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Heterogeneity of the Fiscal Impulse Impact on Inflation in the Russian Regions

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Abstract

The objective of this study is to quantify the impact of the fiscal impulse on inflation in the constituent territories of the Russian Federation, taking into account the heterogeneity of the fiscal positions of the Russian regions. Despite the existing theoretical foundations and accumulated international empirical results, there is a lack of systematic studies of the impact of fiscal policy on inflation at the regional level in Russia. This paper seeks to address this significant research gap proposing an adapted method for estimating the fiscal impulse, based on a comparison of a region's actual consolidated budget deficit from its own resources with its 'neutral' level calculated as the median value over the period of macroeconomic stability from 2017 to 2019. The main hypothesis of the study is that the impact of the fiscal impulse is heterogeneous and depends on a region's fiscal position derived from the results of a cluster analysis of the structural deficit.

The econometric analysis was conducted using panel data for 85 constituent territories of Russia over the period from 2020 Q1 to 2025 Q3, employing dynamic panel models estimated using the Arellano – Bond System GMM. The results indicate that, in a specification with two-way effects, the fiscal impulse has a positive and statistically significant impact on the deviation of regional inflation from the countrywide rate.

Thus, the breakdown of the sample by the fiscal position shows that the proinflationary effect of the fiscal impulse arises in the regions with chronically high structural deficits (Clusters 1 and 3), whereas for the regions with a neutral fiscal position (Cluster 2), the effect is absent. The degeneracy of the instrument matrix makes it impossible to estimate correctly the specified models with time effects for Clusters 1 and 3, which suggests high inertia of fiscal indicators in these regions and the structural nature of their fiscal policies.

Nevertheless, additional analysis reveals a partial significance of the expenditure structure. In the specification with individual effects, the regions with a higher share of social expenditures exhibit a more pronounced inflationary response. However, when time effects are included, this interaction loses statistical significance. The results of this study have practical value and help enhance forecasting of regional inflation, taking into account the structural characteristics of the constituent territories of the Russian Federation.

Keywords: fiscal impulse, regional inflation, economic policy, consolidated budgets, GMM estimation

JEL codes: E31, E52, E62.

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1. Introduction

The fiscal impulse is often viewed as a quantitative measure of the orientation of fiscal policy – whether it is expansionary, neutral, or contractionary. It is generally accepted in the literature that expansionary fiscal policy is proinflationary in nature, as it aims to revive and boost the economy by stimulating aggregate demand through increased government spending and transfers, as well as by reducing the tax burden. Contractionary fiscal policy, to the contrary, is characterised by budget revenues exceeding expenditures, which restrains aggregate demand and cools down business activity in general. Neutral fiscal policy implies a balanced structure of budget revenues and expenditures, which neither restricts nor stimulates aggregate demand or overall business activity relative to its long-term trend.

The role of fiscal policy in the Russian economy has grown in recent years. According to data from Rosstat and the Ministry of Finance of the Russian Federation [1, 2], the share of federal budget expenditures in Russia's nominal gross domestic product (GDP) in 2025 stood at 20.1%, which is slightly higher than 19.9% in 2024 at 18.6% in 2023. This was accompanied by a rise in the average annual inflation rate.¹ That said, during the period of 2017–2019 when economic growth was relatively stable, the average share of federal budget expenditures in Russia's nominal GDP was 16.9%, with the average annual inflation rate equalling 3.7%. These changes underscore the relevance of studying the relationship between fiscal policy and inflationary processes in Russia, including at the regional level, where the fiscal stimulus may manifest itself in unique ways.

Typically, the scientific literature analyses the relationship between fiscal policy and inflation at the country level – either for one economy separately (Mori, 2025; Bhat & Sharma, 2020; etc.) or for a group of independent countries (Checherita-Westphal et al., 2025; Hooley et al., 2024; etc.). However, such an approach remains limited in the context of Russia due to the country's pronounced territorial differentiation. The significant heterogeneity of the Russian constituent territories, manifested in both inflationary processes and fiscal policy parameters, makes it fundamentally important to factor in the regional dimension when assessing the impact of fiscal policy on inflation in the country as a whole.

Interregional differences in inflation may be due to variations in the structure of the economy, budget financing, the level of socioeconomic development, the situation in the labour market, or the characteristics of consumption patterns. In particular, Oshchepkov et al. (2024) demonstrate that inflation volatility significantly varies across the Russian regions, which is associated with the heterogeneity of consumer baskets. At the same time, Sokolov et al. (2025) show that the estimates of fiscal multipliers in the Russian regions depend on the level of debt and the percentages of project expenditures, budget expenditures, and federal grants and subsidies in gross regional product (GRP), which is reflected in the heterogeneity of regional development dynamics.

However, generally, there are relatively few domestic studies examining the impact of fiscal policy on inflation. This is partly because inflation spikes in Russia over the recent decade have been caused primarily by supply-side factors, including sanctions imposed on Russia, rather than by fiscal policy shocks (or other components of aggregate demand). Studies exploring this topic at the regional level are even scarcer, which is largely due to limited data availability. However, since regional authorities in Russia enjoy significant autonomy in conducting fiscal policy, research on the relationship between the fiscal impulse and inflation at the regional level becomes particularly valuable and critical for the development of effective economic policy.

The main objective of this study is to quantify the impact of the fiscal impulse on inflation in Russian regions using an adapted impulse measurement method. The proposed approach is based on comparing a region's actual consolidated budget deficit with a certain 'neutral' deficit / surplus level. For convenience, the 'neutral' level is assumed to be the deficit / surplus observed during the period of 2017–2019 when economic growth was relatively stable (the output gap was near zero and annual inflation was close to 4%, which is the Bank of Russia's target). The difference between the actual and 'neutral' deficit / surplus levels is considered to be the magnitude of the fiscal impulse. A positive fiscal

¹ According to Rosstat (Federal State Statistics Service) [3], the average annual inflation rate was 8.7% in 2025, 8.4% in 2024, and 5.9% in 2023.

impulse is interpreted as expansionary policy (leading to higher inflation), while a negative impulse involves a contractionary effect on the economy.

The main hypothesis (H1) of the study is that the impact of the fiscal impulse on inflation is heterogeneous and depends on a region's initial fiscal position – the steady-state level of the consolidated budget deficit / surplus of the region's own-source revenues formed during the period of macroeconomic stability. In other words, depending on the region's initial dependence on deficit financing, changes in the budget deficit of the same magnitude can lead to different inflationary consequences.

Additionally, this paper posits the hypothesis (H2) that the heterogeneous impact of the fiscal impulse on inflation across the Russian regions may stem from differences in the expenditure structure of a given region. An increase in social expenditures, such as wages to state and municipal employees, social benefits, or transfers, directly stimulates consumer demand, which can lead to rising inflation. At the same time, growth in capital expenditures has a more indirect impact on inflationary processes, as it primarily affects aggregate supply. Thus, the structure of budget expenditures can significantly influence inflationary processes. Regions with a higher share of 'inflationary' expenditure categories, such as social benefits and public sector wages, may face more pronounced inflationary pressures. Understanding the relationship between specific types of government spending and inflation dynamics can contribute to the development of more effective fiscal policy at the regional level. Furthermore, this may help improve the accuracy of inflation forecasts and enhance the effectiveness of monetary policy.

The study examines the consumer price index (CPI), non-repayable revenues, and expenditures of the consolidated budgets of the Russian constituent territories, including across individual categories, for the period from 2016 Q1 to 2025 Q3. This paper explores data for all Russian regions, except for the regions that became part of the country in 2022.

This paper is structured as follows. Section 2 reviews the literature. Section 3 outlines the research question and describes the data used. Section 4 describes the methodology of the study. Section 5 presents the findings of the research. Section 6 concludes.

2. Literature Review

2.1. Approaches to Assessing the Fiscal Impulse

The fiscal impulse is a key indicator to assess the direction and intensity of the government's discretionary fiscal policy in terms of its impact on aggregate demand. The main methodological problem in assessing it, first identified by Brown (1956), is that the actual budget balance (the ratio of revenues to expenditures) may include both discretionary government actions and the automatic impact of the economic cycle on the dynamics of revenues and expenditures. This requires a clear distinction between these components for a correct assessment of the fiscal impulse.

The literature traditionally distinguishes between two main approaches to estimating the fiscal impulse, which differ in how they take into account the economic cycle and automatic stabilisers. One approach includes both discretionary budget decisions and automatic stabilisers: in this case, the fiscal impulse is determined through the cyclically adjusted balance. The second approach estimates only discretionary changes, leaving out automatic stabilisers by using estimated income and expenditure elasticities. Mansur et al. (1986) and Philip & Janssen (2002) note that there is no universal method and the choice of an approach depends on the research objectives and available data.

As for the classical metrics for estimating the fiscal impulse, the following can be highlighted: the GCEE-IMF Measure (Dernberg, 1975), the OECD Measure, the Full-Employment Balance (FEB) method (de Leeuw & Holloway, 1982), the Blanter – Solow structural method, and the European Community (EC) indicator (European Community, 1982). These methods differ in their underlying assumptions. For example, the GCEE-IMF method assumes unitary income elasticity of output and zero elasticity of expenditures, which simplifies calculations but limits their flexibility. The OECD method, conversely, uses estimated elasticities and adjusts for inflation and other factors to isolate the purely discretionary effect. The FEB method estimates the deficit (surplus) that would exist under full employment of resources. The Weighted Standardised Surplus (WSS) and EC methods isolate the structural component of the budget by using econometric models or decomposing the balance into cyclical and other components. Table 1 presents a summary of these methods, as provided in Mansur et al. (1986).

Table 1

Classical methods for estimating fiscal impulse

Method	Description	Advantages	Disadvantages
GCEE-IMF Measure	Measures the effect of fiscal policy (discretionary + automatic stabilisers) on aggregate demand. It relies on a base year when actual output and potential output are equal. A 'cyclically neutral budget' implies that revenues have unit elasticity with respect to actual GDP and expenditures have unit elasticity with respect to potential GDP	Simple to calculate; does not require a large amount of data; factors in the effect of automatic stabilisers	Assumes unit elasticities of revenues / expenditures, which is unrealistic; ignores the impact of inflation, interest rates, and exchange rates; includes structural changes in the economy in the impulse
OECD Measure	Measures discretionary policy changes and the fiscal drag, excluding the effect of automatic stabilisers. Uses modelled (non-unit) elasticities of revenues and expenditures	Takes into account non-unit elasticities; attempts to adjust interest expenditures for inflation on; reflects discretionary policy more accurately	Requires more data (estimates of elasticities); differences in output and budget gap estimates with the IMF may lead to discrepancies in results
FEB Measure	Estimates the budget balance at potential output with high employment. Focuses on the level of the adjusted deficit rather than its change	Measures discretionary policy more accurately; excludes the reverse effect of actual income on the budget	May give false signals if the assessment of tax policy at potential output differs from actual policy
WSS Measure	Uses a structural econometric model to decompose the budget into exogenous (autonomous) and endogenous (induced) components. The	Factors in time lags and structural relationships; does not require an estimate of potential output; evaluates policy at the	Highly complicated and costly; requires an accurate and unbiased model; unsuitable for regular operational assessments

	impulse is defined as the change in the exogenous component	actual level of output	
EC Measure	Decomposes the budget balance into the effect of changes in economic activity, net interest payments, and a residual component similar to the IMF's budget impulse	Is simple; isolates interest payments; uses the first differences for clarity; factors in random supply shocks	Does not adjust interest payments for inflation; uses a single marginal tax rate, which may oversimplify reality

The concept of the fiscal impulse proposed by Blanchard (1990) – the Blanchard Fiscal Impulse – is similar to the OECD approach. Pekşen et al. (2022) note that Blanchard's method emphasises discretionary measures: first, the structural deficit at full employment is estimated (taking into account the Okun coefficient) and, then, the difference between the actual and structural deficits is interpreted as the fiscal impulse from discretionary decisions. Blanchard's method is actually similar to the OECD method, as it also assesses the impact of discretionary fiscal measures through macroeconomic cycle parameters.

The IMF method, in turn, was further developed by Fedelino et al. (2009) who introduced a universal cyclical adjustment formula based on the elasticities of revenues and expenditures relative to the output gap (the percentage difference between actual and potential GDP). Thus, it becomes possible to abandon a rigid link to a base year and adapt calculations to different tax and expenditure structures. The method proposed by Fedelino et al. allows calculating the structural (cyclically adjusted) budget: revenues and expenditures are adjusted using formulas that take into account the output gap, while the fiscal impulse is defined as a change in the net structural deficit. This approach makes the calculations more flexible and transparent, while preserving the logic of the earlier methods (decomposition into discretionary and cyclical components).

It is important to emphasise that the more modern version of the IMF's budget impulse estimate suggested by Fedelino et al. (2009) was also applied by Myasnikov et al. (2023) who assessed how changes in discretionary fiscal policy, net of the economic cycle's influence, might affect inflation at the regional level. The authors proceed from the concept of the structural (cyclically adjusted) budget balance and interpret the fiscal impulse as the first difference of a region's structural budget balance with the opposite sign. Thus, a positive value of the impulse corresponds to fiscal expansion, while its negative value – to fiscal tightening.

To obtain a structural budget balance, Myasnikov et al. (2023) use a multi-step procedure. In the first stage, they estimate regions' potential output and output gap, including by using filtering methods (the HP filter). In the second stage, they adjust regional budget revenues and expenditures for the cyclical component, taking into account the elasticities of tax revenues and individual expenditure items relative to economic activity. As a result, they measure a 'neutral' fiscal stance, which means the absence of a stimulating effect on the economy. Changes in this indicator over time are interpreted as the fiscal impulse. This approach allows the authors to factor in regional heterogeneity and separate the impact of fiscal policy from the endogenous response of fiscal indicators to the economic cycle.

In addition, empirical studies frequently use simpler proxy indicators of expansionary fiscal policy. For example, Alesina & Perotti (1995) classify fiscal policy by the size of the deficit (as a percentage of output in terms of GDP or gross national product (GNP)). They define a deficit exceeding 1.5% of output as expansionary and a deficit below 1.5% as restrictive (in-between values are deemed to be neutral). Such a classification simplifies the assessment of the policy stance but omits cyclical effects and automatic stabilisers. Catao & Terrones (2005), Pekarski (2011), Nguyen (2015), Bhat & Sharma (2020), etc. also use the budget deficit as an indicator characterising the expansionary nature of fiscal policy.

In general, any fiscal impulse indicator should only be viewed as an approximate measure of fiscal policy. Mansur et al. (1986) and Philip & Janssen (2002) emphasise that there is no universal or single method for accurate assessments. The choice of a method depends on the objective, data structure, and desired precision. Any measure of the fiscal impulse provides an approximate reflection of the nature and direction of fiscal policy, and complex macroeconomic models are necessary for a full

understanding of its macroeconomic effects. Nevertheless, applied studies aiming to provide a more comprehensive assessment of the impact of fiscal policy on inflation widely use cyclically adjusted structural budget indicators (a structural deficit / surplus) as a convenient tool.

2.2. Relationship Between Inflation and Fiscal Policy from a Theoretical Perspective

Economic theory defines inflation as a sustained rise in the general price level in the economy. Depending on its sources, two main types of inflation are traditionally distinguished: cost-push inflation and demand-pull inflation.

Cost-push inflation is caused by supply-side shocks amid high aggregate demand and manifests itself in rising production costs that firms pass on to prices amid increased demand. A characteristic example of cost-push inflation is the pandemic period when businesses were forced to raise prices due to disruptions in supply chains, the need to comply with sanitary and epidemiological requirements (especially in public catering), and higher costs associated with adapting to new business conditions.

Demand-pull inflation, in turn, is triggered by excess aggregate demand for goods and services. Government spending² plays a significant role in the structure of aggregate demand.³ To stimulate business activity, governments often resort to increasing government spending, creating a fiscal impulse and implementing expansionary fiscal policy, which boosts consumer and investment activity and, as a result, may put upward pressure on the general price level.

This mechanism is reflected in classical macroeconomic models, particularly in the aggregate demand and aggregate supply (AD–AS) model and the New Keynesian Phillips Curve (NKPC). Although economic theory does not provide an explicit formalised description of the impact of the fiscal impulse on inflation, these models allow tracing the channels through which expansionary fiscal policy affects the dynamics of the general price level.

The AD–AS model developed by John Maynard Keynes is a fundamental concept in economic theory. Keynes proposed this model in the paper *The General Theory of Employment, Interest, and Money* where he laid out in detail his ideas about how the economy operates. The AD–AS model describes the interaction between aggregate demand and aggregate supply in the economy and shows how changes in these components affect the general price level and the level of aggregate output, which is often measured by real GDP. Keynes used this model to analyse macroeconomic problems such as unemployment and inflation and proposed government intervention measures to stabilise the economy.

Assuming nominal price flexibility, higher government spending within this framework shifts the AD curve upwards and to the right. All else being equal, in the short run (SR), this accelerates inflation (pushes up the general price level) and increases the output of goods and services, while in the long run (LR), this leads to inflation and potential output remaining unchanged (Figure 1).

² Government spending includes government consumption (expenditures on government institutions, as well as wages to civil servants), investment expenditures of state-owned enterprises, transfer payments, and interest payments on government bonds.

³ The aggregate demand equation in macroeconomic theory is: $Y = C + I + G + Nx$, where C is consumption, I is investment, G is government spending, and Nx is the balance of trade (exports minus imports).

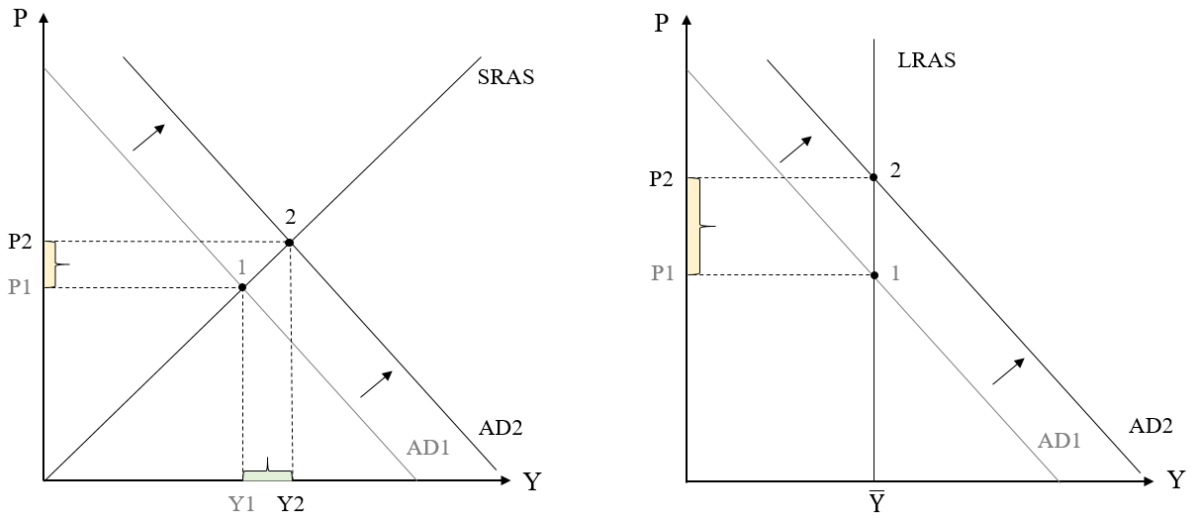


Figure 1. Effect of expansionary fiscal policy in AD–AS model

In the case of contractionary fiscal policy, the effect will be the opposite: following a leftward and downward shift of the AD curve, actual output and the general price level will decline in the short run, while in the long run, this will only lead to a reduction in the general price level. Thus, despite its simplicity, the AD–AS model provides a basic understanding of how fiscal policy can affect the dynamics of output and the general price level in the economy.

The key mechanism linking the fiscal impulse to changes in aggregate demand and, consequently, to price dynamics is the government spending multiplier. In the classical Keynesian model, a change in government spending (ΔG) leads to multiple changes in aggregate output (ΔY) due to the multiplier effect:

$$\Delta Y = \frac{1}{1-MPC} * \Delta G,$$

where

MPC is the marginal propensity to consume.

The size of the multiplier is determined by the structural parameters of the economy: the higher the share of consumption in disposable income, the stronger the initial spending impulse spreads through the income and expenditure chain, creating a cumulative effect on aggregate demand. In the Keynesian model, taking taxes into account, the multiplier takes the form:

$$\Delta Y = \frac{1}{1-MPC(1-t)} * \Delta G,$$

where

t is the marginal tax rate, which acts as a built-in stabiliser by reducing the value of the multiplier.

In the context of this study, it is important that the government spending multiplier directly links the fiscal impulse (a change in the fiscal stance) to a change in aggregate output. The latter, in turn, influences inflationary pressures through the mechanisms described in the AD–AS model and the NKPC. An expansionary fiscal impulse ($\Delta G > 0$ or < 0) increases the output gap, which in the NKPC serves as a proxy for marginal costs, leading to rising inflation. Conversely, a contractionary fiscal impulse ($\Delta G < 0$ or > 0) reduces the output gap and, all else being equal, slows inflation.

An empirical estimation of government spending multipliers in the Russian regions, conducted by Sokolov et al. (2025), reveals significant heterogeneity: the multiplier varies depending on a region’s level of budgetary endowment, share of project expenditures, and amount of federal transfers. In regions with higher debt levels and a greater reliance on subsidies, the multiplier is higher, which is

consistent with the key hypothesis of this study regarding the heterogeneous impact of the fiscal impulse depending on a region's fiscal position.

The Phillips curve, in turn, is a key tool for governments and central banks in shaping the trajectory of economic development and economic policy as a whole. Contemporary research pays particular attention to the NKPC, which posits that current inflation depends on inflation expectations and deviations of average marginal costs from an equilibrium level. Shulgin & Larin (2011) argue that empirical studies often use its hybrid form:

$$\pi_t = \alpha_f E_t \pi_{t+1} + \alpha_p \pi_{t-1} + \lambda \overline{mc} + u_t,$$

where

π_t is current inflation,

$E_t \pi_{t+1}$ is inflation expected by economic agents in a year,

π_{t-1} is inflation in the previous period,

\overline{mc} is the logarithm of the deviation of average marginal costs from equilibrium,

u_t is a random shock,

$\alpha_f, \alpha_p, \lambda$ are estimated sensitivity coefficients.

Shulgin & Larin (2011) also note that, in econometric testing of the NKPC, there is often a problem with marginal costs that cannot be observed directly. Instead, proxy variables are used in practice. Under certain assumptions about labour supply, the GDP gap is linearly related to average marginal costs, which allows it to be used as a proxy variable for \overline{mc} . Thus, among other things, the NKPC model allows estimating the relationship between inflation and the output gap (\hat{Y}):

$$\hat{Y} = (Y - \bar{Y}) / \bar{Y},$$

where

Y is actual output, measured in terms of GDP or GNP,

\bar{Y} is potential output, measured in terms of GDP or GNP.

The dynamics of actual output (Y) are influenced by aggregate demand- and supply-side factors, while the dynamics of potential output (\bar{Y}) – only by supply-side factors, as confirmed in John Maynard Keynes's classical AD–AS model (Figure 1). In the context of the NKPC, the relationship between fiscal policy and inflation can be indirectly assessed through the output gap (Figure 2). In the case of expansionary fiscal policy (increased government spending and/or tax cuts), the output gap widens (actual output increases while potential output remains unchanged, thus widening the gap: $\hat{Y}_0 \rightarrow \hat{Y}_1$), accelerating inflation ($\pi_0 \rightarrow \pi_1$). In the opposite case – contractionary fiscal policy – economic growth falls below its potential level (narrowing the output gap: $\hat{Y}_0 \rightarrow \hat{Y}_2$), thus decelerating inflation ($\pi_0 \rightarrow \pi_2$).

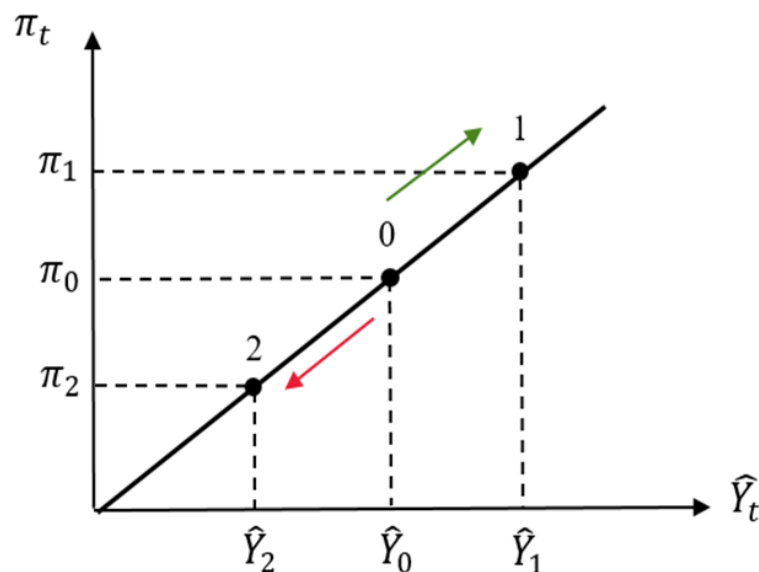


Figure 2. Effect of expansionary and contractionary fiscal policy, expressed in terms of output gap, in NKPC model

At the same time, economic theory devotes particular attention to the concept of the Fiscal Theory of the Price Level (FTPL), which was popularised by U.S. Federal Reserve economist Eric Leeper and Columbia University professor Michael Woodford (Leeper, 1991; Woodford, 1995). According to this theory, inflation is determined not only by the actions of monetary authorities but also by the parameters of fiscal policy, primarily the government's intertemporal budget constraint.

Unlike the traditional monetary approach where the price level is determined by equilibrium in the money market, the FTPL assumes that the nominal value of government debt must be backed, in real terms, by expected future primary budget surpluses (Woodford, 1995; Cochrane, 2001). If current and expected fiscal policy fails to meet this condition, an adjustment occurs through the price level (Leeper, 1991).

From the FTPL perspective, expansionary fiscal policy accompanied by a rise in the primary deficit without a commensurate increase in future surpluses leads to a decline in the real value of public debt due to growing prices. Thus, inflation acts as a mechanism for restoring fiscal sustainability (Cochrane, 2001). Conversely, contractionary fiscal policy, which involves sustainable primary surpluses, reduces inflationary pressures because it increases the coverage of government obligations by future budget revenues (Woodford, 1995). Following this logic, the fiscal impulse can be viewed as an indicator of a fiscal shock capable of directly influencing the price level, provided that monetary policy remains unchanged (Leeper, 1991; Bassetto, 2002).

A key condition for the operation of the FTPL mechanisms is the dominance of fiscal policy over monetary policy, that is, a situation where the central bank does not fully neutralise fiscal imbalances through its policy rate or control over money supply (Leeper, 1991). Under conditions of active coordination between fiscal and monetary policies or under a tight monetary regime, the impact of the fiscal impulse on inflation within the FTPL framework weakens (Woodford, 1995). Nevertheless, this theory provides an important alternative perspective for analysing inflationary processes, emphasising the role of fiscal sustainability and expectations of future fiscal policy in shaping price dynamics (Cochrane, 2001).

Thus, the theoretical framework combining the AD–AS and NKPC models with the concepts of the FTPL and fiscal multipliers allows justifying the expected positive correlation between the fiscal impulse and inflation, as well as the presumed heterogeneity of this effect, which is driven by structural differences in regional economies and their fiscal positions. The next section presents a review of empirical studies that examine in detail the impact of fiscal policy on the growth rate of the general price level.

2.3. Review of Foreign Empirical Studies

Assessing the impact of the fiscal impulse on inflation is of great academic interest, as evidenced by the annual trend in publications on the query ‘the impact of the fiscal impulse on inflation’ in the Google Scholar search engine.⁴ Thus, between 2010 and 2025, the number of articles on the topic increased year on year at an average growth rate of 6.3% (Figure 3).

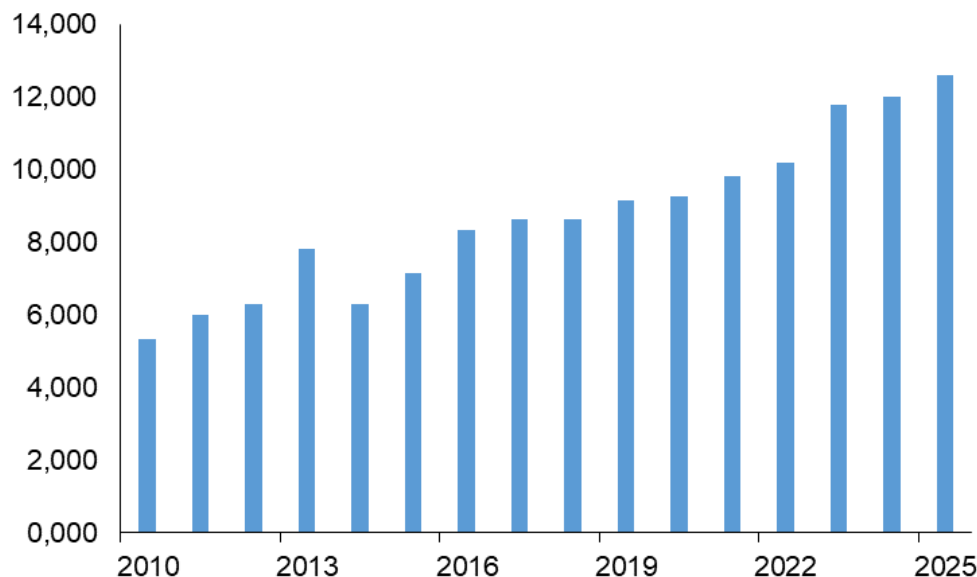


Figure 3. Annual number of publications on query ‘the impact of the fiscal impulse on inflation’ in Google Scholar

It is important to note that empirical studies use various proxy indicators as measures of the fiscal impulse, including those mentioned in Subsection 2.1 of this study – the IMF methodology, the OECD methodology, primary budget deficit indicators, and others. This section provides an overview of studies that directly or indirectly discuss the impact of fiscal policy – expressed in terms of both the fiscal impulse and the nominal growth of government spending as a whole – on inflation.

As discussed earlier (see Subsection 2.2), expansionary fiscal policy is proinflationary in theory. However, at the end of the 20th century, few were able to confirm this thesis relying on real-world data. Employing a comprehensive methodological approach, works by many well-known economists and researchers failed to establish a direct and statistically significant link between inflation and expansionary fiscal policy, which they assessed using the budget deficit indicator or an estimate of the fiscal impulse, among other measures.

For example, applying an econometric approach, e.g. Ordinary Least Squares (OLS) and Vector Autoregression (VAR) models, to assess the impact of the budget deficit on inflation in a number of countries, including the United States, King & Plosser (1985) find no causal relationship between these indicators. Using Granger causality tests and VAR models, Montiel (1989) and Dornbusch et al. (1990) conclude that budget deficits generally tend to offset rather than accelerate inflation, which can primarily be attributed to a combination of exchange rate shocks or the inertia of the process as a whole. Click (1998), in turn, using data from 78 countries, most of which are classified as developing economies, finds no support for the thesis from economic theory either. Employing an OLS approach, Click (1998) concludes that fiscal indicators do not play a significant role in shaping inflationary processes in these countries.

However, as the time horizons of observations expanded and modelling techniques improved at the beginning of the 21st century, studies began to emerge that succeeded in establishing a statistically

⁴ A search engine for scientific publications. Using search robots, the portal indexes metadata and performs full-text searches of scientific literature, including journal articles, preprints, dissertations, books, and technical reports. Users can search for relevant works by author, keyword, or journal title. Advanced search allows users to sort the results by publication, date, and subject area.

significant link between inflation and expansionary fiscal policy. For example, using fixed-effects (FE) regression analysis, Fischer et al. (2002) conclude that the budget deficit is the main driver of high inflation. The authors also demonstrate that, all else being equal, a one-percentage-point improvement (deterioration) in the budget balance-to-GDP ratio typically leads to a one-percentage-point decrease (increase) in inflation, respectively. Additionally, Fischer et al. (2002) emphasise that fluctuations in the budget deficit do not lead to major changes in inflationary processes in countries with low inflation (or during episodes of low inflation in countries with historically high inflation).

Catao & Terrones (2005) significantly contribute to this literature by proposing a non-linear approach to analysing the relationship between the budget deficit and inflation. Unlike previous studies, which failed to yield a clear conclusion, the authors model inflation as non-linearly related to the budget deficit, assessing this relationship as dynamic and using panel methods to distinguish between short- and long-term effects. The results, covering 107 countries over the period of 1960–2001, indicate a strong positive correlation between the budget deficit and inflation in groups of countries with high inflation and developing economies, but not in countries with low inflation and advanced economies.

Furthermore, recent studies do not show the inconsistency in results that was characteristic of the 1990s and 2000s. Generally, most studies of the past decade confirm the thesis that expansionary fiscal policy leads to higher inflation (Bhat & Sharma, 2020; Mori, 2025; Ascari et al., 2024; Hooley et al., 2024). Among other things, this is due to an increase in the number of observations, advances in modelling techniques, and the growing role of fiscal policy in the global economy as a result of stimulus measures, particularly those widely implemented during the COVID-19 pandemic period in 2020–2021.

Using a non-linear autoregressive distributed lag model, Bhat & Sharma (2020) establish an asymmetric long-run positive relationship between the budget deficit and inflation in India. Additionally, the study shows that an increase in the deficit has a more significant impact on inflation, whereas a reduction in the deficit affects inflation to a lesser extent. The authors note that the asymmetric impact of the budget deficit on inflation can be explained by the presence of liquidity constraints, the inflexibility of consumption and investment, as well as downward price rigidity.

Mori (2025) employs a structural vector autoregression model to identify three types of shocks (fiscal, monetary, and other) and analyses their dynamics using the US and eurozone economies as examples. The study shows that the large-scale fiscal stimulus measures implemented during the pandemic, particularly those under the CARES Act and the ARP Act, significantly contributed to US inflation, accounting for a large portion of it in 2020–2021. A similar but more moderate effect is also observed in the eurozone, underscoring the central role of fiscal shocks in inflationary processes in recent years.

Using a Bayesian Vector Autoregression model, Ascari et al. (2024) demonstrate that fiscal policy had a significant impact on inflation in the eurozone countries following the pandemic. By the end of 2022, fiscal shocks led to a 1.5 percentage point increase in the Harmonized Index of Consumer Prices and a 1 percentage point increase in output, measured in terms of the GDP deflator. The authors also demonstrate that demand-side shocks (resulting from expansionary fiscal policy) had a more significant impact on inflation compared to negative supply-side shocks (resulting from declines in production and output). An equally important finding by Ascari et al. (2024) is that the impact of fiscal shocks on inflation in the eurozone countries proved to be heterogeneous. Among the main reasons for this heterogeneity, the authors highlight the varying scale of fiscal measures (e.g. Italy undertook more aggressive fiscal expansion, while France adopted a more restrained approach, which affected inflation rates in these countries accordingly), the structure of support measures (some measures, such as tax cuts, could temporarily curb inflation but indirectly stimulate demand), and different economic sensitivities (Germany and the Netherlands were less affected by the pandemic than France and Italy, which influenced the initial conditions).

Hooley et al. (2024) analyse the phenomenon of fiscal dominance⁵ in Sub-Saharan African countries and its macroeconomic implications. Using a new database on legal restrictions on central bank financing of the government, they show that this practice is widespread and intensifies during

⁵ A situation where the government's fiscal policy takes precedence over the central bank's monetary policy.

periods of fiscal pressure and limited access to alternative sources of borrowing. Empirical results indicate that formal legal limits and IMF programmes curb the extent of fiscal dominance, although they do not always prevent it entirely. The authors find that an increase in central bank lending to the government leads to depreciation of the national currency and, with a time lag, accelerates inflation, primarily through the foreign exchange channel. Thus, the results of the study indirectly confirm the assumptions of the FTPL macroeconomic framework.

At the same time, Checherita-Westphal et al. (2025) confirm the findings of earlier studies demonstrating that the overall stance of expansionary fiscal policy (measured by the fiscal impulse or the change in the fiscal stance) does not have a direct sustained impact on the inflation rate. However, the study also identifies important qualifying findings showing that fiscal policy can still contribute to inflation differentiation through indirect channels and specific instruments. Thus, analysing data from 19 eurozone countries for the period between 1999 and 2019, the authors find that fiscal policy exerts significant influence on inflation differentials indirectly – through the GDP gap channel, which confirms the practical value of the NKPC model: by affecting economic activity in individual countries, it creates differences in inflation. Moreover, this effect is asymmetric and most pronounced during periods when the economy is operating above its potential. An equally significant contribution of this work lies in demonstrating that specific fiscal instruments can play an important role in shaping the dynamics of inflationary processes. As the authors note, a reduction in the VAT rate and growth in public sector wages speed up inflation, likely through increased consumption in the private sector.

However, there are also studies that do not confirm any impact of the aggregate level of government spending on inflation, while identifying an important role of individual components of discretionary fiscal policy. For instance, Dikeogu (2018) shows that, in the short term, total government spending has no statistically significant impact on inflation in Nigeria, whereas capital expenditures, on the contrary, exhibit a negative correlation with inflation. Specifically, a 1 percentage point rise in capital expenditures, all else being equal, leads to a 0.49 percentage point decrease in inflation. A similar conclusion is drawn by Joy et al. (2021) who employ an Autoregressive Distributed Lag (ARDL) approach to establish a negative and statistically significant effect of capital expenditures on inflation in Nigeria.

As a result, based on the review of foreign empirical studies, it is possible to conclude that the impact of the fiscal stimulus on inflation is not universal and depends on macroeconomic conditions, the inflation rate, and economic development, as well as the structure of fiscal measures. While early studies do not find a consistent relationship, contemporary research, particularly based on data from recent crisis periods, more often confirms the proinflationary effect of expansionary fiscal policy, while simultaneously highlighting its heterogeneity across countries. In this context, not only the scale of the fiscal impulse but also specific fiscal policy instruments – primarily differences between direct social and capital expenditures – are of significant importance.

2.4. Review of Domestic Empirical Studies

Compared to the international literature, there are considerably fewer domestic studies that examine the relationship between fiscal policy and inflation. As noted earlier, this may be because inflation spikes in Russia in recent years have been largely driven by surges in government spending

(or other components of aggregate demand) and primarily by supply-side shocks – including those resulting from sanctions against Russia (Figure 4).

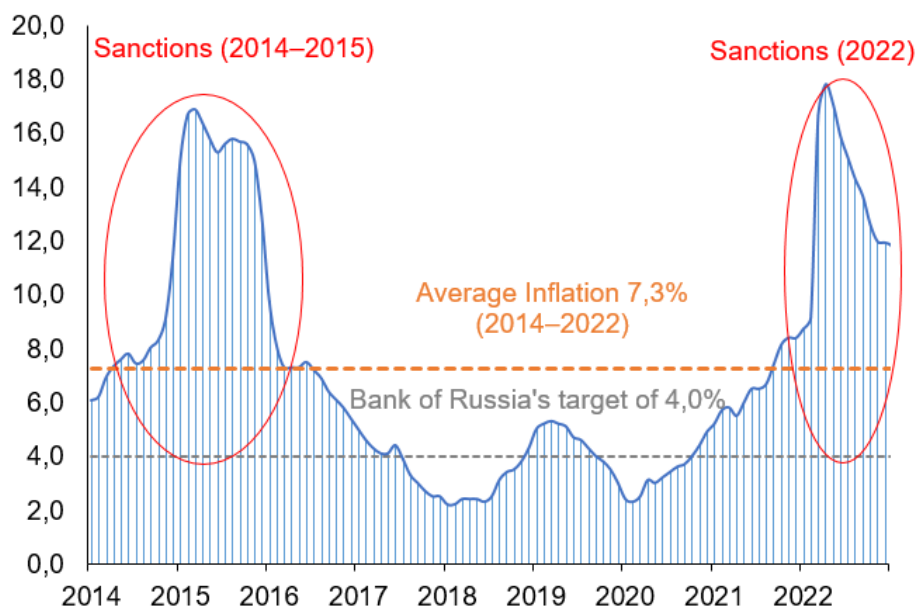


Figure 4. Inflation (% YoY) in Russia from 2014 to 2022

For example, the impact of international sanctions on inflation in Russia has received particular attention in academic circles. The literature includes studies examining the impact of anti-Russian sanctions on inflation and inflation expectations in Russia both in 2014–2015 (Tashamirov et al., 2015; Ponomareva & Magomedov, 2017; Kirilyuk & Osipova, 2019) and 2022 (Matevosova, 2024; Markina, 2024; Krivova, 2024).

However, as the role of fiscal policy in the Russian economy has grown in recent years, studies in this area have become more frequent, being of particular practical value for the development of the scientific problem.

One example of such research is the study by Tyukavkin et al. (2023), which assesses the impact of government spending on inflationary processes in Russia. The results of the ARDL model estimation show that changes in government spending affect inflation over an eleven-month period. In the first ten months, these variables demonstrate a direct correlation, with the maximum effect occurring with a lag of two to three months. However, by the eleventh month, the correlation becomes negative, although the intensity of the effect decreases significantly over time. This study is one of the few attempts in economic-mathematical modelling to quantify the impact of government spending on the inflation rate in Russia. The work significantly contributes to understanding the mechanisms underlying inflationary processes in the country, which develop in accordance with macroeconomic theory.

To assess the effects of expansionary fiscal policy, Polbin (2024) proposes a new specification of the DSGE model for the Russian economy that factors in the preferences of Ricardian and non-Ricardian households, thereby complementing the results of Votinov & Elkin (2018) who also applied the DSGE methodology to assess the fiscal stimulus for the Russian economy. The model used by Polbin (2024) includes two production sectors and is realistically calibrated to analyse fiscal multipliers under various economic conditions. As Polbin notes, under standard conditions with free capital mobility, short-term government spending on final consumption has multipliers greater than 1, especially when monetary policy is accommodative. For government investment and transfers, multipliers are set below 1 due to imports. The author demonstrates that, under strict capital controls, multipliers increase to 1.5, which is reflected in high inflation. Hence, the author concludes that high inflation and the rapid GDP recovery in recent years may indeed be linked to expansionary fiscal policy and capital controls. Additionally, the study shows that growth in government spending on final consumption is most effective

for stimulating GDP, especially in the short term. This study thus confirms the conclusions of John Maynard Keynes's classical macroeconomic (AD–AS) model.

As noted above (see Subsection 2.1), Myasnikov et al. (2023) use the fiscal impulse in the regions – calculated based on the IMF methodology (Fedelino et al., 2009) – as a key indicator reflecting the direction of fiscal policy. Earlier studies, e.g. by Vasilyeva et al. (2009), Platonov (2012), and Bakalova (2012), estimated the cyclically adjusted balance in Russia.

Nevertheless, the study by Myasnikov et al. (2023) remains one of the few in the Russian literature focusing on the impact of the fiscal impulse on inflation. Based on data from 2010 to 2021, the study shows that the influence of the fiscal impulse on inflation in the Russian regions is heterogeneous. The authors find a negative correlation between the level of regional economic development and the impact of the fiscal impulse on inflationary processes: in regions with a relatively low level of GRP, expansionary fiscal policy has a stronger impact on inflation compared to regions where per capita GRP exceeds the national average.

In the regional context, it is also important to emphasise the relevance of studies on heterogeneity in inflationary processes. There are numerous examples of such works in the domestic literature – Deryugina et al. (2018), Zhemkov (2019), Zhurakovskiy et al. (2021), Semiturkin et al. (2021), Oshchepkov et al. (2024). In particular, the results of the study by Oshchepkov et al. (2024) indicate the existence of interregional differences in inflation levels and volatility depending on the structure of the consumer basket. Using cluster analysis, the authors divide the regions into two clusters. The first one includes regions with a higher share of food products in the consumer basket, while the second one – regions with a higher share of services and non-food goods. Regions in Cluster 1 are characterised by higher inflation volatility compared to Cluster 2, which primarily consists of the country's major regional centres.

Furthermore, it should be stressed that the analyses of Russia's fiscal policy often focus on the consolidated budget.⁶ Although the consolidated budget excludes significant federal budget expenditures, such as pension payments and funding for major infrastructure projects, it remains an important tool for assessing overall fiscal policy. Moreover, compared to the federal budget, data on the consolidated budget are more accessible and transparent, which makes it more convenient for analysis.

For example, Gilmundinov & Denisov (2012) analyse the role of non-monetary factors in inflationary processes in Russia. The authors note that the increase in the share of consolidated budget expenditures in GDP from 26.1% in 1999 to 37.3% in 2010 had a significant impact on inflationary pressures in the domestic market for goods and services. Additionally, the growth in government spending was accompanied by a reduction in public debt, which further underscores the significance of fiscal policy in shaping inflationary trends in the country.

2.5. Summary of Findings and Research Gaps

The literature review conducted herein helps systematise the key conclusions regarding the impact of the fiscal impulse on inflationary processes and identify the remaining points of debate. Methodologically, the literature indicates the absence of a unified approach to measuring the fiscal impulse. The most common methods involve assessing the cyclically adjusted balance and structural components of the budget, as used, in particular, by the IMF and the OECD, as well as alternative approaches relying on less complex indicators. Differences in methodologies lead to ambiguity in quantitative estimates and make it difficult to compare results across countries and periods.

Classical theoretical models (AD–AS, NKPC) provide a consistent picture showing that, all else being equal, expansionary fiscal policy increases inflationary pressures. However, the nature and magnitude of the effect may depend on the state of the business cycle, the monetary policy regime, and the degree of coordination between fiscal and monetary authorities (FTPL).

Empirical studies, particularly in the post-pandemic period, more often find a positive correlation between a large-scale fiscal stimulus and accelerating inflation. However, the observed effect is

⁶ A comprehensive summary of all budgetary funds allocated at all territorial-administrative levels (entities) within a single country.

heterogeneous. Some studies highlight differences in the impact of current and capital expenditures, as well as social transfers, indicating the need to factor in the compositional effect of fiscal policy.

In the Russian context, the empirical base remains limited, and the regional level of analysis is presented in a fragmented manner. Regional heterogeneity in income levels, fiscal capacity, and consumption patterns implies potential heterogeneity in the inflationary effects of the fiscal impulse. Hence, there is a lack of systematic studies that would compare regional estimates of the fiscal impulse with changes in the general price level, which creates a significant research gap.

3. Research Question and Data Description

3.1. Research Question

The above review of the literature shows that, despite the existing theoretical foundations and accumulated international empirical results, refining the estimates for Russian regions is an essential task, particularly in the light of the structural transformation of the economy and the growing role of fiscal policy. Filling this gap will not only expand the empirical base on the interplay between fiscal policy and inflation, but will also refine conclusions regarding the scale and transmission channels of the fiscal impulse in the context of economic heterogeneity across the Russian regions.

In view of this, the research question of this study is as follows: ‘How does the fiscal impulse affect inflation in the constituent territories of the Russian Federation?’.

The methodology of this study involves estimating the fiscal impulse in the Russian regions as the difference between a certain neutral level and the actual amount of the deficit / surplus of own-source revenues (see Section 3 for details). The period from 2017 to 2019 is assumed to correspond to a state of macroeconomic equilibrium when regional fiscal policy exerted neither a stimulating nor a restraining effect on inflation.

The main hypothesis (H1) of the study is that the impact of the fiscal impulse on inflation is heterogeneous and depends on the fiscal position of a given region. This hypothesis is based on the fundamental principles of economic theory and is supported by the analysis of relevant foreign and domestic literature. Unlike previous studies, this work focuses not on the presence or absence of the fiscal impulse impact *per se*, but on its heterogeneity across the Russian regions with different fiscal positions. The fiscal position is understood as the structural level of a region’s consolidated budget deficit / surplus based on its own-source funds, calculated as the median value for 2017–2019, which characterises the region’s long-term dependence on borrowing and intergovernmental transfers.

The second hypothesis (H2) of the study is that an increase in the fiscal impulse has a stronger impact on inflation acceleration in the regions with a higher share of ‘inflationary’ expenditures, which include public sector wages, social benefits, and transfers (as they directly stimulate consumer demand), than in other regions.

3.2. Data Description

Consolidated budget expenditures of a constituent territory of the Russian Federation should be considered as a sufficiently representative indicator of aggregate budget expenditures within its territory (Gilmundinova & Denisova, 2012).

In addition to regional and municipal expenditures, the so-called direct federal expenditures – such as pension payments and funding for government procurements – play an important role and are used as indicators by Myasnikov et al. (2023) as they also affect consumer and investment demand in a given region. However, in recent years, a significant portion of this information has become unavailable in open sources, partly due to the specific practices used in accounting of the defence-industrial complex’s expenditures and the remuneration paid to securities agencies personnel.

Concurrently, it is regional and municipal budgets that are the source of funds for remuneration paid to the largest category of public sector employees – staff in preschool, school, and secondary vocational education, as well as outpatient and clinical healthcare. The responsibilities of regional and local authorities also include maintaining educational and healthcare institutions, providing housing and utility services (including urban improvement and road maintenance), as well as organising local and inter-municipal transportation. Expenditures of consolidated budgets thus account for a significant share

of regular public obligations within a given region and can serve as a reliable and practical basis for assessing total budget financing and its impact on the region's economy.

In view of this, the study examines consolidated budget indicators and the CPI of the Russian regions for the period from 2016 Q1 to 2025 Q3. This paper explores data for all constituent territories of the Russian Federation, except for the regions that became part of the country in 2022.

The dependent variable under study is seasonally adjusted (SA) inflation in a particular region. The source of data on monthly inflation (SA) is the Bank of Russia [4]. The data were then converted to be presented in quarter-on-quarter (QoQ) terms.

The following indicators of regional consolidated budgets are used as explanatory variables in this study: total revenues,⁷ total non-repayable receipts,⁸ total expenditures,⁹ including expenditures on public sector wages,¹⁰ government procurements,¹¹ social payments,¹² capital expenditures,¹³ transfers,¹⁴ subsidies,¹⁵ and appropriations.¹⁶ Over the period from 2020 Q1 to 2025 Q3, the examined expenditure items collectively accounted for 99.4% of total consolidated budget expenditures in the Russian regions, with expenditures on public sector wages making up 10.4%, government procurements – 14.7%, social payments – 19.0%, capital expenditures – 9.2%, subsidies – 36.8%, transfers – 1.6%, and appropriations – 7.8%. The data source is Form No. 050317, Roskazna [5]. The aggregated indicators of regional consolidated budgets (revenues, expenditures, non-repayable receipts) were further seasonally adjusted using the X13-ARIMA-SEATS method.

Additionally, the study examines other macroeconomic indicators characterising consumer demand (retail turnover, Rosstat [6]), monetary conditions (the Bank of Russia's benchmark RUONIA,¹⁷ Bank of Russia [7]), and foreign trade conditions (the market exchange rate of the US dollar against the ruble, Bank of Russia [8]). Retail turnover data were converted into QoQ SA terms, while data on RUONIA and the US dollar exchange rate were calculated as the arithmetic mean for a quarter without additional conversions.

⁷ Total consolidated budget revenues (₽ bn). Revenue item code: 010 *** 85 00000000000000.

⁸ Non-repayable receipts (₽ bn). Revenue item code: 010000200000000000000000.

⁹ Total expenditures of the consolidated budget (₽ bn). Expenditure item code: 200 *** 9600 0000000000 000.

¹⁰ Expenditures for personnel payments to ensure the performance of functions by state (municipal) authorities, government institutions, and agencies managing state extra-budgetary funds (₽ bn). Expenditure item code: 200 *** 9600 0000000000 100.

¹¹ Procurements of goods, works, and services to meet state (municipal) needs (₽ bn). Expenditure item code: 200 *** 9600 0000000000 200.

¹² Social security and other payments to the population (₽ bn). Expenditure item code: 200 *** 9600 0000000000 300.

¹³ Capital investment in state (municipal) property (₽ bn). Expenditure item code: 200 *** 9600 0000000000 400.

¹⁴ Intergovernmental transfers (₽ bn). Expenditure item code: 200 *** 9600 0000000000 500.

¹⁵ Subsidies paid to budgetary and autonomous institutions and other non-profit organisations (₽ bn). Expenditure item code: 200 *** 9600 0000000000 600.

¹⁶ Other budget appropriations (₽ bn). Expenditure item code: 200 *** 9600 0000000000 800.

¹⁷ RUONIA (Ruble Overnight Index Average) is the weighted average interest rate on overnight interbank loans (deposits) reflecting the cost of unsecured overnight borrowing.

4. Methodology

4.1. Methodology for Assessing the Fiscal Impulse

Despite its conceptual soundness, replicating the methodology of Myasnikov et al. (2023) – one of the few studies examining the impact of the fiscal impulse on regional inflation – for a more recent period appears challenging for several reasons.

First, a key element of the method by Fedelino et al. (2009), used in the work by Myasnikov et al. (2023), is the estimation of potential output and the output gap at the regional level. For the new period, this task is significantly complicated by structural shifts in the Russian economy, changes in the sectoral structure of the regions, and the lack of up-to-date information on GRP. In the context of frequent shocks, filtering methods and standard procedures for estimating potential lose stability, while the resulting estimates become sensitive to the choice of a specification and sample length, which is also noted by Myasnikov et al. (2023).

Second, a correct cyclical adjustment of budget indicators requires stable and reliable estimates of the elasticities of revenues and expenditures with respect to economic activity. In practice, such elasticities are either estimated using historical data, which may not be representative of the new period, or borrowed from previous studies, thus compromising the accuracy and reproducibility of the results.

Third, the method relies on detailed data about the structure of revenues and expenditures of the Russian regions' federal budgets and assumes their comparability over time. However, the direct application of the adjustments used previously becomes methodologically incorrect since the budget classification, intergovernmental transfer mechanisms, and the role of unplanned expenditures have changed significantly in recent years.

Finally, the multi-step nature of the procedure leads to the accumulation of measurement errors: inaccuracies at the stage of estimating the output gap and cyclical components are directly carried over into the estimate of the fiscal impulse. This is particularly critical when analysing inflation, which is sensitive to measurement noise in explanatory variables.

Given the said limitations, this study employs a simpler and more transparent method for measuring the fiscal impulse, focused on the comparability of the regions and the interpretability of the results.

The proposed approach is based on comparing the actual deficit / surplus of a region's consolidated budget (its own deficit / surplus excluding subsidies)¹⁸ against a conditionally 'neutral' level. The 'neutral' level is assumed to be the deficit / surplus observed during the period of 2017–2019 when economic growth was relatively stable (the output gap was near zero and annual inflation was close to 4%, which is the Bank of Russia's target). Accordingly, the fiscal impulse is defined as the difference between the actual and neutral levels of the deficit / surplus. Therefore, a positive value of the impulse means fiscal expansion, potentially increasing inflationary pressures, while a negative value – fiscal tightening. The framework for assessing the fiscal impulse herein is presented below.

In the first stage, the budget deficit / surplus is estimated based on the consolidated budget's own-source revenues (d) for each region (i) in each period (t):

$$d_{i,t} = \frac{R_{i,t} - E_{i,t} - GT_{i,t}}{R_{i,t} - GT_{i,t}},$$

where

R is total revenues of the consolidated budget,

E is total expenditures of the consolidated budget,

¹⁸ Non-repayable receipts are excluded from the calculation to assess a region's autonomous fiscal policy, separating it from the effect of federal funds redistribution.

GT is the amount of non-repayable receipts.

Next, we estimate the ‘neutral’ level of the budget deficit / surplus based on own-source revenues (\bar{d}^*), which corresponds to the period of stable economic growth when the output gap was near zero and annual inflation was close to the Bank of Russia’s target of 4%. As shown in Figure 5, between 2017 and 2020, the output gap ranged from -2.1% to 0.2%, with the median output gap equalling -0.5%. Annual inflation during this period ranged from 2.2% to 5.3%, with its median level equalling 3.6%. In view of this, the ‘neutral’ level of the budget deficit for each region i is estimated based on its median over 2017–2019 ($T_{inf \sim 4\%; y_{gap} \sim 0\%}$):

$$\bar{d}_i^* = \frac{1}{T} \sum_{t \in T_{inf \sim 4\%; y_{gap} \sim 0\%}} d_{i,t}$$

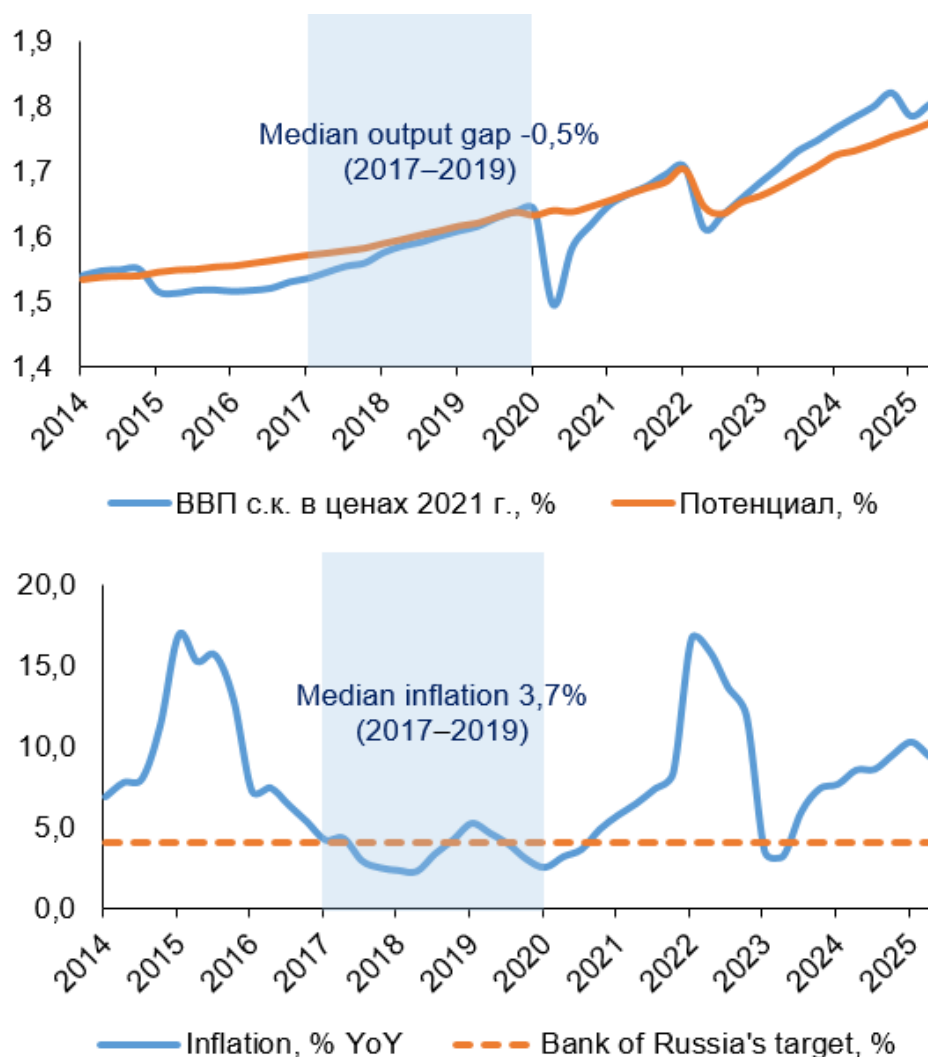


Figure 5. Trends in actual and potential output and inflation in Russia from 2014 to 2025*

*Source: Bank of Russia, Rosstat, author’s calculations.

As a result, the fiscal impulse (bi) is estimated as the difference between the ‘neutral’ and actual levels of the budget deficit / surplus for each region i :

$$bi_{i,t} = \bar{d}_i^* - d_{i,t}$$

It is important to note that the proposed fiscal impulse metric intentionally simplifies the estimation procedure in favour of transparency and reproducibility, omitting the complex cyclical adjustment

characteristic of the IMF and OECD methods. This means that the resulting impulse includes both discretionary measures by regional authorities and the automatic response of the budget to the economic cycle, which should be taken into account when interpreting the results.

This approach deliberately omits the cyclically adjusted balance in favour of the methodological transparency and the stability of estimates over a new time horizon, which allows directly linking the dynamics of regional fiscal policy with inflationary processes and testing the study's main hypothesis regarding the heterogeneous impact of the fiscal impulse on inflation across the Russian regions.

The key idea of the proposed approach is that the fiscal impulse is interpreted not in absolute terms, but relative to a region's individual fiscal position. The reference point of a region with a high structural deficit (e.g. the republics of the North Caucasus) significantly differs from that of a region with a budget surplus (e.g. Moscow, the Tyumen Region). A similar actual level of the deficit may imply expansion for one region and tightening for another. This is why the main hypothesis is that the effect of the fiscal impulse is heterogeneous rather than universal.

4.2. Specifications of Econometric Models

The primary methodological tool in this study is the dynamic regression using the Arellano – Bond instrumental variables method on panel data, estimated based on the System Generalised Method of Moments (System GMM). As Myasnikov et al. (2023) argue, its use allows resolving the endogeneity problem – the presence of covariance between explanatory variables and the error term in the model, which entails bias and the lack of consistency and effectiveness of the obtained coefficient estimates.

The lagged values of the explanatory variables – the second and third lags – serve as instrumental variables in the models. Other macroeconomic indicators were also used as control variables for modelling. Retail turnover and RUONIA were treated as endogenous and instrumented in the same way as inflation and the fiscal impulse – using their own lags.¹⁹ The RUB/USD exchange rate was treated as an exogenous variable. Additionally, a dummy variable for 2022 Q1 was included in the models as an indicator of a structural external shock.

It is important to emphasise that the use of System GMM potentially allows addressing the endogeneity problem, while not guaranteeing elimination of reverse causality. Regional authorities may increase spending in response to accelerating inflation (e.g. when indexing social benefits or implementing anti-crisis measures), which creates a bidirectional relationship between the fiscal impulse and inflation. Using lagged values of regressors as instruments (the second and third lags) mitigates this problem, while not eliminating it. Hence, the obtained estimates should be interpreted as evidence of a stable correlation rather than a strict causality.

The basic econometric model is as follows:

$$(1) \text{ inf}_{i,t} = \beta_1 \text{ bi}_{i,t-1} + \beta_2 \text{ inf}_{i,t-1} + \beta_3 \text{ cons}_{i,t-1} + \beta_4 \text{ RUONIA}_{t-3} + \beta_5 \text{ usd}_{t-1} + \beta_6 D_{2022Q1} + u_{i,t} + e_{i,t},$$

where:

$\text{bi}_{i,t}$ is the fiscal impulse of region i in quarter t (% SA);

$\text{inf}_{i,t}$ is inflation in region i in quarter t (% QoQ SA);

$\text{cons}_{i,t}$ is trade turnover in region i in quarter t (% QoQ SA);

$\text{RUONIA}_{i,t}$ is the Bank of Russia's benchmark RUONIA in quarter t (%);

¹⁹ For RUONIA, its indicator with the third lag – RUONIA_{t-3} – was used as the baseline. The values RUONIA_{t-4} , RUONIA_{t-5} , RUONIA_{t-6} were selected as instruments for it. In this case, the selection of the lags is explained by the time it takes for a key rate change to fully translate into the economy. According to the Bank of Russia's estimates, it takes from three to six quarters for a key rate change to fully translate into inflation dynamics (see [the transcript of the press conference by Bank of Russia Governor Elvira Nabiullina on 16 February 2024](#), accessed: Jul. 2026).

$usd_{i,t}$ is the market exchange rate of the US dollar against the ruble in quarter t ;

D_{2022Q1} is the dummy variable for 2022 Q1;

$u_{i,t}$ is an individual fixed effect;

$e_{i,t}$ is a random error.

To take the issue of endogeneity into account, inflation data in a number of models were transformed further. To this end, the difference between inflation in a given region and nationwide inflation was calculated ($diff_inf$). To explain the differences in inflationary processes (without including macro indicators – interest rates, exchange rates, or external shocks), only regional indicators were used:

$$(2) \text{diff_inf}_{i,t} = \beta_1 bi_{i,t-1} + \beta_2 \text{diff_inf}_{i,t-1} + \beta_3 \text{cons}_{i,t-1} + u_{i,t} + e_{i,t},$$

where:

$diff_inf_{i,t}$ is the difference between inflation in region i and nationwide inflation in quarter t (% QoQ SA).

Both Model (1) and Model (2) assume the inclusion of only individual (regional) effects. Additionally, a specification similar to Model (2) is considered, but one that also takes into account time effects:

$$(3) \text{diff_inf}_{i,t} = \beta_1 bi_{i,t-1} + \beta_2 \text{diff_inf}_{i,t-1} + \beta_3 \text{cons}_{i,t-1} + u_{i,t} + \lambda_{i,t} + e_{i,t},$$

where:

$\lambda_{i,t}$ is time effects.

It is important to emphasise that modelling and hypothesis testing in this study are conducted using data from 2020 Q1 to 2025 Q3. The period from 2016 Q1 to 2019 Q4 is used to estimate the neutral level of the consolidated budget deficit / surplus based on a region's own-source revenues. To test the neutrality of regional fiscal policy during this period, Models (4)–(5) are additionally estimated, whose specifications are similar to those of Models (2)–(3), except that, instead of the budget impulse indicator (bi), actual estimates of the deficit / surplus of the regions' consolidated budgets based on their own-source revenues (d) are used:

$$(4) \text{diff_inf}_{i,t} = \beta_1 d_{i,t-1} + \beta_2 \text{diff_inf}_{i,t-1} + \beta_3 \text{cons}_{i,t-1} + u_{i,t} + e_{i,t},$$

$$(5) \text{diff_inf}_{i,t} = \beta_1 d_{i,t-1} + \beta_2 \text{diff_inf}_{i,t-1} + \beta_3 \text{cons}_{i,t-1} + u_{i,t} + \lambda_{i,t} + e_{i,t}.$$

Additionally, this study assesses the structure of consolidated budget expenditures by region for the period under review (from 2020 Q1 to 2025 Q3). In this case, the average shares of expenditures for each region are estimated for the following categories: public sector wages, government procurements, social payments, capital expenditures, subsidies to municipalities, transfers, and appropriations. The results are compared with nationwide estimates (averaged across all Russian regions), which allows determining the regions demonstrating a more pronounced increase or decrease in the share of expenditures on specific items compared to the national average.

As the literature review shows, the uneven impact of the fiscal stimulus on inflation as a whole (or its absence) may stem from differences in the structure of budget expenditures. In other words, an increase in the overall level of budget expenditures may be 'non-inflationary' due to a high share of capital investment, which has a greater stimulating effect on aggregate supply than on demand. In view of this, it is reasonable to assume that a higher share of social expenditures – which include wages to state and municipal employees, social benefits, and direct transfers (expenditures that directly stimulate consumer demand) – may have a more 'inflationary' character. Therefore, this study additionally proposes the hypothesis that such regions (with a higher share of social expenditures than the national average) might face a more pronounced impact of the fiscal impulse than other regions where the share

of social expenditures is lower (H2). To test this hypothesis, we estimate Models (6)–(8) by introducing the interaction term $D_{high_social_share} * bi_{i,t-1}$:

$$(6) \ inf_{i,t} = \beta_1 bi_{i,t-1} + \beta_2 D_{high_se_share} * bi_{i,t-1} + \beta_3 inf_{i,t-1} + \beta_4 cons_{i,t-1} + \beta_5 RUONIA_{t-3} + \beta_6 usd_{t-1} + \beta_7 D_{2022Q1} + u_{i,t} + e_{i,t},$$

$$(7) \ diff_inf_{i,t} = \beta_1 bi_{i,t-1} + \beta_2 D_{high_se_share} * bi_{i,t-1} + \beta_3 diff_inf_{i,t-1} + \beta_4 cons_{i,t-1} + u_{i,t} + e_{i,t},$$

$$(8) \ diff_inf_{i,t} = \beta_1 bi_{i,t-1} + \beta_2 D_{high_se_share} * bi_{i,t-1} + \beta_3 diff_inf_{i,t-1} + \beta_4 cons_{i,t-1} + u_{i,t} + \lambda_{i,t} + e_{i,t},$$

where:

$D_{high_se_share}$ is the dummy variable equalling 1 if the average share of social expenditures in a region's consolidated budget is higher than the national average and 0 if the average share of social expenditures in a region's consolidated budget is lower than the national average.

All estimated models are constructed using log differences under the Arellano – Bond System GMM (specification `ld`, implementation `pgmm` in R Studio). The dependent variable (inflation inf and its deviation from the federal level $diff_inf$) is measured in percentage points on a quarterly basis. The key explanatory variable (the fiscal impulse bi) is also expressed in percentage points and reflects the deviation of a region's actual deficit / surplus from its neutral level calculated for 2017–2019.

Thus, all coefficients in Models (1)–(8) should be interpreted as a change in the dependent variable in percentage points when the explanatory variable changes by one percentage point.

5. Research Findings

5.1. Descriptive Analysis of Inflation and the Balance and Expenditure Structure of the Budget by Region

This section describes current inflation trends (Subsection 4.1.1), the estimates of the deficit / surplus of a region's own resources, including its neutral level, and the structure of consolidated budget expenditures (Subsection 4.1.2) in the Russian regions. The results provide some additional context to the methodological framework of this study.

Assessment of inflationary processes in the Russian regions

Over the past five years, annual inflation in Russia has remained above the Bank of Russia's target of 4% (Figure 5). Additionally, the volatility of regional inflation has been increasing since 2022, which is attributable to, among other things, external shocks and the structural transformation of the economy (Figures 6 and 7).

In QoQ SA terms, over 2017–2019, the spread (the difference between the minimum and maximum values) of the deviation of regional inflation from the countrywide rate averaged 2.48 percentage points. Moreover, afterwards, this indicator remained higher than during the period of relatively steady economic growth and stable inflation. Thus, in 2020, the spread was 2.51 percentage points, in 2021 – 3.71 percentage points, in 2022 – 7.57 percentage points, in 2023 – 3.70 percentage points, in 2024 – 3.06 percentage points, and in 2025 Q1–Q3 – 3.12 percentage points.

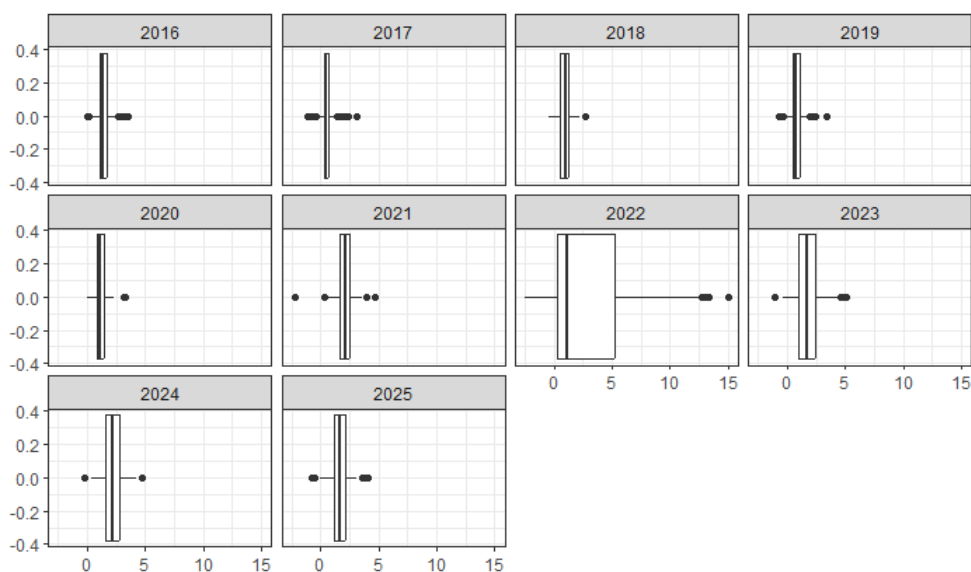


Figure 6. Box plots of regional inflation distribution (% QoQ SA), by year (2016–2025)

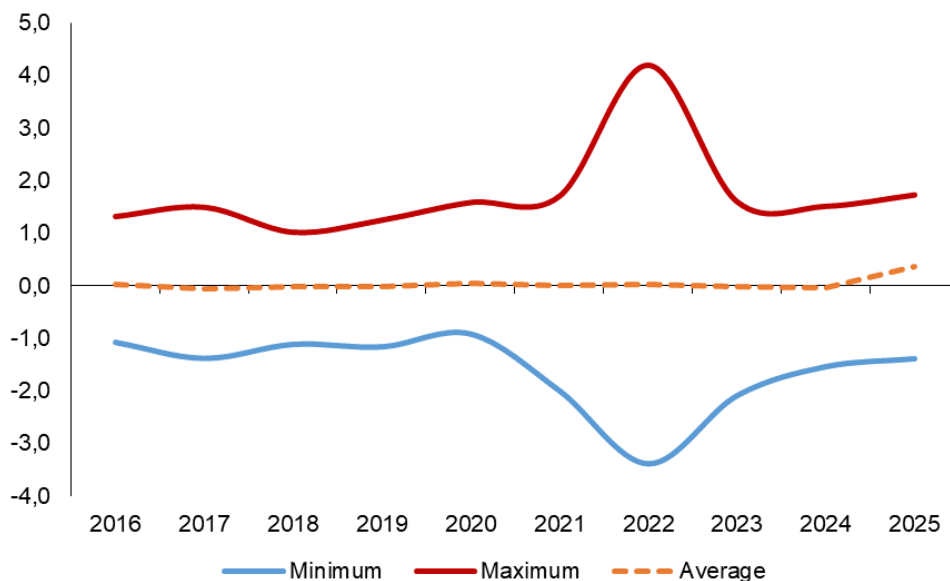


Figure 7. Dynamics of difference between regional and countrywide inflation (% QoQ SA), by year (2016–2025)

One possible reason for the increase in regional inflation volatility may be the growing role of regional fiscal policy (Figure 8).

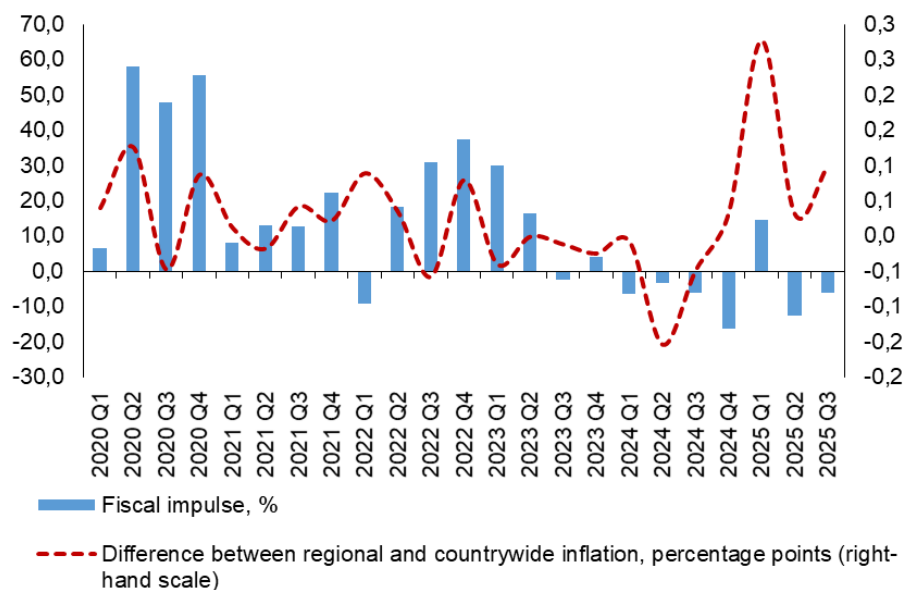


Figure 8. Dynamics of fiscal impulse and difference between regional and countrywide inflation, averaged across all Russian regions

A preliminary assessment of the relationship between the fiscal impulse and inflationary processes in the regions, measured as a deviation from the countrywide dynamics, indicates a weak direct correlation between them, with the correlation coefficient equalling 0.16. Despite the low value of the coefficient, this relationship warrants closer examination: an increase in the fiscal impulse at the regional level may translate into consumer prices not synchronously but with a certain lag, through growth in aggregate demand in local markets for goods and services.

Assessment of the balance and the expenditure structure of the Russian regions' consolidated budgets

An assessment of the neutral level of a deficit / surplus of the consolidated budget based on a constituent territory's own-source revenues allows determining the level of the budget balance that corresponds to a state of relatively sustainable macroeconomic equilibrium – the period of stable economic growth with an output gap close to zero and annual inflation of about 4%, which is the Bank of Russia's target. Within this methodology, a neutral deficit reflects the structural parameters of regional finances and serves as the basis for calculating the fiscal impulse as the difference between the actual and neutral budget balances. A positive value of the impulse is interpreted as fiscal expansion of the economy, whereas a negative value indicates fiscal tightening.

The estimates obtained (Appendix 1) indicate significant heterogeneity across the Russian regions in terms of the magnitude of the neutral budget balance. Nationwide, the neutral level is approximately -18.3%, meaning that under conditions of macroeconomic equilibrium, the regional budget system operates with a moderate structural deficit on average. However, the distribution of values across Russia's constituent territories is extremely heterogeneous: values range from -467.9% in the Chechen Republic to +6.7% in the Tyumen Region. Thus, the variance of the indicator exceeds 470 percentage points, indicating a marked asymmetry in fiscal conditions and differences in the regions' economic bases.

Nevertheless, the regions can be tentatively divided into several groups. The highest values of the structural deficit are characteristic of a number of republics in the North Caucasus and certain territories with a limited tax base. The maximum values are observed in the Chechen Republic (-467.9%) and the Republic of Ingushetia (-421.3%). A significant neutral deficit is also observed in the Republic of Tuva (-251.7%), the Republic of Altai (-227.4%), and the Karachayevo-Circassian Republic (-220.9%). Values below -200% are also characteristic of the Republic of Crimea (-205.6%). Such indicators reflect the structural dependence of these regions' budgets on interbudget transfers and a comparatively low level of own tax revenues. These regions are generally characterised by limited economic diversification, low investment activity, and a significant share of social expenditures.

A relatively high structural deficit (ranging from approximately -200 to -100%) is also observed in a number of regions of the North Caucasus and the Far East, including the Republic of Dagestan (-193.8%), the Kamchatka Territory (-154.7%), the Chukotka Autonomous Area (-152.9%), the Kaliningrad Region (-141.0%), and the Kabardino-Balkarian Republic (-121.3%). These regions are characterised by a combination of a limited tax base and high budgetary obligations, driven by both socioeconomic and geographic factors. In particular, the significant remoteness and low population density in a number of Far Eastern regions increase the cost of infrastructure and public services.

The largest group consists of the regions having a moderate structural deficit ranging from approximately -100 to -30%. This category includes many regions of Central Russia, the Volga Region, and Siberia, including the Kurgan, Bryansk, Pskov, Ivanovo, and Tambov Regions, the Republic of Mari El, the Republic of Karelia, and the Chuvash Republic, as well as the Republic of Altai and the Trans-Baikal Territory. These regions are characterised by relatively limited economic growth and a gradual decline in the industrial base, which constrains the growth of tax revenues. Concurrently, the deficit level there is significantly lower than in the country's most heavily subsidised regions.

A separate group consists of more economically developed regions with a relatively low neutral deficit (approximately from -30 to -10%). This category includes many industrially developed constituent territories, such as the Volgograd, Rostov, Voronezh, Saratov, and Omsk Regions, as well as large regions with diversified economies – the Krasnoyarsk Territory, the City of St Petersburg, and the Moscow Region. A relatively low structural deficit in these territories is associated with a higher tax base, developed industrial production, and a significant volume of business operations.

Regions with a neutral balance of close to zero or a structural surplus occupy a special position. These include the Republic of Tatarstan (-1.0%), the Kemerovo Region (-0.8%), as well as several oil- and gas producing regions – the Yamal-Nenets Autonomous Area (+4.4%) and the Tyumen Region (+6.7%). This group also includes Moscow (+4.2%), which has the most diversified economy and the

largest tax base in the country. These regions are characterised by a high concentration of financial and corporate resources, as well as significant tax revenues from mining and quarrying or large corporations.

Since the median value for 2017–2019 is taken as the neutral deficit level, any deviation vs this period is interpreted as a shock. This period was chosen because of its macroeconomic stability, but it is not the only possible option. Alternative methods for determining the neutral level (e.g. smoothing over a longer interval or using structural estimates) could yield different quantitative values for the impulse, which is a subject for further research.

It is important to note that the classification of the Russian regions based on the estimates of the neutral budget deficit is not entirely stable. As shown in Figure 9, over the course of the three reference years, regions frequently shifted from one group to another. To achieve more stable estimates of the grouping of the Russian regions based on the estimates of the neutral budget deficit level, this study examines cluster analysis tools.

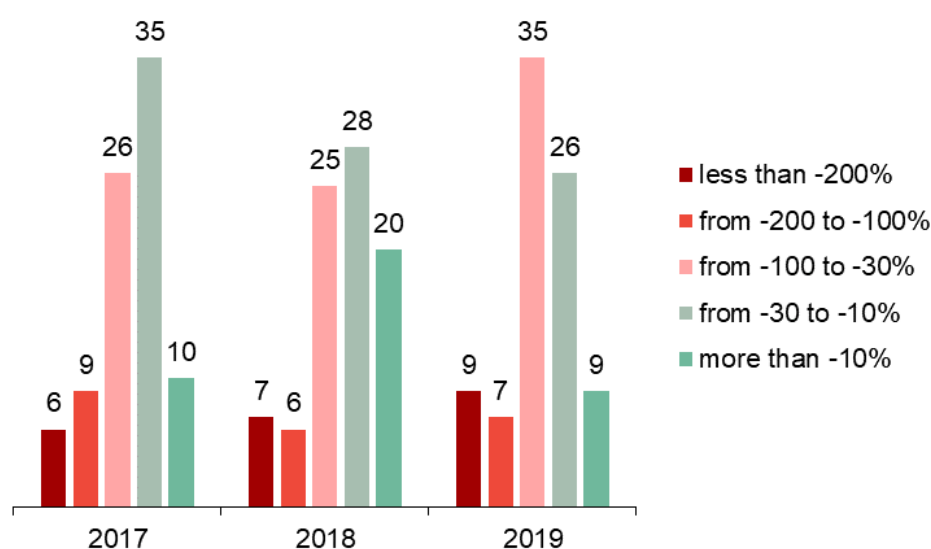


Figure 9. Distribution of Russian regions by neutral level of consolidated budget deficit / surplus based on own-source revenues in 2017–2019, number by group

The k-means algorithm is used as the cluster analysis method, which is one of the most common methods for partitioning numerical observations into clusters based on the distances between objects in a multidimensional feature space.²⁰

To ensure data comparability and prevent differences in the scales of indicators from affecting the clustering results, the original variables are standardised beforehand. The optimal number of clusters is determined based on the analysis of the within-cluster sum of squared deviations. The results of applying the algorithm allow dividing the regions into three clusters (Table 2; Appendix 2, Table 1).

²⁰ The k-means algorithm involves partitioning a set of observations into a predetermined number of clusters in such a way that the objects within a single cluster are as similar to one another as possible, while the differences between clusters are maximised. The similarity between objects is determined based on the distance between their feature values, typically the Euclidean distance. The main idea of the method is to minimise the intra-cluster sum of the squares of the deviations of observations from the centres of the corresponding clusters. Formally, the algorithm's objective is to minimise the intra-cluster variation functional, which is the sum of the squares of the distances between each object and the centre of the cluster to which it belongs.

Table 2

Cluster	Neutral budget balance level, %		
	Minimum	Average	Maximum
1	-227.7	-154.7	-92.4
2	-67.7	-27.9	+5.3
3	-389.4	-285.3	-81.2

Thus, the results obtained indicate the structural heterogeneity of Russia's regional budget systems. The vast majority of the regions have a sustained neutral budget deficit, reflecting the need to continuously raise additional funds in order to maintain government spending at a balanced level. The highest dependence on deficit financing is characteristic of the republics of the North Caucasus and a number of less economically developed regions of Siberia and the Far East. In contrast, the regions having a developed industrial or resource base are significantly more sustainable in terms of their budgets, and in some cases, even have a structural surplus.

This cluster structure (Table 2; Appendix 2, Table 1) allows formulating the concept of a fiscal position for the purposes of econometric analysis. The regions in Cluster 2 (70 constituent territories) are characterised by a neutral fiscal position: their structural deficit is close to the Russian average, ranging from -68 to +5%. The regions in Clusters 1 and 3 (11 and 4 constituent territories, respectively) exhibit elevated and extremely high fiscal vulnerability: their structural deficits reach -227% and -389%, respectively. It is these clusters of constituent territories that may act as the main 'drivers' of the fiscal impulse impact on inflation in Russia's regions.

Appendix 3, Table 1 presents an assessment of the structure of consolidated budget expenditures by Russian region – the shares of expenditures across various categories from 2020 Q1 to 2025 Q3. With the exception of expenditures on social benefits, the sum of all shares is close to 100% – covering the largest categories of expenditures. The share of social expenditures is given separately and is calculated as the sum of the shares of expenditures on public sector wages, social benefits, and transfers. The values for those regions where the share of expenditures on a particular item (capital expenditures or social expenditures) is higher than the national average are highlighted in colour. The analysis shows that, generally, the share of capital expenditures in the regions where the share of social expenditures is higher than the national average does not exceed the national average.

This inverse relationship between the shares of social and capital expenditures reflects a structural trade-off in regional budget policies under tight budgetary constraints. Regions forced to make higher allocations for social support and labour remuneration (often due to objective demographic or economic reasons) inevitably reduce the investment component of the budget. On the one hand, this helps them maintain current social stability, but on the other hand, may limit their potential for long-term economic growth and infrastructure development. Such reallocation towards current expenditures can perpetuate structural imbalances, exacerbating regional disparities in terms of fiscal development and investment attractiveness.

5.2. Assessment of the Neutrality of Fiscal Policy with Respect to Regional Inflation

To confirm the thesis regarding the neutral nature of regional fiscal policy during the period from 2017 to 2019, this study estimates Models (4)–(5) (see Subsection 4.2). The model estimates, as well as the results of their diagnostic tests, are presented in Tables 3 and 4.

Table 3

Estimates of System GMM models to test neutrality of regional fiscal policy on inflation in Russian regions over 2017–2019

	One-way effect	Two-way effects
	Model (4)	Model (5)
Dependent variables		
	<i>diff_inf_t</i>	<i>diff_inf_t</i>
Main explanatory variable		
<i>d_{t-1}</i>	0.0001 (0.0003)	-0.0001 (0.0002)
Control variables		
<i>diff_inf_{t-1}</i>	-0.075 (0.051)	0.088 (0.054)
<i>cons_{t-1}</i>	0.023** (0.011)	0.017** (0.008)
Number of observations	1,020 (12 x 85)	
Note:	* p < 0.1, ** p < 0.05, *** p < 0.01	

Table 4

Results of diagnostic tests for Models (4)–(5), estimates of statistics

Test	Model (4)	Model (5)
Sarghan test	$\chi^2_{est.} = 34.07$ units***	$\chi^2_{est.} = 2.66$ units
First-order autocorrelation	$Z_{est.} = -4.07$ units ***	$Z_{est.} = -3.13$ units ***
Second-order autocorrelation	$Z_{est.} = -1.26$ units	$Z_{est.} = -0.084$ units
Wald test	$\chi^2_{est.} = 7.44$ units*	$\chi^2_{est.} = 363.79$ units***
Note:	* p < 0.1, ** p < 0.05, *** p < 0.01	

In Model (4), which only factors in individual effects, the coefficient for the lagged value of the inflation differential is statistically insignificant ($\beta_2 = -0.075$), indicating the absence of persistent inertia in regional inflation differentials. The key variable – the budget deficit – has no statistically significant effect on inflation ($\beta_1 = 0.0001$) either. A similar result is obtained in Model (5), which additionally factors in time effects: the coefficient for the deficit remains statistically insignificant ($\beta_1 = -0.0001$). This indicates the absence of a systematic relationship between changes in regional budget deficits and inflation differentials relative to the countrywide level.

In both models, the coefficient for retail turnover is statistically significant (*cons_{t-1}*). Its positive value, namely 0.023 in Model (4) and 0.017 in Model (5), indicates that growth in consumer activity contributed to the acceleration of inflation in the region relative to the nationwide level in 2017–2019.

Diagnostic tests (Table 4) only partially confirm the validity of the models. Both models reveal expected first-order autocorrelation, while second-order autocorrelation is absent. The Wald test proves the overall significance of the models, whereas the Sarghan test reveals no issues with the validity of the instruments in Model (5) only.

Thus, the results confirm the assumption about the neutral nature of regional fiscal policy in 2017–2019: changes in regional budget deficits did not have a statistically significant impact on inflationary processes in the Russian regions. According to the estimates, regional inflation differences were driven by consumer demand dynamics to a greater extent.

5.3. Assessment of the Fiscal Impulse Impact on Regional Inflation

Tables 5 and 6 sum up the results of the estimates of Models (1)–(3) described in Subsection 3.2, which allows testing the hypothesis that an increase in the fiscal impulse leads to higher inflation.

Table 5

Estimates of System GMM models for assessing impact of fiscal impulse changes on inflation dynamics in Russian regions

	One-way effect		Two-way effects
	Model (1)	Model (2)	Model (3)
	Dependent variables		
	inf_t	$diff_inf_t$	$diff_inf_t$
Main explanatory variable			
bi_{t-1}	0.00001 (0.0001)	0.0001 (0.0001)	0.0001*** (0.00004)
Control variables			
inf_{t-1}	0.107*** (0.024)		
$diff_inf_{t-1}$		0.151*** (0.035)	0.003 (0.036)
$cons_{t-1}$	0.013 (0.011)	0.001 (0.003)	0.004 (0.004)
$RUONIA_{t-3}$	-0.038*** (0.007)		
usd_{t-1}	0.023*** (0.001)		
$dummy_2022Q1$	8.265*** (0.307)		
Number of observations	1,955 (23 × 85)		
Note:	* p < 0.1 ** p < 0.05, *** p < 0.01		

Table 6

Results of diagnostic tests for Models (1)–(3), estimates of statistics

Test	Model (1)	Model (2)	Model (3)
Sarghan test	$\chi^2_{est.} = 71.34$ points***	$\chi^2_{est.} = 11.05$ points*	$\chi^2_{est.} = 6.44$ units
First-order autocorrelation	$Z_{est.} = -5.08$ units***	$Z_{est.} = -2.80$ units***	$Z_{est.} = -3.44$ units***
Second-order autocorrelation	$Z_{est.} = 0.23$ units	$Z_{est.} = 0.99$ units	$Z_{est.} = 0.89$ units
Wald test	$\chi^2_{est.} = 3,860.81$ units***	$\chi^2_{est.} = 20.21$ units***	(c) $\chi^2_{est.} = 12.35$ units*** (t) $\chi^2_{est.} = 340.3$ units***
Note:	* p < 0.1, (**) p < 0.05, *** p < 0.01		

The results of estimating the dynamic panel models using the System GMM method allow drawing a number of conclusions regarding the factors of regional inflation and, above all, the role of the fiscal impulse.

Model (1), where the dependent variable is regional inflation, shows a statistically significant positive correlation between inflation and its own lagged value ($\beta_2 = 0.107$; $p < 0.01$). This indicates the presence of inertia in inflationary processes in the Russian regions: the acceleration of inflation in the previous quarter is partially carried over to the current period. The impact of the fiscal impulse (β_1)

in this specification turns out to be statistically insignificant. Thus, when controlling for macroeconomic factors (consumer demand, interest rates, exchange rates, and external shocks), the estimate finds no direct effect of changes in the regional fiscal impulse on inflation dynamics.

However, macroeconomic factors turn out to be significant. The coefficient for RUONIA with a three-quarter lag is negative and statistically significant ($\beta_5 = -0.038$; $p < 0.01$), which corresponds to the economic logic of the monetary policy transmission mechanism: policy tightening leads to a slowdown in inflation with a time lag. Conversely, changes in the US dollar exchange rate have a positive and statistically significant effect on inflation ($\beta_6 = 0.023$; $p < 0.01$), reflecting the pass-through of the exchange rate to prices. The structural shock of 2022 Q1 also proved to be significant: the coefficient for the corresponding dummy variable (8.265; $p < 0.01$) indicates a short-term spike in inflation during this period.

In Model (2), the dependent variable is the deviation of regional inflation from the national average (*diff_inf*). This specification allows focusing on differences in inflation dynamics across the Russian regions, excluding the influence of nationwide macroeconomic factors. The estimates show that the inflation differential also exhibits inertia ($\beta_2 = 0.151$; $p < 0.01$), indicating that regional inflation disparities persist over time. However, the coefficients for the fiscal impulse and retail turnover remain statistically insignificant, indicating that these factors do not have a sustained impact on regional inflation differentials.

Model (3) additionally factors in time effects that reflect shocks and macroeconomic changes common to all Russian regions. In this specification, the coefficient for the lagged inflation differential loses statistical significance, indicating that the inertia observed in Model (2) was largely explained by general time-varying economic factors. However, it is Model (3) that identifies a statistically significant positive effect of the fiscal impulse ($\beta_1 = 0.0001$; $p < 0.01$).

Although the coefficient for the lagged fiscal impulse in Model (3) is only 0.0001, its economic significance becomes apparent when the actual volatility of the impulse is taken into account in the data. The analysis of absolute changes in the fiscal impulse ($|\Delta bi_{i,t-1}|$) shows that typical (median) changes amount to 17.0 percentage points, while exceeding 34.4 percentage points in 25% of the quarters under review. The most frequently occurring change is 8.6 percentage points.

Multiplying the model coefficient by these values allows estimating the substantive contribution of the fiscal impulse to inflation dynamics (Appendix 6):

- with a median change in the impulse (17.0 percentage points), the deviation of regional inflation from the countrywide level changes by 0.0017 percentage points;
- with a change in the 75th percentile (34.4 percentage points) – by 0.0034 percentage points; and
- with the most frequent change (8.6 percentage points) – by 0.00086 percentage points.

Thus, even with a small coefficient value, its economic significance becomes evident when factoring in the actual volatility of the fiscal impulse in the regions. Taking into account the statistical significance, the identified relationship may be interpreted as robust and meaningful.

However, the diagnostic tests (Table 6), as before, confirm the validity of the obtained estimates only partially. In all models, the Arellano – Bond test reveals statistically significant first-order autocorrelation ($p < 0.01$), which is an expected result for difference-in-differences models. The critically important absence of second-order autocorrelation (AR(2) is insignificant in all specifications) indicates the soundness of the instrumental variables used. The Wald test confirms the statistical significance of all models in general ($p < 0.01$). The key criterion for selecting a specification is the Sargan test for the validity of the instruments: for Model (3), it does not reject the hypothesis of instrument validity ($p = 0.375$), whereas for Models (1)–(2), the test indicates a potential problem of over-identification ($p < 0.1$ and $p < 0.01$, respectively). Thus, Model (3), which takes into account two-way effects, is the only correctly specified one, and therefore, its results are considered to be the main confirmation of the thesis that an increase in the fiscal impulse leads to rising inflation.

The results of the model estimation provide partial but convincing support for the thesis that the fiscal impulse has a positive correlation with inflation. In the broad model with macroeconomic variables, this effect is not evident; however, analysing regional inflation deviations and factoring in time effects do reveal a statistically significant positive correlation. It is important to emphasise that the identified effect is not homogeneous: as shown in Subsection 4.1.2, the Russian regions differ significantly in terms of the level of the neutral deficit, and the preliminary analysis suggests that the impact of the fiscal impulse may be concentrated in the regions with chronically high structural deficits (Clusters 1 and 3). This suggests that the impact of fiscal policy on inflation manifests itself primarily at the regional level through local demand imbalances, whereas nationwide inflation dynamics are largely determined by macroeconomic factors – monetary policy, exchange rate dynamics, and/or external shocks.

Overall, the estimates from dynamic panel models using the System GMM show that the fiscal impulse has a positive correlation with inflationary processes in the Russian regions. In the specification that takes into account time effects (Model 3), the coefficient for the lagged value of the fiscal impulse is positive and statistically significant, which is consistent with the study's main hypothesis (H1). This indicates that an increased fiscal stimulus at the regional level is accompanied by rising inflationary pressures, likely through an expansion of aggregate demand in the regional economies; however, the magnitude of this effect is small and requires consideration of the structural characteristics of the Russian regions.

5.4. Assessment of the Heterogeneity of the Fiscal Impulse Impact on Regional Inflation

The results presented in Subsection 4.3 indicate the presence of a statistically significant positive correlation between the fiscal impulse and the deviation of regional inflation from the countrywide level in the specification with bidirectional effects (Model (3)). However, as shown in Subsection 4.1.2, the Russian regions differ significantly in their fiscal positions, specifically in the structural level of the consolidated budget deficit relative to own-source revenues, formed during the period of macroeconomic stability from 2017 to 2019. In this regard, the main hypothesis of the study (H1) posits that the impact of the fiscal impulse on inflation is heterogeneous and depends on whether a given region belongs to one cluster or another based on the level of its structural deficit.

To test this hypothesis, specifications similar to Models (1)–(3) were estimated, but on subsamples formed in accordance with the results of the cluster analysis (Subsection 4.1.2). Three groups of regions were considered: Cluster 2 (70 territories with a neutral fiscal position, with the structural deficit ranging from -68% to +5%), Cluster 1 (11 territories with elevated fiscal vulnerability, with the structural deficit ranging from -227 to -92%), and cluster 3 (4 territories with extremely high fiscal vulnerability, with the structural deficit reaching up to -647%).

Results for the regions with a neutral fiscal position

Model estimates for Cluster 2 are presented in Tables 7 and 8.

Table 7

Estimates of System GMM models for assessing impact of fiscal impulse changes on inflation in Russian regions with neutral deficit levels

	One-way effect		Two-way effects
	Model (1_2)	Model (2_2)	Model (3_2)
	Dependent variables		
	inf_t	$diff_inf_t$	$diff_inf_t$
Main explanatory variable			
bi_{t-1}	-0.004** (0.002)	-0.001 (0.001)	-0.0002 (0.001)
Control variables			
inf_{t-1}	0.110*** (0.027)		

$diff_inf_{t-1}$		0.081 (0.058)	-0.013 (0.035)
$cons_{t-1}$	0.026** (0.013)	0.009** (0.003)	0.003 (0.005)
$RUONIA_{t-3}$	-0.038*** (0.007)		
usd_{t-1}	0.023*** (0.002)		
$dummy_2022Q1$	8.437*** (0.298)		
Number of observations	1,610 (23 x 70)		
Note:	* p < 0.1 ** p < 0.05, *** p < 0.01		

Table 8

Results of diagnostic tests for Models (1_2)–(3_2), estimates of statistics

Test	Model (1_2)	Model (2_2)	Model (3_2)
Sarghan test	$\chi^2_{est.} = 59.20$ points***	$\chi^2_{est.} = 69.32$ points	$\chi^2_{est.} = 4.75$ units
First-order autocorrelation	$Z_{est.} = -4.55$ units***	$Z_{est.} = -3.55$ units ***	$Z_{est.} = \text{NaN}$
Second-order autocorrelation	$Z_{est.} = 0.07$ units	$Z_{est.} = 0.68$ units	$Z_{est.} = \text{NaN}$
Wald test	$\chi^2_{est.} = 4,074.18$ units***	$\chi^2_{est.} = 10.30$ units**	(c) $\chi^2_{est.} = 0.43$ units (t) $\chi^2_{est.} = 409.02$ units***
Note:	* p < 0.1 ** p < 0.05, *** p < 0.01		

In the specification with two-way effects (Model 3_2), the coefficient for the lagged budget impulse is statistically insignificant ($\beta_1 = -0.0002$, $p > 0.1$). In Model (1_2) with macroeconomic control variables, the coefficient for bi was also negative but statistically significant. The diagnostic tests for Model (3_2) confirm the correctness of the specification: there is no second-order autocorrelation, the Wald test confirms the significance of time effects ($p < 0.001$), but the Sargin test for Model (1_2) indicates a redundancy of instruments. Overall, for the cluster of the constituent territories with a neutral fiscal stance, no sustained impact of the fiscal impulse on inflation is identified.

Results for the regions with heightened fiscal vulnerability

For this cluster (11 constituent territories), the model estimation involves technical constraints: in the specification with bidirectional effects (Model (3_1)), an error of singularity of the instrument matrix occurs (message ‘the second-step matrix is singular’). This is due to insufficient intra-group variation of the variables in this subsample, which is explained by high inertia of budget indicators in the regions with chronic deficits – their deficits are consistently high, quarterly fluctuations are insignificant, and the time series (23 quarters) is insufficient for a robust estimation of a dynamic model with fixed time effects.

Nevertheless, we managed to estimate specifications with individual effects for Cluster 1 (Models (1_1) and (2_1)), the results of which are presented in Tables 9 and 10.

Table 9

Estimates of System GMM models for assessing impact of fiscal impulse changes on inflation in Russian regions with elevated deficit levels

	One-way effect	
	Model (1_1)	Model (2_1)
	Dependent variables	
	inf_t	$diff_inf_t$
Main explanatory variable		
bi_{t-1}	-0.002 (0.002)	0.002 (0.004)
Control variables		
inf_{t-1}	0.134 (0.095)	
$diff_inf_{t-1}$		-0.893 (0.579)
$cons_{t-1}$	-0.011 (0.013)	0.012 (0.029)
$RUONIA_{t-3}$	-0.029 (0.029)	
usd_{t-1}	0.022*** (0.006)	
$dummy_2022Q1$	9.066*** (1.776)	
Number of observations	253 (23 x 11)	
Note:	* p < 0.1, ** p < 0.05, *** p < 0.01	

Table 10

Results of diagnostic tests for Models (1_1)–(2_1), estimates of statistics

Test	Model (1_2)	Model (2_2)
Sarghan test	$\chi^2_{est.} = 6.67$	$\chi^2_{est.} = 5.71$ units
First-order autocorrelation	$Z_{est.} = \text{NaN}$	$Z_{est.} = 0.065$ units
Second-order autocorrelation	$Z_{est.} = \text{NaN}$	$Z_{est.} = -1.23$ units
Wald test	$\chi^2_{est.} = 1,219.43$ units***	$\chi^2_{est.} = 2.40$ units
Note:	* p < 0.1, ** p < 0.05, *** p < 0.01	

In Model (1_1) with macroeconomic controls, the coefficient for the macro bi is negative but not significant ($\beta_1 = -0.0002$, $p > 0.1$). In Model (2_1) with the dependent variable $diff_inf$, the coefficient for the fiscal impulse is positive but also fails to reach statistical significance. However, it is important to note that the number of observations for this subsample is 253 (11 constituent territories \times 23 quarters), which is 2.5 times less than for Cluster 2 (1,610 observations). The low power of the tests, combined with the small variation in the regressors, prevents unambiguous conclusions; nevertheless, the sign of the coefficient in Model (2_1) is consistent with the general hypothesis of a positive correlation between the fiscal impulse and inflation in the Russian regions.

Results for the regions with extremely high fiscal vulnerability

For Cluster 3, comprising four regions (the Chechen Republic, the Republic of Ingushetia, the Republic of Tyva, and the City of Sevastopol), we were able to estimate only the simplest specification (Model (2_3)) with individual effects and the dependent variable $diff_inf$ (Tables 11 and 12).

Table 11

Estimates of System GMM models for assessing impact of fiscal impulse changes on inflation in Russian regions with extremely high deficit levels

	One-way effect
	Model (2_3)
	Dependent variable
	$diff_inf_t$
Main explanatory variable	
bi_{t-1}	0.0001 (0.0002)
Control variables	
$diff_inf_{t-1}$	1.025 (2.641)
$cons_{t-1}$	-0.029 (0.838)
Number of observations	92 (23 x 4)
<i>Note:</i>	* p < 0.1, ** p < 0.05, *** p < 0.01

Table 12

Results of diagnostic tests for Models (2_3), estimation of statistics

Test	Model (2_3)
Sarghan test	$\chi^2_{est.} = 3.47$
First-order autocorrelation	$Z_{est.} = -0.40$
Second-order autocorrelation	$Z_{est.} = -0.44$
Wald test	$\chi^2_{est.} = 0.32$ units
<i>Note:</i>	* p < 0.1 ** p < 0.05, *** p < 0.01

The coefficient at bi is positive ($\beta_1 = 0.0001$), but statistically insignificant ($p > 0.1$). The diagnostic tests for this model reveal no problems; however, the power of the tests is extremely low due to the small number of observations (92). Estimating the models with time effects for this cluster is impossible due to the degeneracy of the instrument matrix, which is explained by the lack of degrees of freedom given that the cluster includes only four regions and 23 time dummies must be estimated.

The obtained estimates allow drawing a number of substantive conclusions regarding hypothesis H1. First, the fiscal impulse has a statistically significant positive correlation with inflation only in the specifications that include all Russian regions and control for time effects (Model (3)). Dividing the sample by fiscal position reveals that this average effect is not universal but is concentrated in the groups of the regions with elevated and extremely high fiscal vulnerability (Clusters 1 and 3), for which estimating the full specification is impossible due to insufficient variation.

Second, for the regions with a neutral fiscal position (Cluster 2), the positive correlation between the fiscal impulse and inflation is not confirmed. Moreover, some specifications reveal a negative correlation, which may indicate the presence of compensatory mechanisms – for example, in economically developed regions, an increase in budget expenditures may be accompanied by the crowding out of private investment or a rapid adjustment of supply, which offsets the inflationary effect.

Third, the impossibility to estimate correctly the specified models with time effects for Clusters 1 and 3 is a significant result in itself as it shows that fiscal indicators in these regions exhibit high inertia and the variation in the deficit over time is insufficient for employing dynamic panel methods. This implies that fiscal policy in the regions with chronically high deficits is structural rather than cyclical in

nature, and its impact on inflation, as identified in the full sample, manifests itself over a long-term horizon rather than in quarterly dynamics.

The results obtained should be interpreted with technical limitations in mind. For Clusters 1 and 3, it is impossible to estimate the model with time effects due to the degeneracy of the instrument matrix, and therefore, hypothesis H1 can be neither confirmed nor refuted for these groups with the same degree of rigor as for the entire sample. However, the very fact that a significant effect exists in the full sample, combined with its absence in the subsample of the 'neutral' regions, indirectly suggests that the effect is driven by the constituent entities with elevated and extremely high fiscal vulnerability.

5.5. Assessment of the Fiscal Impulse Impact on Regional Inflation, Considering the Expenditure Structure

The paper further examines hypothesis (H2) that the regions with a higher share of social expenditures, which include expenditures on public sector wages, social benefits, and transfers, face a more pronounced inflationary shock in case of an increase in the fiscal impulse. To test this hypothesis, Models (6)–(8) are estimated with the introduction of the interaction term $D_{high_social_share} * bi_{i,t-1}$ (see Subsection 4.2).

Appendix 3, Table 1 shows that about half (~45%) of the country's constituent territories are characterised by a higher share of social expenditures in the total consolidated budget. These are 38 constituent territories that include both more economically developed and less economically developed regions. Additionally, it is important to note that 7 out of the 15 regions in Clusters 1 and 3 (Appendix 2, Table 1) belong to the group of regions with a higher share of social expenditures.

Tables 13 and 14 present the results of the estimated models and the results of the diagnostic tests.

Table 13

Estimates of System GMM models for testing hypothesis about more inflationary impact of fiscal impulse in Russian regions whose share of social spending is above national average

	One-way effect		Two-way effects
	Model (6)	Model (7)	Model (8)
	Dependent variables		
	inf_t	$diff_inf_t$	$diff_inf_t$
Main explanatory variables			
bi_{t-1}	-0.00000 (0.0001)	-0.0001 (0.0001)	0.0001*** (0.00004)
$D_{high_se_share} * bi_{t-1}$	-0.00003 (0.0002)	0.0004*** (0.0001)	0.0001 (0.0001)
Control variables			
inf_{t-1}	0.146*** (0.031)		
$diff_inf_{t-1}$		0.145*** (0.035)	0.001 (0.036)
$cons_{t-1}$	0.014 (0.011)	0.001 (0.003)	0.003 (0.004)
$RUONIA_{t-3}$	-0.013 (0.009)		
usd_{t-1}	0.019*** (0.001)		
$dummy_2022Q1$	8.344*** (0.320)		
Number of observations	1,955 (23 × 85)		
Note:	* p < 0.1 ** p < 0.05, *** p < 0.01		

Table 14

Results of diagnostic tests for Models (6)–(8), estimates of statistics

Test	Model (6)	Model (7)	Model (8)
Sarghan test	$\chi^2_{est.} = 72.23$ points***	$\chi^2_{est.} = 11.04$ points	$\chi^2_{est.} = 8.87$ units
First-order autocorrelation	$Z_{est.} = -4.51$ units***	$Z_{est.} = -2.52$ units **	$Z_{est.} = -3.45$ units ***
Second-order autocorrelation	$Z_{est.} = 0.51$ units	$Z_{est.} = 0.89$ units	$Z_{est.} = 0.88$ units
Wald test	$\chi^2_{est.} = 4,192.44$ units***	$\chi^2_{est.} = 52.07$ units ***	(c) $\chi^2_{est.} = 12.39$ units** (t) $\chi^2_{est.} = 309.58$ units***
Note:	* $p < 0.1$ ** $p < 0.05$, *** $p < 0.01$		

As before, the baseline specification (Model (6)) failed to detect a significant effect of the fiscal impulse on inflation, even when factoring in the expenditure structure. Concurrently, in this version of the model, the variable $RUONIA_{t-3}$ loses its significance ($\beta_6 = -0.13$, $p > 0.1$), while the significance of the coefficient estimates for the remaining variables remains unchanged.

In the specification with individual effects (Model (7)), the interaction coefficient is positive and statistically significant at 1% ($\beta_2 = 0.00038$, $p < 0.001$). This means that, in the regions with a high share of social spending, the impact of the fiscal impulse on the deviation of regional inflation from the countrywide level is considerably stronger than in the regions with a low share. At the same time, the direct effect of the fiscal impulse (bi) in this specification is insignificant and has a negative sign, indicating that the positive correlation between the impulse and inflation identified in Model (3) may be entirely attributable to the regions with a higher share of social obligations. The diagnostic tests for Model (7) confirm its validity: no second-order autocorrelation ($p = 0.376$), the validity of the instruments according to the Sargin test ($p = 0.199$) – in contrast to the results for Model (6) – and the joint significance of the regressors ($p < 0.001$).

However, in the most rigorous specification with two-way effects (Model (8)), which factors in time shocks common to all regions (changes in monetary policy, exchange rates, and terms of trade), the interaction coefficient loses statistical significance ($p = 0.235$). Concurrently, the direct effect of the fiscal impulse remains weakly significant at 10% ($\beta_1 = 0.00008$, $p = 0.058$), which is consistent with the results of Model (3). The diagnostics of Model (7) are also unobjectionable: AR(2) is insignificant ($p = 0.380$), the Sargin test confirms the validity of the instruments ($p = 0.353$), and the Wald tests are significant for the coefficients and time effects.

The results obtained allow drawing a number of conclusions regarding hypothesis H2. First, the structure of budget expenditures does matter in the transmission of the fiscal impulse to inflation; however, this effect is not robust to the inclusion of time factors. In the specification controlling only for regional heterogeneity (Model (7)), hypothesis H2 is convincingly confirmed: socially oriented regions exhibit a significantly stronger inflationary response to the fiscal stimulus. This is consistent with theoretical expectations: expenditures on labour costs, social benefits, and transfers directly increase household disposable income, translating into consumer demand, whereas, for example, capital expenditures have a greater impact on aggregate supply and exhibit a longer lag in their effect on prices.

Second, the disappearance of the interaction's significance when time effects are included (Model (8)) indicates that structural differences across the regions partially correlate with general macroeconomic shocks. In other words, during periods of high volatility (the COVID-19 pandemic in 2020, the sanction pressure in 2022, and monetary policy tightening), the regional heterogeneity in the expenditure structure is offset by factors common to the country as a whole. This can be explained by, among other things, the fact that during crisis periods, social transfers are indexed at the federal level, creating a synchronised inflationary impulse across all constituent territories regardless of their budget structures.

Third, there is some correlation between belonging to the high-deficit clusters (Clusters 1 and 3) and a high share of social expenditures. The analysis of the distribution of the Russian regions (Appendix 2, Table 1; Appendix 3, Table 1) shows that most constituent territories with chronically high structural deficits (the Chechen Republic, the Republic of Ingushetia, the Kabardino-Balkarian Republic, the Karachayevo-Circassian Republic, the Republic of Altai, the Republic of Dagestan, and the Republic of Kalmykia) are all characterised by a high share of social expenditures significantly exceeding the Russian average. This creates a ‘double vulnerability’ effect: such regions not only have a limited tax base and are highly dependent on federal transfers, but also allocate a significant portion of their budget funds for current consumption, which, when a fiscal stimulus occurs, is translated into price increases as quickly as possible.

Hypothesis H2 is confirmed partially. In the specification controlling for regional effects, the impact of the expenditure structure is statistically significant and economically meaningful. However, in the most rigorous specification with bidirectional effects – which is deemed valid based on the diagnostic test results – the interaction coefficient loses its significance. This leads to the conclusion that the expenditure structure is significant, but its role is secondary to general macroeconomic conditions. It is likely that the inflationary effect of the fiscal impulse is primarily determined by the very fact of a chronic deficit (Clusters 1 and 3), while the expenditure structure acts as an additional, while not independent, factor that amplifies the transmission during periods of relative instability.

5.6. Recommendations for Economic Policy and Limitations of the Study

It is important to emphasise that this study includes an additional test conducted to check the obtained econometric modelling results for robustness. To this end, the neutral deficit level was redefined:²¹ instead of the median value for 2017–2019, the arithmetic mean for the same period was used. This alternative specification allows assessing how sensitive the conclusions are to the choice of an aggregation method for the reference period. The results of the assessment show that the qualitative conclusions remain unchanged: the coefficient for the lagged fiscal impulse in Model (3) retains a positive sign and statistical significance ($p < 0.01$). The estimates of all specifications (Models (1)–(8)), obtained using the mean value as the neutral level, are presented in Appendix 5.

The stability test conducted indicates that the identified relationship between the fiscal impulse and regional inflation is not an artefact of the choice of a specific method for calculating the neutral deficit level, but rather points to a stable empirical pattern. The availability of consistent and robust estimates allows formulating a number of recommendations for economic policy, which are presented below.

Recommendations for economic policy

This study makes it possible to formulate a number of recommendations for fiscal and monetary policies.

1. Taking into account regional heterogeneity in the analysis of inflation risks.

The results indicate that the impact of the fiscal impulse on inflation is not universal but is concentrated in the constituent territories with chronically high structural deficits (Clusters 1 and 3). These regions are characterised by high levels of fiscal support (levels 3 and 4 in the proposed classification – see Appendix 2, Table 1), a limited tax base, and a high share of social spending in the budget structure (Appendix 3, Table 1). Concurrently, the analysis of the regions’ weights in the countrywide inflation rate (Appendix 4) shows that the contribution of the constituent territories included in Clusters 1 and 3 into Russia’s aggregate CPI is minimal: their combined weight accounts for about 6% in the national CPI (4.2% for Cluster 1 and 1.8% for Cluster 3 in 2025). In contrast, the constituent territories in Cluster 2, including the largest economic centres (Moscow, the City of St Petersburg, the

²¹ A broader set of robustness checks could include: the use of an alternative estimation method (e.g. the fixed effect-two-stage least squares estimator with exogenous instruments); model estimation using annual data to reduce the impact of short-term volatility; the application of Bayesian panel econometric methods, which are more robust to small samples; and spatial econometric models to take into account interregional inflation spillovers. Employing these approaches is a promising direction for future research.

Moscow Region, the Krasnodar Territory, the Republic of Tatarstan, etc.), account for about 94% in the country's CPI.

This leads to an important conclusion for monetary policy: even significant inflationary pressures in the regions with high fiscal vulnerability does not have a substantial impact on nationwide price dynamics, since their share in consumer spending is small. However, ignoring these regions might be erroneous from a social perspective, as they account for a significant proportion of low-income residents who are most sensitive to rising prices. When analysing inflation risks, the Bank of Russia should monitor inflation differentials, particularly in the regions with a high share of social spending and low budget resources where price shocks might entail more pronounced social consequences.

2. Restructuring of budget expenditures in the regions with high fiscal vulnerability.

The constituent territories in Clusters 1 and 3 face a systemic problem, specifically a high structural deficit combined with a high share of social spending (accounting for up to 58% of the budget in some cases) and a low share of capital investment. This expenditure structure perpetuates dependence on federal transfers and limits economic growth potential. Regional authorities in these constituent territories are advised to re-evaluate their fiscal policy priorities to increase the investment component, even if this requires a temporary reduction in current expenditures. When allocating grants to equalise fiscal capacity, the federal government should incentivise regions to increase the share of capital expenditures, for example, through mechanisms of conditional transfers.

3. Monitoring the fiscal impulse as an indicator of regional policy

The method for assessing the fiscal impulse ($bi_{i,t} = \bar{d}_i^* - d_{i,t}$) proposed in this paper can be used by regional and federal authorities to promptly assess the stance of fiscal policy in the constituent territories of the Russian Federation. A positive value of the impulse indicates that fiscal policy is expansionary relative to a region's long-term fiscal norm, which may signal potential local inflationary pressures. Incorporating this indicator into the monitoring system will enable timely identification of regions where fiscal policy poses heightened risks to price stability.

Limitations of the study

This study has a number of limitations to be taken into account when interpreting the results. These limitations pave the way for future research.

1. Simplified procedure for assessing the fiscal impulse.

The main methodological limitation is the absence of a comprehensive cyclical adjustment of fiscal indicators. The proposed indicator bi is based on comparing the actual deficit with its median value during the 'neutral' period of 2017–2019 and does not allow a complete separation of discretionary fiscal measures from automatic stabilisers. During periods of economic shocks (the COVID-19 pandemic in 2020, the sanction pressure in 2022), regional budget revenues may decline automatically, increasing the deficit regardless of government actions, which is interpreted as a stimulus in the method used herein. This limitation is acknowledged. That said, the simplified approach was chosen due to the lack of reliable quarterly data on GRP and structural shifts in the Russian economy, which makes the application of filtering methods unstable.

2. Ignoring spatial effects.

The models assume that inflation in a region is determined solely by its own characteristics and nationwide macroeconomic factors. However, in the conditions of high interregional integration and goods mobility, inflationary processes can spread across regions (spatial autocorrelation). Price increases in one region, triggered by a fiscal stimulus, may spill over to neighbouring regions through trade links. As a result, the effect for the initiating region would be underestimated, whereas that for the recipient regions would be overestimated. Including spatial lags of the dependent variable (spatial autoregressive and spatial error models) could refine the results, but this is beyond the scope of this study.

3. Excluding the federal budget.

This study only analyses the consolidated budgets of the Russian constituent territories, while it is the federal budget that is a source of funds covering a substantial portion of budget expenditures within the regions (funding for law enforcement agencies, the defence-industrial complex, and major infrastructure projects). Excluding these flows may lead to an underestimation of the aggregate fiscal impulse in a given region. As noted in the introduction, using federal budget data broken down by region has been difficult in recent years due to non-disclosure of a considerable portion of the information, which makes it impossible to eliminate this limitation under current conditions.

4. Technical limitations in estimating the subsamples.

For the constituent territories in Clusters 1 and 3, estimating the models with two-way effects proved to be impossible due to the degeneracy of the instrument matrix, which is explained by high inertia of budget indicators and insufficient variation in the variables within these clusters. As a result, it is impossible to obtain the direct confirmation of hypothesis H1 for these clusters with the same degree of rigor as for the entire sample. Cluster 3 only includes four constituent territories, which does not allow using panel methods with time effects in principle. This limitation is objective in nature and can only be overcome by accumulating a larger number of observations or switching to an annual frequency.

5. The crisis nature of the period under review.

The period under review (2020–2025) encompasses numerous crises: the COVID-19 pandemic, the post-pandemic recovery, the sanction pressure of 2022, and the structural transformation of the national economy. High data volatility and structural shifts reduce the reliability of econometric estimates and make it difficult to distinguish between short-term cyclical effects and long-term trends. The results obtained may not be representative of calm periods with low volatility, as evidenced by the differences between the results for 2017–2019 (neutral policy) and 2020–2025 (significant fiscal stimulus).

6. Conclusion

Monitoring the impact of fiscal policy on inflationary processes at the regional level is an important task for regulatory authorities. Taking into account the heterogeneity of the impact of the fiscal impulse could allow for more accurate forecasting of regional inflation and the development of a balanced fiscal policy at the sub-federal level, taking into account the structural features of each region. Understanding how fiscal policy at the level of Russia's constituent territories translates into price dynamics takes on particular significance in the Russian context today, as the role of a fiscal stimulus has grown substantially in recent years.

From the perspective of macroeconomic theory, the impact of expansionary fiscal policy on inflation is unambiguous. According to the classical AD–AS model, an increase in government spending shifts the aggregate demand curve upwards and to the right, which, all else being equal, accelerates inflation. The NKPC complements this mechanism, showing that an increase in the output gap caused by a fiscal stimulus translates into price growth through marginal costs. The key link in this transmission is the government spending multiplier, the magnitude of which varies depending on the economy's structural characteristics. The FTPL proposes an alternative channel, emphasising the role of fiscal sustainability and expectations regarding future fiscal policy.

Empirical studies show conflicting results: early works found no consistent link between the budget deficit and inflation, whereas contemporary studies, particularly those using post-pandemic data, more often confirm the proinflationary effect of expansionary fiscal policy, highlighting its heterogeneity. As for the Russian literature, such studies at the regional level are fragmentary, and the existing methodologies for assessing a fiscal impulse are difficult to apply to the current period due to data limitations and structural shifts in the economy.

This study proposes an alternative, simpler, and more transparent methodology for estimating a fiscal impulse at the regional level, based on the comparison of a constituent territory's actual consolidated budget deficit from own-source revenues with its 'neutral' level calculated as the median value for the period of macroeconomic stability from 2017 to 2019. The analysis was conducted using panel data for 85 constituent territories of Russia for 2020 Q1–2025 Q3, employing dynamic panel models estimated using the Arellano – Bond System GMM.

The results allow drawing a number of well-founded conclusions. First and foremost, the study confirms the hypothesis regarding the heterogeneous impact of the fiscal impulse depending on a region's fiscal position. In the specification with two-way effects, the coefficient for the lagged fiscal impulse is positive and statistically significant ($\beta_3 = 0.0001$, $p < 0.01$), indicating a positive correlation on average across all constituent territories. It is important to note that the model is estimated using log difference transformation, and therefore, the coefficient reflects the relationship between the changes in the variables. However, to interpret the coefficient's value, it is necessary to take into account the actual volatility of the data. The analysis of absolute changes shows that the typical (median) change in the fiscal impulse is 17.0 percentage points, while exceeding 34.4 percentage points in 25% of the quarters under review (Appendix 5). Multiplying the coefficient by these values yields a measurable effect on the inflation differential: 0.0017 percentage points for the median change and 0.0034 percentage points for the change in the 75th percentile. Thus, the high volatility of the fiscal impulse compensates for the small value of the coefficient, ensuring a meaningful contribution of fiscal policy to regional inflation dynamics.

To confirm the reliability of the conclusions, an additional assessment of the models was conducted using an alternative method for calculating the neutral deficit level – the arithmetic mean for 2017–2019 instead of the median. The results presented in Appendix 4 demonstrate that all qualitative conclusions hold: the coefficient for the lagged fiscal impulse in Model (3) remains positive and statistically significant. This indicates the robustness of the identified relationship and allows the results to be interpreted as a stable empirical link.

When the sample is divided by fiscal position, as determined by the results of the cluster analysis of the structural deficit, it is found that the average effect is concentrated in the constituent territories with high and extremely high fiscal vulnerability (Clusters 1 and 3), whereas for the regions with a neutral

fiscal position (Cluster 2), there is no effect. The very fact that it is impossible to estimate correctly the specified models with time effects for Clusters 1 and 3 due to the degeneracy of the instrument matrix suggests that these regions' budget indicators are highly inertial and their fiscal policy has a structural nature.

Additionally, the study identifies the role of the structure of budget expenditures. In the specification with individual effects, the interaction coefficient between the budget impulse and the dummy variable for a high share of social expenditures is positive and significant, indicating a stronger inflationary response in socially oriented regions. However, in the most rigorous specification with bidirectional effects, the significance of the interaction disappears, while the direct effect remains significant. It is thus possible to conclude that the structure of expenditures does matter, but its role is secondary relative to general macroeconomic conditions and is outweighed by the fiscal stance.

An important result confirming the validity of the methodological assumptions is the assessment of the neutrality of regional fiscal policy over 2017–2019. Changes in the actual regional budget deficits during that period did not have a statistically significant impact on regional inflation differentials, which justifies the use of deviations from the 'neutral' level as a measure of a fiscal stimulus in subsequent years.

From a practical standpoint, an important conclusion is that the contribution of the regions with high fiscal vulnerability to nationwide inflation is minimal. The analysis of the constituent territories' weights in the country's CPI shows that the aggregate contribution of Clusters 1 and 3 to nationwide inflation is about 6%, while Cluster 2 accounts for more than 94% of the CPI. Consequently, even strong local inflationary pressures in the vulnerable regions does not have a substantial impact on nationwide price dynamics, which has important implications for monetary policy: when making its key rate decisions, the Bank of Russia should be primarily guided by price dynamics in the donor regions and major economic centres, while social policy for the regions with high fiscal vulnerability is a focus of special attention.

However, this study has a number of limitations that should be taken into account when interpreting the results. These include a simplified procedure for estimating the fiscal impulse, which does not allow a complete separation of discretionary measures from automatic stabilisers; omission of the spatial effects of interregional inflation spillovers and the federal component of budget expenditures; technical limitations preventing the estimation of the models with time effects for the subsets with a low variation of the variables; and the crisis nature of the period under study (2020–2025), which may limit the representativeness of the results for calm periods.

Promising directions for future research include developing a method for cyclical adjustment of regional budgets using available proxy variables of economic activity, applying spatial econometric models to take into account interregional interactions, assessing the aggregate fiscal impulse by including the federal component as data become available, switching to an annual frequency for analysing long-term effects in the regions with high fiscal vulnerability, and using Bayesian panel econometric methods, which are more robust to small samples.

Overall, the results indicate that the fiscal impulse has a positive correlation with inflation. However, this effect is not universal and is concentrated in the constituent territories with chronically high structural deficits and a high share of social spending, whereas in economically developed regions with a neutral fiscal position, there is no such effect. Understanding this heterogeneity enables more accurate forecasting of regional inflation and developing a balanced fiscal policy at the subfederal level that would take into account the structural characteristics of each region.

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Appendices

Appendix 1

Estimation of the Neutral Level of the Consolidated Budget Deficit / Surplus from Own-source Revenues in Russia's Constituent Territories

Region	Neutral level, %
Altai Territory	-56.34
Amur Region	-22.67
Arkhangelsk Region	-27.57
Astrakhan Region	-18.02
Belgorod Region	-21.28
Bryansk Region	-74.66
Vladimir Region	-27.12
Volgograd Region	-32.22
Vologda Region	-3.91
Voronezh Region	-22.20
Moscow	4.21
City of St Petersburg	-13.08
City of Sevastopol	-90.12
Jewish Autonomous Region	-70.15
Trans-Baikal Territory	-60.10
Ivanovo Region	-58.23
Irkutsk Region	-13.49
Kabardino-Balkarian Republic	-121.31
Kaliningrad Region	-141.02
Kaluga Region	-14.67
Kamchatka Territory	-154.66
Karachayevo-Circassian Republic	-220.92
Kemerovo Region – Kuzbass	-0.79
Kirov Region	-45.70
Kostroma Region	-42.03
Krasnodar Territory	-9.19
Krasnoyarsk Territory	-17.11
Kurgan Region	-83.67
Kursk Region	-33.33
Leningrad Region	-9.11
Lipetsk Region	-24.32
Magadan Region	-67.81
Moscow Region	-11.20
Murmansk Region	-16.07
Nenets Autonomous Area	-10.50
Nizhny Novgorod Region	-15.69
Novgorod Region	-33.68
Novosibirsk Region	-12.40
Omsk Region	-31.77
Orenburg Region	-21.43
Orel Region	-60.12
Penza Region	-47.94
Perm Territory	-8.54
Primorye Territory	-19.60

Pskov Region	-66.48
Republic of Adygea	-65.31
Republic of Altai	-227.35
Republic of Bashkortostan	-18.53
Republic of Buryatia	-93.57
Republic of Dagestan	-193.82
Republic of Ingushetia	-421.29
Republic of Kalmykia	-105.67
Republic of Karelia	-53.41
Komi Republic	-6.86
Republic of Crimea	-205.61
Republic of Mari El	-58.47
Republic of Mordovia	-71.45
Republic of Sakha (Yakutia)	-52.74
Republic of North Ossetia–Alania	-105.66
Republic of Tatarstan	-0.97
Republic of Tyva	-251.70
Republic of Khakassia	-39.09
Russian Federation	-18.28
Rostov Region	-22.48
Ryazan Region	-24.84
Samara Region	-9.98
Saratov Region	-30.61
Sakhalin Region	-7.07
Sverdlovsk Region	-7.96
Smolensk Region	-24.03
Stavropol Territory	-43.65
Tambov Region	-58.09
Tver Region	-16.26
Tomsk Region	-31.05
Tula Region	-21.38
Tyumen Region	6.65
Republic of Udmurtia	-27.69
Ulyanovsk Region	-24.42
Khabarovsk Territory	-35.40
Khanty-Mansi Autonomous Area – Yugra	-7.27
Chelyabinsk Region	-12.74
Chechen Republic	-467.92
Chuvash Republic	-51.05
Chukotka Autonomous Area	-152.93
Yamal-Nenets Autonomous Area	4.45
Yaroslavl Region	-17.81

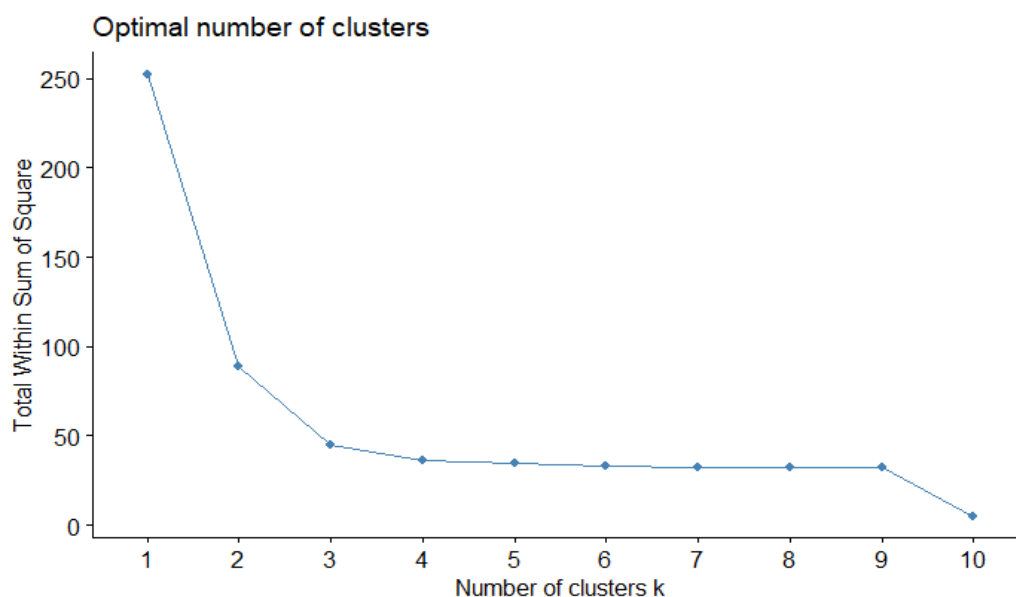
Cluster Analysis Results²²

Figure 1. Determining optimal number of clusters

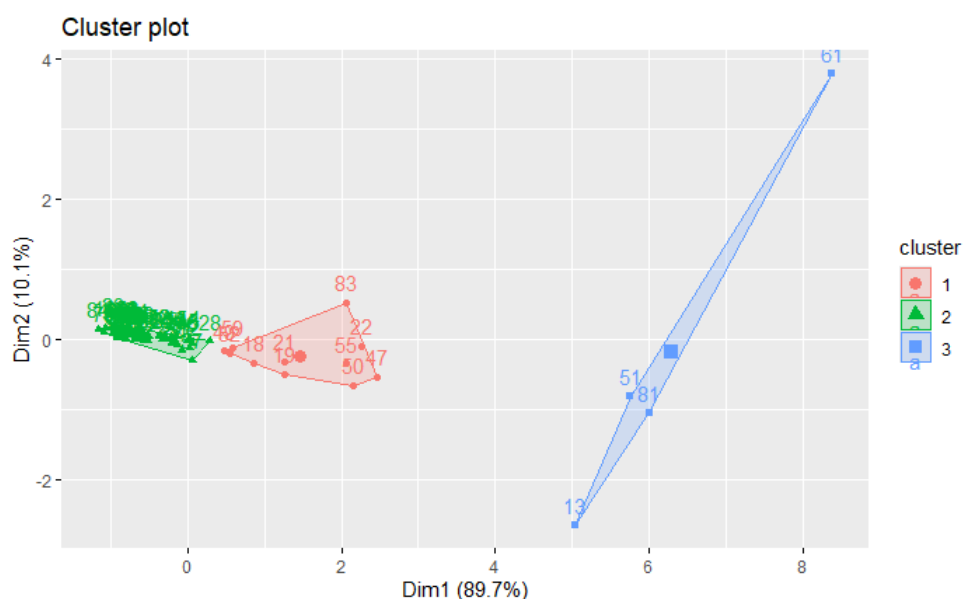


Figure 2. Visualisation of distribution of regions by cluster based on results of k-means algorithm

²² To verify the robustness of the clustering results, an additional assessment was conducted to evaluate the stability of the regional clustering with respect to the temporal structure of the source data. Specifically, a series of alternative clusterings was performed using various subsets of regional budget deficit indicators for 2017–2019. The resulting partitioning variants were compared using the Adjusted Rand Index (ARI). This index is used to quantify the degree of overlap between two cluster partitions and takes values ranging from -1 to 1 (Steinley, 2004). A value close to 1 indicates a nearly complete overlap of the cluster structures. Calculations show that the ARI value was 1, indicating a complete overlap of the resulting regional clusterings under various specifications of the input data. This indicates a high degree of robustness in the cluster analysis results and confirms that the identified cluster structure is not dependent on minor changes in the set of time-series observations used. Thus, the resulting typology of the regions by budget deficit level is characterised by high stability and can be considered statistically valid.

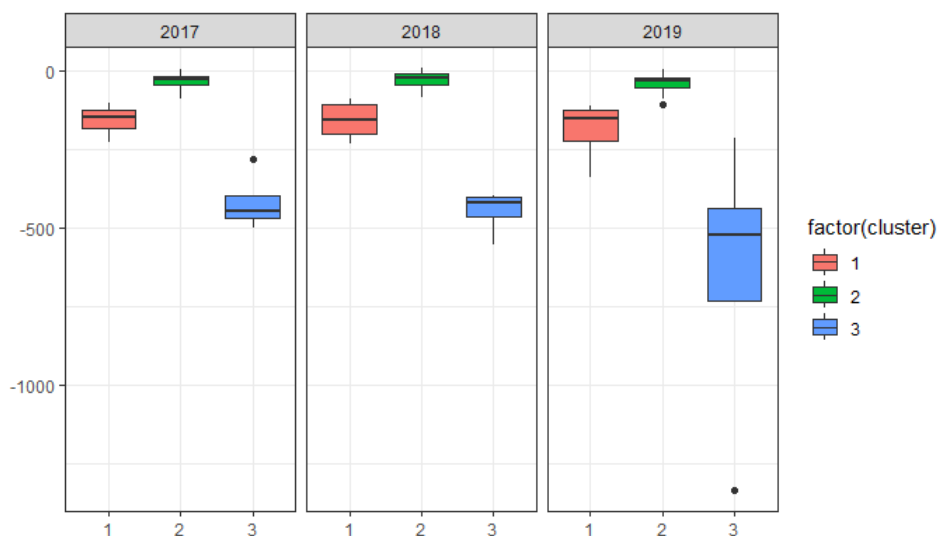


Figure 3. Box plots of distribution of clusters by actual estimate of consolidated budget deficit / surplus from own-source funds based on results of k-means algorithm

Table 1

Region	Cluster	Level of subsidising ²³				
		2024	2023	2022	Mode	
Kabardino-Balkarian Republic	Cluster 1	3	3	3	3	
Kaliningrad Region		2	2	2	2	
Kamchatka Territory		3	4	4	4	
Karachayevo-Circassian Republic		3	3	3	3	
Republic of Altai		3	3	4	3	
Republic of Buryatia		3	3	3	3	
Republic of Dagestan		4	4	4	4	
Republic of Kalmykia		3	3	3	3	
Republic of Crimea		3	3	3	3	
Republic of North Ossetia – Alania		3	3	3	3	
Chukotka Autonomous Area		3	3	3	3	
Altai Territory		Cluster 2	3	3	3	3
Amur Region			2	2	2	2
Arkhangelsk Region	3		3	3	3	
Astrakhan Region	2		2	3	2	
Belgorod Region	1		1	1	1	
Bryansk Region	3		3	3	3	
Vladimir Region	2		3	3	3	
Volgograd Region	2		3	3	3	
Vologda Region	1		1	1	1	
Voronezh Region	2		2	2	2	
Moscow	1		1	1	1	
City of St Petersburg	1		1	1	1	
Jewish Autonomous Region	3		3	3	3	
Trans-Baikal Territory	3		3	3	3	
Ivanovo Region	3		3	3	3	

²³ Level 1 – constituent territories of the Russian Federation that receive no budget subsidies for fiscal equalisation; Level 2 – constituent territories of the Russian Federation whose budgets, over two of the past three reporting fiscal years, had a share of federal budget subsidies not exceeding 10% of the consolidated budget's own-source revenues; Level 3 – constituent territories of the Russian Federation whose budgets, over two of the past three reporting fiscal years, had a share of federal budget subsidies ranging from 10% to 40% of the consolidated budget's own-source revenues; Level 4 – constituent territories of the Russian Federation whose budgets, over two of the past three reporting fiscal years, had a share of federal budget subsidies exceeding 40% of the consolidated budget's own-source revenues. Source: Level of Subsidising in Russia's Constituent Territories // URL: <https://budget.gov.ru/регионы/уровень-дотационности-субъектов-рф> (accessed Jul. 2026).

Irkutsk Region		1	1	1	1
Kaluga Region		1	1	1	1
Kemerovo Region – Kuzbass		2	2	2	2
Kirov Region		3	3	3	3
Kostroma Region		3	3	3	3
Krasnodar Territory		2	2	2	2
Krasnoyarsk Territory		1	1	1	1
Kurgan Region		3	3	3	3
Kursk Region		2	2	2	2
Leningrad Region		1	1	1	1
Lipetsk Region		1	1	1	1
Magadan Region		3	3	3	3
Moscow Region		1	1	1	1
Murmansk Region		1	1	1	1
Nenets Autonomous Area		2	1	1	1
Nizhny Novgorod Region		1	1	1	1
Novgorod Region		2	2	2	2
Novosibirsk Region		2	2	2	2
Omsk Region		2	3	3	3
Orenburg Region		2	2	2	2
Orel Region		3	3	3	3
Penza Region		3	3	3	3
Perm Territory		2	2	1	2
Primorye Territory		2	2	3	2
Pskov Region		3	3	3	3
Republic of Adygea		3	3	3	3
Republic of Bashkortostan		2	2	2	2
Republic of Karelia		3	3	3	3
Komi Republic		2	2	2	2
Republic of Mari El		3	3	3	3
Republic of Mordovia		3	3	3	3
Republic of Sakha (Yakutia)		3	3	3	3
Republic of Tatarstan		1	1	1	1
Republic of Khakassia		3	3	3	3
Rostov Region		2	2	2	2
Ryazan Region		2	2	2	2
Samara Region		1	1	1	1
Saratov Region		3	3	3	3
Sakhalin Region		1	1	1	1
Sverdlovsk Region		1	1	1	1
Smolensk Region		2	2	2	2
Stavropol Territory		3	3	3	3
Tambov Region		3	3	3	3
Tver Region		2	2	2	2
Tomsk Region		2	2	2	2
Tula Region		1	1	1	1
Tyumen Region		1	1	1	1
Republic of Udmurtia		3	3	3	3
Ulyanovsk Region		2	2	2	2
Khabarovsk Territory		2	2	2	2
Khanty-Mansi Autonomous Area – Yugra		1	1	1	1
Chelyabinsk Region		1	1	2	1
Chuvash Republic		3	3	3	3
Yamal-Nenets Autonomous Area		1	1	1	1
Yaroslavl Region		1	1	1	1
City of Sevastopol		3	3	3	3
Republic of Ingushetia	Cluster 3	4	4	4	4
Republic of Tuva		4	4	4	4
Chechen Republic		4	4	4	4

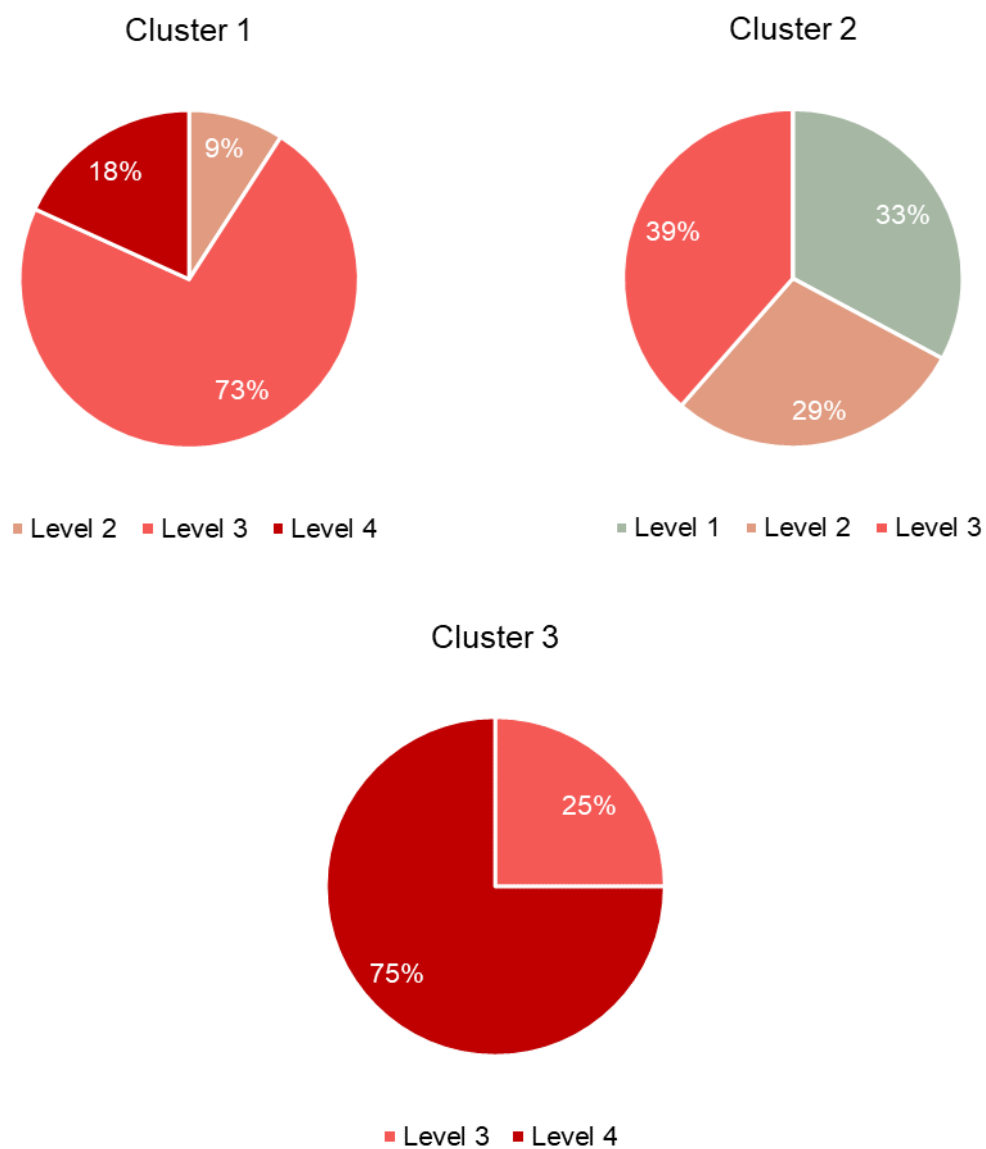


Figure 4. Distribution of clusters by level of subsidising

Appendix 3

Table 1

Region	2020 Q1–2025 Q3							
	Government procurements, %	Labour costs, %	Capital expenditure, %	Social benefits, %	Transfers, %	Subsidies, %	Appropriations, %	Social expenditures, %
Altai Territory	18.5	9.5	6.4	24.9	0.6	35.0	5.0	35.0
Amur Region	13.9	9.5	10.5	17.8	1.2	36.2	10.3	28.4
Arkhangelsk Region	12.4	7.9	8.0	18.4	0.8	41.4	9.6	27.1
Astrakhan Region	17.5	14.9	6.1	25.0	2.0	30.4	3.9	41.9
Belgorod Region	20.6	8.6	6.4	15.6	0.8	41.9	5.3	25.0
Bryansk Region	14.7	6.9	7.3	21.9	0.9	37.5	10.5	29.7
Vladimir Region	9.4	10.4	8.7	21.5	0.8	45.3	3.7	32.8
Volgograd Region	14.3	14.7	7.4	21.5	1.3	33.4	6.5	37.5
Vologda Region	18.1	7.4	9.1	21.6	1.3	37.9	4.6	30.4
Voronezh Region	18.9	16.7	10.2	17.8	1.0	29.2	6.1	35.5
Moscow	7.0	3.3	14.2	13.5	2.9	45.5	13.5	19.6
City of St Petersburg	10.8	5.9	12.4	16.4	3.5	39.8	10.7	25.9
City of Sevastopol	11.8	5.8	25.1	15.2	0.5	33.7	7.9	21.5
Jewish Autonomous Region	13.2	16.8	6.3	22.0	0.9	31.0	8.7	39.7
Trans-Baikal Territory	14.1	9.3	6.5	22.2	1.0	39.6	6.7	32.4
Ivanovo Region	20.6	11.9	5.3	21.4	1.2	34.8	4.5	34.5
Irkutsk Region	14.9	18.6	7.8	21.2	1.7	30.5	5.0	41.4
Kabardino-Balkarian Republic	19.7	26.9	7.5	29.3	1.9	9.0	5.4	58.1
Kaliningrad Region	10.7	5.3	13.1	13.4	2.1	32.2	22.7	20.8
Kaluga Region	16.7	16.7	10.5	18.8	2.0	27.3	7.8	37.4
Kamchatka Territory	10.6	9.7	8.7	10.4	0.3	32.6	27.4	20.4
Karachayev-Circassian Republic	18.4	15.6	15.7	22.1	1.3	21.8	4.8	39.0
Kemerovo Region	16.3	7.7	10.5	18.7	1.1	36.4	8.8	27.5
Kirov Region	22.3	18.4	5.1	20.1	0.9	26.9	5.9	39.4
Kostroma Region	13.8	14.3	7.3	16.8	0.8	39.7	6.5	31.9
Krasnodar Territory	16.1	9.0	10.3	21.6	1.6	36.3	4.5	32.3
Krasnoyarsk Territory	12.6	11.2	6.6	19.4	1.6	39.8	7.9	32.2
Kurgan Region	20.9	18.1	4.6	22.0	0.5	27.9	5.2	40.6
Kursk Region	18.5	15.5	6.3	25.2	0.7	25.8	7.9	41.3
Leningrad Region	16.7	11.2	8.8	13.4	4.6	33.6	11.7	29.2
Lipetsk Region	16.2	6.5	9.9	17.1	1.3	42.1	6.6	24.9
Magadan Region	10.7	16.0	13.5	8.4	0.5	35.2	14.4	24.9
Moscow Region	15.0	7.7	11.3	15.0	2.9	39.9	7.3	25.6
Murmansk Region	9.5	7.9	3.9	18.1	1.6	47.7	10.3	27.6
Nenets Autonomous Area	11.1	12.3	13.8	12.2	0.9	32.5	16.9	25.5
Nizhny Novgorod Region	15.5	7.7	8.4	15.5	1.1	42.3	8.1	24.3
Novgorod Region	18.7	7.8	7.7	18.7	1.2	37.7	7.8	27.7
Novosibirsk Region	15.3	14.4	9.3	19.3	1.6	31.2	7.8	35.2

Omsk Region	13.7	9.8	5.0	21.5	1.1	42.5	5.3	32.4
Orenburg Region	17.7	8.1	5.3	23.3	1.3	39.3	4.5	32.7
Orel Region	15.8	9.3	6.5	20.0	0.9	41.5	5.1	30.2
Penza Region	15.9	8.4	8.4	18.2	0.8	43.6	3.7	27.4
Perm Territory	15.0	7.5	12.2	18.1	3.4	38.8	4.8	29.1
Primorye Territory	14.4	10.1	7.3	20.6	1.1	34.5	11.9	31.8
Pskov Region	12.7	8.2	8.7	20.3	0.3	42.5	6.3	28.9
Republic of Adygea	9.9	8.7	17.7	18.4	0.3	40.7	3.9	27.4
Republic of Altai	21.4	15.1	7.1	17.3	0.5	33.6	5.0	32.9
Republic of Bashkortostan	14.3	7.3	9.0	21.0	2.1	40.0	5.8	30.4
Republic of Buryatia	9.3	7.3	10.6	22.0	0.9	44.3	5.2	30.2
Republic of Dagestan	13.8	20.5	9.8	24.4	1.7	25.3	4.5	46.6
Republic of Ingushetia	10.9	7.9	14.8	28.1	1.3	33.8	2.9	37.3
Republic of Kalmykia	20.8	20.3	7.2	20.5	0.4	25.1	5.1	41.2
Republic of Karelia	16.4	14.0	10.7	21.4	0.6	29.4	6.6	36.0
Komi Republic	9.4	8.8	5.0	18.6	1.8	45.1	10.5	29.1
Republic of Crimea	16.5	5.5	21.3	17.1	0.4	30.7	8.5	22.9
Republic of Mari El	18.1	6.8	9.7	19.7	0.5	38.0	6.5	27.1
Republic of Mordovia	20.6	7.9	11.1	16.6	0.9	35.1	5.9	25.4
Republic of Sakha (Yakutia)	9.0	8.9	10.9	12.4	0.9	37.3	19.7	22.3
Republic of North Ossetia–Alania	15.7	7.1	13.4	22.4	1.2	36.0	4.1	30.7
Republic of Tatarstan	13.4	4.7	11.6	12.2	3.8	46.0	8.2	20.6
Republic of Tuva	11.2	8.3	8.4	18.6	0.7	42.2	10.3	27.7
Republic of Khakassia	10.6	11.2	6.8	21.1	0.9	43.3	4.3	33.3
Rostov Region	12.5	6.9	9.2	23.4	1.5	40.9	5.1	31.8
Ryazan Region	18.3	9.2	7.1	17.3	0.7	40.8	6.2	27.2
Samara Region	15.4	7.0	13.0	18.6	2.1	36.6	6.6	27.7
Saratov Region	16.0	7.2	8.3	20.8	1.0	40.2	5.8	29.0
Sakhalin Region	10.4	10.4	14.3	12.7	2.7	33.4	15.9	25.8
Sverdlovsk Region	12.6	8.9	10.0	19.1	1.5	42.7	4.4	29.5
Smolensk Region	10.2	7.1	5.1	18.5	1.3	53.2	4.0	26.8
Stavropol Territory	12.7	14.9	7.3	27.1	0.7	32.6	4.4	42.6
Tambov Region	15.5	9.7	6.3	17.9	0.9	42.9	5.8	28.4
Tver Region	23.0	9.6	8.3	18.9	1.2	35.7	3.2	29.7
Tomsk Region	14.3	9.8	5.6	20.7	1.1	40.7	6.1	31.5
Tula Region	15.1	12.4	7.3	19.5	1.1	39.7	4.2	33.1
Tyumen Region	12.5	4.5	8.6	12.2	16.3	34.8	11.2	32.9
Republic of Udmurtia	14.9	9.8	5.7	19.3	1.4	42.4	5.3	30.5
Ulyanovsk Region	14.7	12.2	5.9	22.3	1.3	34.0	7.6	35.8
Khabarovsk Territory	10.5	12.7	7.5	20.0	1.7	37.8	9.0	34.4
Khanty-Mansi Autonomous Area – Yugra	10.9	11.9	9.4	15.1	4.3	43.3	5.0	31.3
Chelyabinsk Region	17.0	10.6	7.3	21.3	1.9	36.8	4.8	33.8
Chechen Republic	11.4	4.6	16.5	27.1	1.6	35.5	3.0	33.3
Chuvash Republic	16.9	5.0	7.9	21.0	0.9	43.6	4.6	26.8

Chukotka Autonomous Area	6.8	9.1	9.0	5.5	2.1	26.8	40.3	16.8
Yamal-Nenets Autonomous Area	15.6	11.7	10.3	9.9	3.3	38.1	11.0	24.9
Yaroslavl Region	17.5	7.0	5.7	16.7	1.4	44.0	6.0	25.1

Appendix 4

Average Weight in Russia's CPI from 2016 to 2025

Region	Weight in CPI, %	Cluster
Kabardino-Balkarian Republic	0.37	Cluster 1
Kaliningrad Region	0.59	
Kamchatka Territory	0.34	
Karachayevo-Circassian Republic	0.21	
Republic of Altai	0.09	
Republic of Buryatia	0.45	
Republic of Dagestan	1.38	
Republic of Kalmykia	0.12	
Republic of Crimea	0.89	
Republic of North Ossetia–Alania	0.32	
Chukotka Autonomous Area	0.04	
Altai Territory	1.09	Cluster 2
Amur Region	0.48	
Arkhangelsk Region	0.84	
Astrakhan Region	0.63	
Belgorod Region	1.02	
Bryansk Region	0.60	
Vladimir Region	0.77	
Volgograd Region	1.44	
Vologda Region	0.75	
Voronezh Region	1.25	
Moscow	15.89	
City of St Petersburg	5.33	
Jewish Autonomous Region	0.10	
Trans-Baikal Territory	0.61	
Ivanovo Region	0.64	
Irkutsk Region	1.39	
Kaluga Region	0.70	
Kemerovo Region – Kuzbass	1.39	
Kirov Region	0.73	
Kostroma Region	0.36	
Krasnodar Territory	3.59	
Krasnoyarsk Territory	2.07	
Kurgan Region	0.42	
Kursk Region	0.63	
Leningrad Region	1.27	
Lipetsk Region	0.66	
Magadan Region	0.15	
Moscow Region	6.41	
Murmansk Region	0.71	
Nenets Autonomous Area	0.04	
Nizhny Novgorod Region	2.17	
Novgorod Region	0.35	
Novosibirsk Region	1.57	
Omsk Region	1.03	
Orenburg Region	1.02	

Orel Region	0.40	
Penza Region	0.66	
Perm Territory	1.59	
Primorye Territory	1.50	
Pskov Region	0.31	
Republic of Adygea	0.26	
Republic of Bashkortostan	2.57	
Republic of Karelia	0.40	
Komi Republic	0.54	
Republic of Mari El	0.30	
Republic of Mordovia	0.35	
Republic of Sakha (Yakutia)	0.83	
Republic of Tatarstan	2.56	
Republic of Khakassia	0.29	
Rostov Region	2.57	
Ryazan Region	0.53	
Samara Region	2.03	
Saratov Region	1.17	
Sakhalin Region	0.46	
Sverdlovsk Region	2.92	
Smolensk Region	0.46	
Stavropol Territory	1.45	
Tambov Region	0.45	
Tver Region	0.73	
Tomsk Region	0.67	
Tula Region	0.87	
Tyumen Region	0.91	
Udmurt Republic	0.90	
Ulyanovsk Region	0.63	
Khabarovsk Territory	1.12	
Khanty-Mansi Autonomous Area – Yugra	1.58	
Chelyabinsk Region	2.07	
Chuvash Republic	0.49	
Yamal-Nenets Autonomous Area	0.57	
Yaroslavl Region	0.73	
City of Sevastopol	0.32	
Republic of Ingushetia	0.17	Cluster 3
Republic of Tuva	0.13	
Chechen Republic	0.61	

Appendix 5

Table 1

Estimates from System GMM models assessing impact of fiscal impulse changes on inflation in Russian regions²⁴

	One-way effect		Two-way effects
	Model (1)	Model (2)	Model (3)
	Dependent variables		
	inf_t	$diff_inf_t$	$diff_inf_t$
Main explanatory variable			
bi_{t-1}	-0.00002 (0.0001)	0.0001 (0.0001)	0.0001*** (0.00003)
Control variables			
inf_{t-1}	0.109*** (0.024)		
$diff_inf_{t-1}$		0.154*** (0.034)	0.004 (0.036)
$cons_{t-1}$	0.013 (0.011)	0.002 (0.003)	0.004 (0.004)
$RUONIA_{t-3}$	-0.038*** (0.007)		
usd_{t-1}	0.023*** (0.001)		
$dummy_2022Q1$	8.280*** (0.306)		
Number of observations	1,955 (23 × 85)		
Note:	* p < 0.1 ** p < 0.05, *** p < 0.01		

Table 2

Results of diagnostic tests for Models (1)–(3), estimates of statistics

Test	Model (1)	Model (2)	Model (3)
Sarghan test	$\chi^2_{est.} = 1.70$ points***	$\chi^2_{est.} = 10.11$ points*	$\chi^2_{est.} = 6.32$ units
First-order autocorrelation	$Z_{est.} = -5.00$ units ***	$Z_{est.} = -2.85$ units ***	$Z_{est.} = -3.56$ units ***
Second-order autocorrelation	$Z_{est.} = 0.25$ units	$Z_{est.} = 1.02$ units	$Z_{est.} = 0.92$ units
Wald's test	$\chi^2_{est.} = 3703.74$ units***	$\chi^2_{(est.)} = 21.37$ units***	(c) $\chi^2_{est.} = 14.95$ units*** (t) $\chi^2_{est.} = 341.23$ units***
Note:	* p < 0.1 ** p < 0.05, *** p < 0.01		

²⁴ The average value of the actual deficit / surplus of the consolidated budget based on Russian regions' own-source revenues is considered as the neutral level for calculating the fiscal impulse.

Table 3

Estimates of System GMM models for assessing impact of fiscal impulse changes on inflation in Russian regions with neutral deficit level²⁵

	One-way effect		Two-way effects
	Model (1_2)	Model (2_2)	Model (3_2)
	Dependent variables		
	inf_t	$diff_inf_t$	$diff_inf_t$
Main explanatory variable			
bi_{t-1}	-0.004** (0.002)	-0.001 (0.001)	-0.0002 (0.001)
Control variables			
inf_{t-1}	0.110*** (0.027)		
$diff_inf_{t-1}$		0.081 (0.058)	-0.012 (0.035)
$cons_{t-1}$	0.026** (0.013)	0.009** (0.004)	0.003 (0.005)
$RUONIA_{t-3}$	-0.038*** (0.007)		
usd_{t-1}	0.023*** (0.002)		
$dummy_2022Q1$	8.435*** (0.298)		
Number of observations	1,610 (23 x 70)		
Note:	* p < 0.1 ** p < 0.05, *** p < 0.01		

Table 4

Results of diagnostic tests for Models (1_2)–(3_2), estimates of statistics

Test	Model (1_2)	Model (2_2)	Model (3_2)
Sarghan test	$\chi^2_{est.} = 59.20$ points***	$\chi^2_{est.} = 69.05$ points	$\chi^2_{est.} = 4.95$ units
First-order autocorrelation	$Z_{est.} = -4.56$ units***	$Z_{est.} = -3.54$ units ***	$Z_{est.} = \text{NaN}$
Second-order autocorrelation	$Z_{est.} = 0.07$ units	$Z_{est.} = 0.67$ units	$Z_{est.} = \text{NaN}$
Wald test	$\chi^2_{est.} = 4,054.13$ units***	$\chi^2_{est.} = 10.68$ units**	(c) $\chi^2_{est.} = 0.47$ units (t) $\chi^2_{est.} = 406.20$ units***
Note:	* p < 0.1 ** p < 0.05, *** p < 0.01		

²⁵ The average value of the actual deficit / surplus of the consolidated budget based on the Russian regions' own-source revenues is considered as the neutral level for calculating the fiscal impulse.

Table 5

Estimates of System GMM models for assessing impact of fiscal impulse changes on inflation in Russian regions with high budget deficits²⁶

	One-way effect	
	Model (1_1)	Model (2_1)
	Dependent variables	
	inf_t	$diff_inf_t$
Main explanatory variable		
bi_{t-1}	-0.002 (0.002)	0.002 (0.004)
Control variables		
inf_{t-1}	0.131 (0.091)	
$diff_inf_{t-1}$		-0.909* (0.551)
$cons_{t-1}$	-0.011* (0.007)	0.029 (0.025)
$RUONIA_{t-3}$	-0.032 (0.028)	
usd_{t-1}	0.022*** (0.005)	
$dummy_2022Q1$	9.257*** (2.067)	
Number of observations	253 (23 x 11)	
Note:	* p < 0.1 ** p < 0.05, *** p < 0.01	

Table 6

Results of diagnostic tests for Models (1_1)–(2_1), estimates of statistics

Test	Model (1_2)	Model (2_2)
Sarghan test	$\chi^2_{est.} = 6.821$	$\chi^2_{est.} = 4.59$ units
First-order autocorrelation	$Z_{est.} = \text{NaN}$	$Z_{est.} = 0.03$ units
Second-order autocorrelation	$Z_{est.} = \text{NaN}$	$Z_{est.} = -1.45$ units
Wald test	$\chi^2_{est.} = 1,062.202$ units***	$\chi^2_{est.} = 3.50$ units
Note:	* p < 0.1 ** p < 0.05, *** p < 0.01	

²⁶ The average value of the actual deficit / surplus of the consolidated budget based on the Russian regions' own-source revenues is considered as the neutral level for calculating the fiscal impulse.

Table 7

Estimates of System GMM models for assessing impact of fiscal impulse changes on inflation in Russian regions with extremely high budget deficits²⁷

One-way effect	
Model (2_3)	
Dependent variable	
<i>diff_inf_t</i>	
Main explanatory variable	
<i>bi_{t-1}</i>	0.0002 (0.0005)
Control variables	
<i>diff_inf_{t-1}</i>	1,045 (3,367)
<i>cons_{t-1}</i>	0.102 (1.009)
Number of observations	92 (23 x 4)
Note:	* p < 0.1 ** p < 0.05, *** p < 0.01

Table 8

Results of diagnostic tests for Models (2_3), estimation of statistics

Test	Model (2_3)
Sarghan test	$\chi^2_{est.} = 3.20$ units
First-order autocorrelation	$Z_{est.} = -0.25$ units
Second-order autocorrelation	$Z_{est.} = -0.05$ units
Wald test	$\chi^2_{est.} = 0.58$ units
Note:	* p < 0.1 ** p < 0.05, *** p < 0.01

²⁷ The average value of the actual deficit / surplus of the consolidated budget based on the Russian regions' own-source revenues is considered as the neutral level for calculating the fiscal impulse.

Table 9

Estimates of System GMM models for testing hypothesis of more inflationary impact of fiscal impulse in Russian regions with share of social spending exceeding national average²⁸

	One-way effect		Two-way effects
	Model (6)	Model (7)	Model (8)
	Dependent variables		
	inf_t	$diff_inf_t$	$diff_inf_t$
Main explanatory variables			
bi_{t-1}	0.00002 (0.0001)	-0.0001 (0.0001)	0.0001*** (0.00004)
$D_{high_se_share} * bi_{t-1}$	-0.0001 (0.0002)	0.0004*** (0.0001)	0.0001 (0.0001)
Control variables			
inf_{t-1}	0.145*** (0.031)		
$diff_inf_{t-1}$		0.146*** (0.036)	0.001 (0.036)
$cons_{t-1}$	0.014 (0.012)	0.001 (0.003)	0.003 (0.004)
$RUONIA_{t-3}$	-0.013 (0.009)		
usd_{t-1}	0.019*** (0.002)		
$dummy_2022Q1$	8.343*** (0.322)		
Number of observations	1,955 (23 × 85)		
Note:	* p < 0.1 ** p < 0.05, *** p < 0.01		

Table 10

Results of diagnostic tests for Models (6)-(8), estimates of statistics

Test	Model (6)	Model (7)	Model (8)
Sarghan test	$\chi^2_{est.} = 72.47$ points***	$\chi^2_{est.} = 11.76$ points	$\chi^2_{est.} = 9.13$ units
First-order autocorrelation	$Z_{est.} = -4.63$ units***	$Z_{est.} = -2.47$ units **	$Z_{est.} = -3.56$ units ***
Second-order autocorrelation	$Z_{est.} = 0.51$ units	$Z_{est.} = 0.87$ units	$Z_{est.} = 0.91$
Wald test	$\chi^2_{est.} = 4161.87$ units***	$\chi^2_{est.} = 48.89$ units***	(c) $\chi^2_{est.} = 12.74$ units** (t) $\chi^2_{est.} = 316.03$ units***
Note:	* p < 0.1 ** p < 0.05, *** p < 0.01		

²⁸ The average value of the actual deficit / surplus of the consolidated budget based on the Russian regions' own-source revenues is considered as the neutral level for calculating the fiscal impulse.

Appendix 6

Estimates of Fiscal Impulse Changes and Deviations of Regional Inflation from the Countrywide Rate

Indicator	$\Delta bi_{i,t-1}$, p.p.	$\Delta diff_inf_{i,t-1}$, p.p.
25 th percentile	7.71	0.25
Median	16.99	0.55
75 th percentile	34.39	1.07
Average	48.94	0.80
Standard deviation	207.46	0.84
Coefficient of variation	12.21	1.52