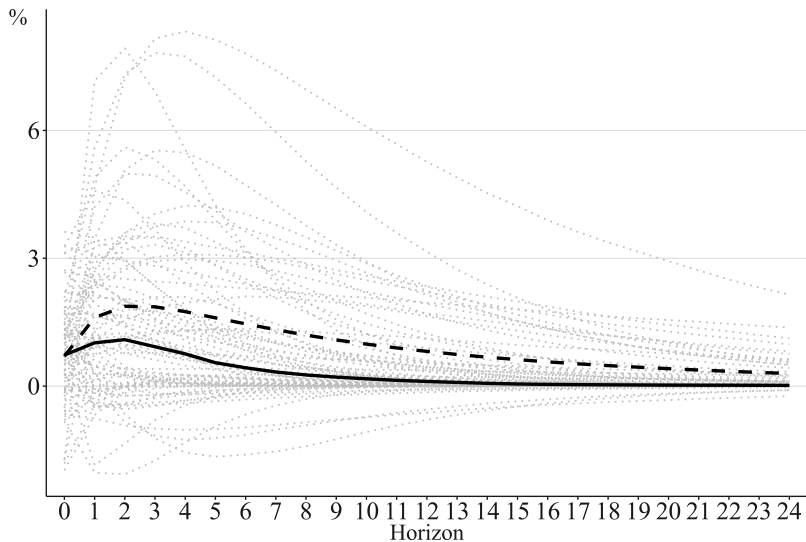
Sources of Heterogeneity: Potential Channels

- ▶ Liquidity constraints for households and firms (Bernardini, De Schryder, and Peersman 2020; Debuque-Gonzales 2021)

- ▶ The source of financing and regional debt dynamics (Chodorow-Reich 2019)

- ▶ Govrenment spending composition and allocation between labour- and capital-intensive industries (Juarros, Muratori, and Valderrama 2023)

- ▶ Trade linkages: spillover effects are stronger in regions with a trade deficit (Bernardini, De Schryder, and Peersman 2020; Dupor et al. 2023)

Sources of Heterogeneity: Hypotheses

1. Size and structure of the economy: real GRP per capita, share of mining, manufacturing and construction in GRP
2. Income distribution: decile coefficient and share of population with incomes below the poverty line
3. Regional labor market: unemployment rate, number of unemployed per vacancy, share of employment in non-state-owned organizations, share of employment in small and medium-sized enterprises
4. Trade relations: share of imports from abroad in GRP, ratio of shipment of products from other regions of Russia and to other regions of Russia to total regional output
5. Regional budget: level of regional debt to GRP (excluding budget loans), share of regional budget expenditures on national defense, security, national economy and social sphere

Main Conclusions: Regional Multipliers

- ▶ Median multiplier reaches 1.09% after 2 and dies out gradually
- ▶ The effect is stronger in regions with:
  - ▶ High GRP per capita (market size and lower propensity to import)
  - ▶ High share of construction in GRP
  - ▶ High income inequality (population groups with a high propensity to consume)
  - ▶ Predominance of employment in large enterprises (structure of budget recipients)
  - ▶ High share of expenditure on the national economy in the budget (productive expenditure)

Spillover Effects: Definition

We calculate two measures of spillover effects:

1. Spill-out effect reflects how strongly other regions react to a government spending shock in a given region:

$$SO_j = \sum_{i \neq j} \omega_i \text{mult}_{ijh}^y$$

2. Spill-in effect reflects the sensitivity of a given region to government spending shocks in other regions:

$$SI_i = \sum_{j \neq i} \omega_j \text{mult}_{ijh}^y$$

The responses are weighted using regional GRP: $\omega_i = \frac{\text{GRP}_i}{\sum_k \text{GRP}_k}$

Main Conclusions: Spillover Effects

- ▶ The average spill-out effect at a 1-year horizon is 0.05%. A stronger response is found in:
  - ▶ Larger economies
  - ▶ Regions with a lower share of intra-Russia exports
  - ▶ Regions with a higher share of foreign imports
  - ▶ Regions with a higher unemployed-vacancy ratio

- ▶ The average spill-in effect at a 1-year horizon is 0.09%. A stronger response is found in:
  - ▶ Regions with a higher share of manufacturing in GRP
  - ▶ Regions with lower income inequality
  - ▶ Regions with a lower unemployed-vacancy ratio

Discussion and Conclusions

- The results are within the range of existing estimates, but higher than the national multiplier for Russia:
  - Regional budgets vs. federal budget: expenditure structure
  - General equilibrium effects at the national level: Central Bank response, inflation expectations, debt trajectory
  - Dependent variable: GDP vs. monthly GRP proxy (covers from 30% to 80% of GVA in regions)

- The multiplier is higher in larger regions which can systematically conduct looser fiscal policy due to a higher and more stable tax base:
  - A join fiscal stimulus in top-10 richest regions slightly increases intraregional Gini coefficient (the effect is mediated by spillovers)

- Price level reaction to a government spending shock: significantly negative in approximately 50% of the cases
  - Contradicts traditional views but is often encountered empirically (Jørgensen and Ravn 2022)
  - The importance of supply-side fiscal policy effects (Jørgensen and Ravn 2022; Choi, Shin, and Yoo 2022)

Sources I

Auerbach, Alan J., and Yuriy Gorodnichenko. 2011. "Fiscal Multipliers in Recession and Expansion (Preprint)." NBER Working Paper Series 17447 (September). https://doi.org/10.3386/w17447.

Auerbach, Alan J., Yuriy Gorodnichenko, and Daniel Murphy. 2020. "Local Fiscal Multipliers and Fiscal Spillovers in the USA." IMF Economic Review 68 (1): 195–229. https://doi.org/10.1057/s41308-019-00102-3.

Bernardini, Marco, Selien De Schryder, and Gert Peersman. 2020. "Heterogeneous Government Spending Multipliers in the Era Surrounding the Great Recession." The Review of Economics and Statistics 102 (2): 304–22. https://doi.org/10.1162/rest_a_00830.

Broer, Tobias, Per Krusell, and Erik Öberg. 2023. "Fiscal Multipliers: A Heterogeneous-agent Perspective." Quantitative Economics 14 (3): 799–816. https://doi.org/10.3982/QE1901.

Chodorow-Reich, Gabriel. 2019. "Geographic Cross-Sectional Fiscal Spending Multipliers: What Have We Learned?" American Economic Journal: Economic Policy 11 (2): 1–34. https://doi.org/10.1257/pol.20160465.

Choi, Sangyup, Junhyeok Shin, and Seung Yong Yoo. 2022. "Are Government Spending Shocks Inflationary at the Zero Lower Bound? New Evidence from Daily Data." Journal of Economic Dynamics and Control 139 (June): 104423. https://doi.org/10.1016/j.jedc.2022.104423.

Debuque-Gonzales, Margarita. 2021. "Local Fiscal Multipliers and Spillover Effects: Evidence from Philippine Regions." Economic Systems 45 (2): 100764. https://doi.org/10.1016/j.ecosys.2020.100764.

Dupor, Bill, Marios Karabarbounis, Marianna Kudlyak, and M Saif Mehkari. 2023. "Regional Consumption Responses and the Aggregate Fiscal Multiplier." The Review of Economic Studies 90 (6): 2982–3021. https://doi.org/10.1093/restud/rdad007.

Sources II

Ghassibe, Mishel, and Francesco Zanetti. 2022. "State Dependence of Fiscal Multipliers: The Source of Fluctuations Matters." Journal of Monetary Economics 132 (November): 1–23. https://doi.org/10.1016/j.jmoneco.2022.09.003.

Jørgensen, Peter L., and Søren H. Ravn. 2022. "The Inflation Response to Government Spending Shocks: A Fiscal Price Puzzle?" European Economic Review 141 (January): 103982. https://doi.org/10.1016/j.euroecorev.2021.103982.

Juarros, Pedro, Umberto Muratori, and Daniel Valderrama. 2023. "Heterogeneous Spending, Heterogeneous Multipliers." IMF Working Papers 2023 (052): 1. https://doi.org/10.5089/9798400233777.001.

Nakamura, Emi, and Jón Steinsson. 2014. "Fiscal Stimulus in a Monetary Union: Evidence from US Regions." American Economic Review 104 (3): 753–92. https://doi.org/10.1257/aer.104.3.753.

Pesaran, M. Hashem, Til Schuermann, and Scott M. Weiner. 2004. "Modeling Regional Interdependencies Using a Global Error-Correcting Macroeconometric Model." Journal of Business & Economic Statistics 22 (2): 129–62. https://doi.org/10.1198/073500104000000019.

Ramey, Valerie A. 2011. "Can Government Purchases Stimulate the Economy?" Journal of Economic Literature 49 (3): 673–85. https://doi.org/10.1257/jel.49.3.673.

Власов, Сергей Алексеевич, and Е. Б. Дерюгина. 2018. "Фискальные мультипликаторы в России." Журнал Новой Экономической Ассоциации 2 (38): 104–19. https://doi.org/10.31737/2221-2264-2018-38-2-5.

Демидова, О. А., and Д. С. Иванов. 2016. "Модели экономического роста с неоднородными пространственными эффектами (на примере российских регионов)." Экономический журнал Высшей школы экономики 20 (1): 52–75. https://publications.hse.ru/articles/publications.hse.ru/articles/181143290.

Sources III

Демидова, О. А., Е. В. Каяшева, and А. В. Демьяненко. 2021. "Государственные расходы на здравоохранение и экономический рост в России: региональный аспект." Пространственная эконометрика 17 (1): 97–122. https://doi.org/10.14530/se.2021.1.097-122.

Зверева, В. А., О. А. Демидова, Коршунов Д. А, and А. А. Мясников. 2024. "Влияние внутрирегионального неравенства по доходам на работу трансмиссионного механизма денежно-кредитной политики Банка России." Деньги и кредит 83 (1): 3–31. https://publications.hse.ru/articles/publications.hse.ru/articles/909673909.

Зверева, В. А., and А. В. Скуратова. 2024. "Реакция Банковских Ставок На Изменение Ключевой Ставки Банка России в Условиях Региональной Неоднородности (Оценки На Панельных Данных)." Банк России, Серия Докладов Об Экономических Исследованиях 129. https://www.cbr.ru/StaticHtml/File/161845/wp_129_2.pdf.

Зяблицкий, И. Е. 2020. "Оценка фискальных мультипликаторов в российской экономике." Экономический Журнал Высшей Школы Экономики 24 (2): 268–94. https://doi.org/10.17323/1813-8691-2020-24-2-268-294.

Кудрин, Алексей Леонидович, and Александр Юрьевич Кнобель. 2017. "Бюджетная политика как источник экономического роста." Вопросы Экономики, no. 10: 5–26. https://doi.org/10.32609/0042-8736-2017-10-5-26.

Напалков, В., А Новак, and А Шульгин. 2021. "Различия в эффектах единой денежно-кредитной политики: случай регионов России." Деньги и кредит 80 (1): 3–45. https://doi.org/10.31477/rjmf.202101.03.

Regional Government Spending Multiplier

Статистика	Горизонт (месяцев)					
	0	1	3	6	12	24
Min	-1.97	-2.03	-1.75	-1.61	-0.79	-0.23
15th percentile	-0.35	-0.20	-0.18	-0.02	0.00	0.00
Median	0.73	1.02	0.92	0.43	0.11	0.02
85th percentile	1.86	2.92	3.37	2.62	1.35	0.44
Maximum	3.62	7.16	8.15	7.81	5.26	2.14
Average[1]	0.70	1.61	1.86	1.46	0.81	0.30
Share of significant[2]	0.37	0.48	0.47	0.47	0.54	0.68

Note:
the estimates are using a GVAR model on the sample of 2009-2024
using a recursive identification scheme. The multiplier is understood as
the percentage change in the business activity index in response to an
increase in government spending equivalent to 1% of GRP.

[1] When calculating the average, regional per capita GRP is used as
weights

[2] 68% credible intervals are used to test significance.

Heterogeneity Regressions I

	GRP	Inequality	Labour market
(Intercept)	-22.44 ***	-2.85	4.06
log(GRP)	1.67 ***		
extraction	0.01		
industry	0.18		
construction	0.07 **		
decile_coeff		0.89 **	
poverty		-0.05	
tightness			0.01
unemprate			-0.21
private_empl_share			0.06
sme_empl_share			-0.14 ***
R^2 adj.	0.18	0.11	0.21
P value	0.00	0.01	0.00

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Heterogeneity Regressions II

	External trade	Budget
(Intercept)	2.11 ***	-2.43
imgrp	-0.00	
exsh	-0.00	
imsh	-0.11	
defense		-1.31
security		0.94
economy		0.10 *
social		0.08
debtgrp		-0.21
N	79	79
R^2 adj.	-0.01	0.04
P value	0.52	0.18

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Spillover Effects: Summary Statistics

| | Horizon (months) | | | | | | | |
| | Spill-out | | | | Spill-in | | | |
Statistic	0	6	12	24	0	6	12	24
Min	0.00	0.00	0.00	0.00	-0.16	-0.15	-0.05	-0.05
15th percentile	0.00	0.00	0.00	0.00	0.00	0.04	0.03	0.02
Median	0.01	0.02	0.01	0.01	0.03	0.11	0.10	0.06
85th percentile	0.04	0.11	0.10	0.06	0.09	0.16	0.14	0.09
Maximum	0.20	0.68	0.66	0.46	0.29	0.29	0.19	0.14
Average[1]	0.02	0.06	0.05	0.03	0.05	0.10	0.09	0.06
Share of significant[2]	0.53	0.75	0.75	0.65	0.53	0.75	0.75	0.65

Note: the estimates are obtained using a GVAR model on the 2009-2024 sample using a recursive identification scheme. In all cases, the shock size is normalized to 1% of the GRP of the shock source region.
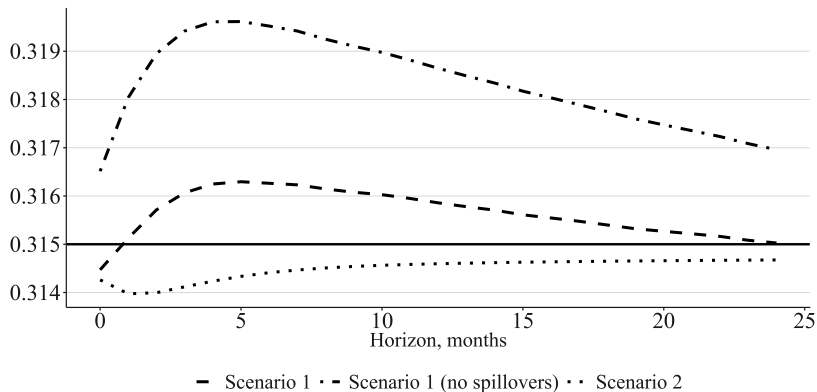
Interregional Inequality

Figure 2: Estimated Gini coefficient for per capita GRP

Scenario 1: fiscal expansion in 10 regions with the highest per capita GRP, scenario 2 - in 10 regions with the lowest per capita GRP. The bold line indicates the value of the Gini coefficient in 2022 (0.315)