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Uncertainty Shock, Fiscal Debt and Inflation Expectation:
An Analysis of Russian Monetary Policy Response

BY

Mercy Gabriel Ezech
NU Student Number: 202244497

APPROVED

BY

Assistant Professor First Name, Surname of Advisor

Signature of Principal Thesis Adviser

Assistant Professor First Name, Surname of Second Reader

_____, and
Signature of the Committee Member

First Name and Surname of External Reviewer
Name of the University

ON

The 10th day of May, 2026.

Statement on the Use of Artificial Intelligence

Artificial Intelligence (AI) tools were utilized in my research solely for technical support purposes, including the interpretation of software error messages, debugging of R codes, language refinement, and formatting assistance in $\text{\LaTeX}$. All econometric estimations, theoretical interpretations, empirical analyses, and final research conclusions remain the original intellectual work of the author.

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Abstract

This research examines how uncertainty shocks influence inflation expectations in Russia and the involvement of fiscal debt and the response of monetary policy in this process after accounting for external oil price movements. Using a structural autoregressive (SVAR) framework and contemporaneous regression analysis, my study identifies a resilient-reactive economic structure. My initial regression results reveal that while growth in oil price was found to have a statistically significant impact on GDP growth and growth in inflation expectation at 1% and 10% significant levels, they do not directly influence fiscal debt or EPU. My key finding reveals a monetary-expectation nexus where the central bank of Russia (CBR) prioritizes anchoring psychological price sentiment over the output gap. The impulse response function (IRF) shows that a 1% GDP shock significantly stabilizes economic policy uncertainty (EPU); however, it triggers a 2.2% increase in inflation expectations and a sharp 4.8% reduction in interest rates. Similarly, a positive shock to inflation expectations results in a significant 7.8% interest cut. whereas the economy remains structurally decoupled and resilient to external energy volatility via institutional firewalls like the budget rule. Notably, the CBR exhibits a procyclical policy stance, normalizing interest rates toward a 7.5% - 8.5% neutral range during growth periods, a move justified by the disinflationary buffer provided by ruble appreciation. My research concludes that internal policy credibility and management of expectations are the primary determinants of Russian macroeconomic stability in the face of global shocks.

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1 Introduction

For about three decades, the economy of Russia has been susceptible to domestic and external uncertainty shocks, which have significantly impacted the sustainability and credibility of its fiscal and monetary policy. Households as the major suppliers of capital and labor, form expectations, particularly regarding inflation. These expectations, once formed, may lead to self-fulfilling prophecies, which can impact patterns in consumption, price setting and wage negotiation. The central bank must respond through its policy instrument; this includes adjustments in interest rates and management of the supply of money to stabilize prices and anchor expectations. One of the primary responsibilities of fiscal policy is the stabilization of the economy through its budgetary actions; however, its ability to minimize welfare loss is inherently contingent on its ability to coordinate with monetary policy. In isolation, fiscal measures may unintentionally intensify macroeconomic volatility if not regulated to the prevalent monetary stance and the nature of the unique economic shocks.

According to Tiron and Zeynalov (2022), uncertainty shocks are unanticipated events that may be in the form of the volatility of commodity prices, unstable financial systems, and geopolitical disruptions, which are important in determining the performance level in the macroeconomy. Output disturbance, inflation, unstable exchange rates, and interest rates can be seen as the effect of these shocks, which can lead to instability in real variables and the financial sector.

In addition, the empirical research by Anderl and Caporale (2023) supports the fact that the asymmetric and inflationary effects of the economic policy uncertainty and oil price volatility are asymmetric and inflationary when there are persistent negative shocks.

Thus, the main research question can be as follows: ***How do uncertainty shocks influence inflation expectations in Russia, and what is the involvement of fiscal debt and the response of the monetary policy in the process after accounting for external oil price movement?*** This question is vital since the Russian economy is prone to both international and domestic sources of uncertainty as one of the major oil-producing economies. By indication, the oil price movement, a significant source of government revenue, imposes shocks that can quickly spread to inflation, exchange rates, and fiscal balances, thus influencing household and investor expectations since broader uncertainty like shocks in global policy, sanctions, financial crises, and geopolitical unrest can make it difficult for central banks to anchor inflation. In relation to fiscal and monetary policy, this research explores how government borrowing and central bank of Russia (CBR) interventions using instruments like interest rates can stabilize the economy or increase volatility. The emphasis on fiscal debt will be in terms of the determination of its credibility since if debt rises, the central bank's ability to effectively regulate inflation expectations from firms, investors, and households may be undermined, and the effects of the shocks can be mitigated when there is discipline in debt management.

Monetary policy tools are also significant since they can be used to dictate the rate at which uncertainty is transferred to consumer prices and expectations. Overall, the study seeks to

determine whether the policy mix that is a combination of fiscal and monetary policy of Russia can serve as a shock suppressant to uncertainty shocks or whether it is a shock amplifier in terms of increasing inflation expectations instability. Moreover, the study aims to ascertain the relationship between uncertainty, oil-based changes in revenue, debt dynamics, and monetary policy reactions within the Russian economy by using quarterly time-series data from 2010 to 2025.



Figure 1: The Progression of Russian GDP and Uncertainty Indices (Q1 2010-Q2 2025). The figure shows the co-movement of real GDP deviation and the uncertainty signals, highlighting periods of economic distress, including the 2011 Eurozone debt crisis, the 2020 COVID-19 pandemic, and 2022. Geopolitical crisis

As the figure indicates, the Russian GDP growth was, in general, rising with time but had slowdowns during the severe crisis periods in 2011, 2020, and 2022. These drops in the growth of the GDP are accompanied by steep increases in the levels of uncertainty, which means that an increase in the level of uncertainty is typically linked to low economic performance in Russia.

According to Arcelus and Dragomirescu-Gaina (2022), uncertainty is not only national but also transmissible worldwide; inter-border spillovers increase the challenge of identifying local and international sources of uncertainty. In the case of Russia as an emerging economy, high international financial uncertainty increases exchange rate volatility and market forces (Glebocki & Saha, 2024). Azad and Serlestis (2022) are of the opinion that the US plays a leading role in uncertainty shocks exportation. Monetary policy tightening in the advanced economies increases the length of output declines in the emerging economies, making macroeconomic stabilization more expensive (Lastauskas & Nguyen, 2024). These results indicate that the Russian economy, being a resource base, and the globalized economy are structurally susceptible to uncertainty shocks. Thus, how strongly uncertainty shocks spread depends on the level of fiscal policy through government borrowing and monetary policy response.

Liu and Mustapha (2025) proposed that inflation can be more stable if the government does not fully guarantee the repayment of its debt; however, this may result in economic fluctuation.

Cartore and Leonardi (2025) are of the opinion that the combined fiscal and monetary policies have impacts on household saving and portfolio decisions, increasing or weakening uncertainty shocks. This is especially true in Russia, where fiscal regulations and debt arrangements have been developing with recurring crises. Particularly, the fiscal regulation can be seen as the fiscal rule evolution through the management of the national wealth fund (NWF), which protects the Russian economy against sudden swings in exogenous shocks and volatility in oil prices.

Specifically, the fiscal regulation can be seen as the fiscal rule evolution and the national wealth management (NWF), established to control for oil price volatility in its budget. In 2022, which is part of the study period this rule was suspended. Subsequently, in 2024 - 2025, the reform tax law of a 5% progressive corporate tax was introduced to fund the increasing expenditures. According to Dabroski (2025), the new adjustment signals a strategic shift toward non-hydrocarbon taxation and increased domestic borrowing as traditional fiscal reserves in the NWF are utilized. Moreover, inflation expectations are one of the most important channels of transmission in which uncertainty disrupts macroeconomic stability (Kilber, Szyszko, & Prochniak, 2023). In the case of emerging markets, exchange rate fluctuation and a reduced level of central bank credibility can be extremely sensitive to the shocks of the inflation expectations (Aguilar, Guerra, & Martinez, 2024).

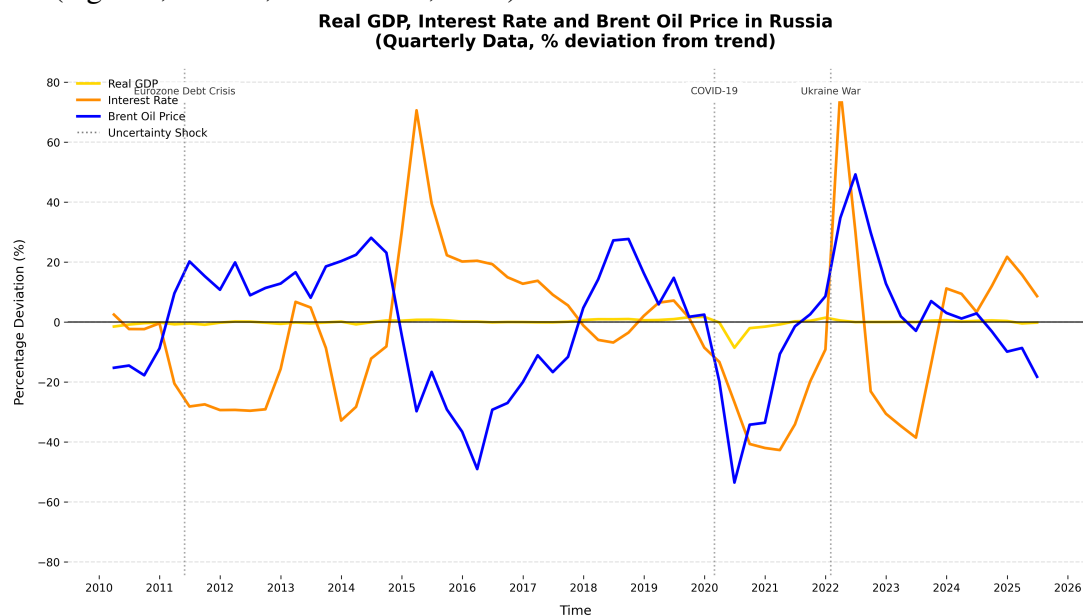


Figure 3: Real GDP, Interest Rate, and Brent Oil Price in Russia for Q1. 2010- Q2. 2025. The figure illustrates the relationship between Real GDP, monetary policy, and oil price dynamics, reflecting periods of economic downturn, including the 2011 Eurozone Debt Crisis, 2020 COVID-19 Pandemic, and 2022 Ukraine War

As seen in figure 3, real GDP maintains a stable trend, suggesting a moderate output trend and less volatility when compared to a spike in oil prices and interest rates, especially during periods of uncertainty. The steady GDP growth suggests a consistent long-term economic growth pattern despite short-term shocks in other variables.

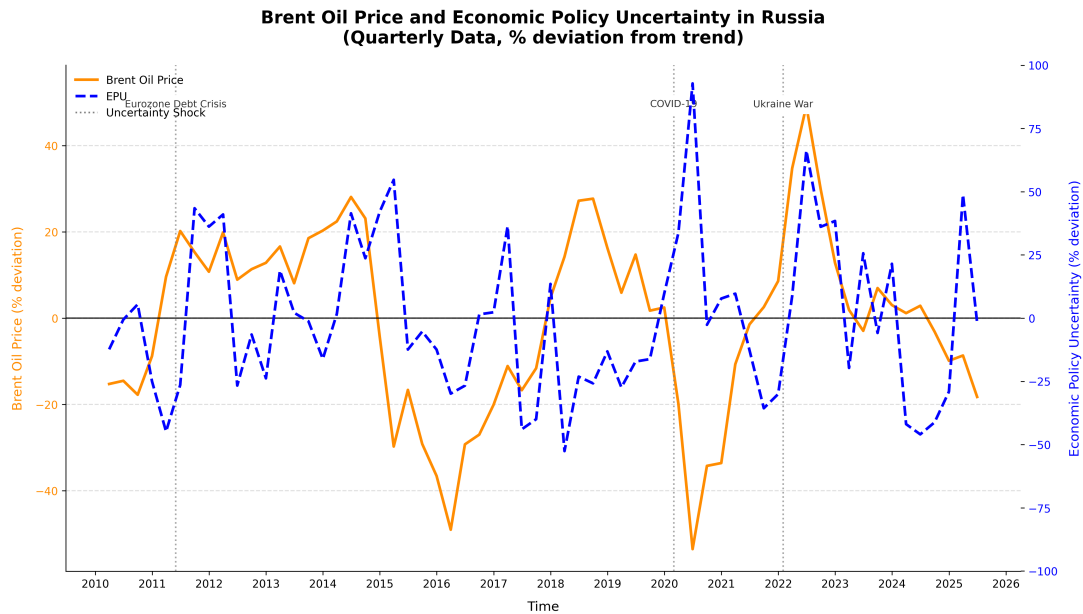


Figure 3: Brent Oil Price and Economic Policy Uncertainty in Russia (Q1. 2010 - Q2. 2025). The figure shows the progression of Brent oil and Uncertainty Indices (Q1 1997-Q4 2022) as exogenous variables.

As depicted in figure 3, there is a distinct co-movement between the uncertainty indices and Brent oil price. This indicates that periods of sharp fluctuations in oil price, whether increase or decrease, lead to spikes in Russian economic uncertainty. This pattern suggests the strong influence of the oil price market on the stability of the Russian economy. Drastic changes in both variables are observed in the 2014 oil price collapse and sanctions, and the 2020 COVID-19 pandemic. Such episodes indicate the impact of exogenous sources of uncertainty on investors' confidence, fiscal stability, and the expectations of inflation in response to external oil market shocks. The post-2020 period also shows increased volatility, indicating that uncertainty shocks have become more sustained and correlated to oil market relationships over the past years. This highlights that the relationship between fiscal debt and inflation expectations in the interaction under uncertainty is important in influencing the monetary policy responses of Russia.

2 Literature Review

In Russia, structural and institutional changes have been experienced over the past several years since the late 1900s. The country had gone through terrible contraction after the collapse of the Soviet Union, but in the early 2000s, oil exports, financial reforms, and future integration into world markets helped it recover (Gurvich & Prilepskiy, 2015). The GDP increased by an average of 7% every year between the years 1999 and 2008, which was bolstered by the high energy prices and the increasing foreign investment (Connolly, 2018). This boom decreased poverty, fiscal balances improved, and Russia was set as one of the fastest-growing emerging economies. Nevertheless, the external shocks, such as the 2008 global financial crisis, the

2014 oil price crunch, the COVID-19 pandemic, and sanctions associated with the geopolitical conflicts, revealed the weakness of this model of growth. Compared to advanced economies, the level of public debt has been comparatively small, having an average of less than 20% of the GDP since the 2000s (IMF, 2021). This conservatism in the fiscal policies started following the 1998 financial crisis, in which the default on national debt greatly demoralized investors and disrupted their confidence (Dabrowski, 2019). The low debt rates have helped Russia to escape the global crisis in 2008 and the COVID-19 recession. Nevertheless, a high reliance on fiscal leverage on oil and gas income still limits fiscal stability: sudden oil price drops in 2014 and 2020 resulted in revenue deficits and an increase in budget strain (Gaddy & Ickes, 2013).

The dynamics of inflation have been influenced by the monetary situation within the nation as well as external shocks. Due to financial instability, inflation rose to over 80% in the late 1990s (Aslund, 2007). In the 2000s the tightening of monetary policy and fiscal discipline was followed by stable prices, but each time a shock sparked off inflation. As an illustration, in 2015, annual inflation reached 12.9%, mainly due to ruble depreciation following the fall in oil prices and external restrictions. (Bank of Russia, 2016). In more recent times, the COVID-19 virus and the 2022 geopolitical crisis led to a stronger growth in consumer prices at the expense of real incomes. It has been acknowledged in literature that inflation expectations in emerging markets are the frailest during turbulent times, and central banks need to reinforce communication and credibility in order to anchor them (Kliber et al., 2023; Abhoff, Belke, & Osowski, 2021).

There has been a longstanding geopolitical uncertainty. In 2014, the annexation of Crimea led to industry sanctions that limited access to Western finance, technology, and capital markets (Connolly, 2018). These sanctions, capital flight, and elite restrictions further exacerbated uncertainty shocks that put a strain on investment and productivity (Bloom, 2014). These pressures were further increased with the 2022 invasion of Ukraine, which has isolated Russia from Western markets, increasing systemic risks. It has been shown that, when fiscal policy shocks are involved, they can consistently have more impact on output and inflation than monetary shocks, and this is why policy coordination is important (Rant, Puc, Cok, & Verbic, 2024). Russia's macroeconomic vulnerability is rooted in its energy dependence: hydrocarbons accounted for about 60% of exports and 39% of federal budget revenues in 2019 (World Bank, 2020), implying that more than half of the federal receipts and more than half of the exports have been oil and gas revenues. However, the surpluses and reserves were supported in the 2000s by high oil prices but collapsed during crises in 2008, 2014, and 2020, which cut off fiscal space and caused exchange rate instability (Gurvich & Prilepskiy, 2015). According to Tiron and Zeynalov (2022), exchange rates, inflation, and interest rates transmit oil price shocks, increasing volatility in industrial production. This cyclic exposure supports the nexus between reliance on commodities, inflation targets, and the debt cycle in Russia.

Uncertainty shocks are identified as major determinants of macroeconomic performance, as they affect the real and financial sectors in various economies. In Russia, Tiron and Zeynalov

(2022) reveal that oil price changes are mostly transmitted via monetary mechanisms, where exchange rates, inflation, and interest rates react counter-cyclically, but industrial production is highly pro-cyclical. This highlights the role of uncertainty shocks caused by commodities in the destabilization of macroeconomic fundamentals. Beyond commodity shocks, broader measures of policy and financial uncertainty reveal asymmetric and global effects. As shown by Anderl and Caporale (2023), the effects of economic policy uncertainty (EPU) and oil price uncertainty (OPU) are greater in a modeled asymmetry situation, where the negative EPU shocks are also highly inflationary. Hong, Ke, and Nguyen (2024) build upon this view by taking the concept of the fiscal policy uncertainty index, which indicates that fiscal uncertainty has a strong negative influence on industrial output and increases the cost of sovereign borrowing across the world. These results highlight that uncertainty shocks do not work only domestically but also via financial linkages globally. On the European level, the research by Arcelus and Dragomirescu-Gaina (2021) reveals that the spillover of uncertainty shocks across borders is such that it is difficult to distinguish between domestic and foreign sources. They reveal amplification mechanisms with the help of global VAR and demonstrate that the European Central Bank manages to respond to the uncertainty related to the policy more proactively than financial shocks. On the same note, Glebocki and Saha (2024) emphasize that surges in international monetary and financial uncertainty enhance exchange rate volatility and exchange market pressure, which have a disproportionate effect in emerging markets.

The United States has a central role in spreading uncertainty to other countries. According to Azad and Serletis (2022), no matter which method of measurement is used, the uncertainty in the U.S. monetary policy has a negative impact on the emergent economies whose policies have to be tuned to inflation. As demonstrated by Lastauskas and Nguyen (2024), output decrees are marked by acute and prolonged declines in the emerging markets due to the U.S. monetary tightening, and the spillovers are increased by the high level of uncertainty. Similarly, Kumar et al. (2020) report that domestic policy shocks prevail in Brazil, India, and Russia, whereas foreign shocks are disproportionately large in China. Surprisingly, U.S. EPU has a positive influence on the stock markets of China and India, which implies that there is a capital flight mechanism into these stock markets. Collectively, these papers assert that uncertainty shocks are widespread, nonlinear, and transmissible at a global level and have significant implications for monetary and fiscal stability.

The fiscal debt-monetary policy interaction determines the propagation of shocks and sustainability of the public finances. Spilimbergo (2005) points to those of Russia following the crisis of 1998 when, despite a positive growth rate and the low real interest rate, debt sustainability managed to improve, and fiscal policy was overly loose to address the inflationary effects of oil windfalls. This explains the necessity of fiscal discipline in dealing with uncertainty. More recent work generalizes the role of debt structures to policy shocks. Liu and Mustapher (2025) construct a model that demonstrates that a coexistence regime whereby public debt is partially unbacked gives better results than a fully backed or unbacked regime. The result of

such a regime is improved inflation stability and sustainable debt levels but at the cost of volatility trade-offs. Cantore and Leonardi (2025) build on this argument with a heterogeneous-agent The new Keynesian model shows that fiscal-monetary policy combinations influence saving incentives of households through liquidity premium. In their self-insurance demand channel, they emphasize the feedback of policy design with macroeconomic stability by affecting portfolio decisions.

The theoretical insights are backed by empirical studies. Mansur (2023) demonstrates the Bayesian SVAR that fiscal multipliers in the United States are below unity, with contractionary monetary policy weakening the output after the lag. Notably, he discovers that fiscal and monetary shocks will interact positively to have heterogeneous effects on consumption, investment, and business cycles. Rant, Puc, Cok, and Verbic (2024) demonstrate that fiscal policy shocks have a greater effect on the output and inflation compared to monetary shocks in the Euro Area, which supports the idea that fiscal policy is still a powerful tool to stabilize the economy. Taken together, this literature indicates that fiscal debt dynamics and policy mixes play a very significant role as mediators of how uncertainty shocks diffuse across economies.

Inflation expectations constitute an important medium that enables uncertainty shocks to have a macroeconomic stability impact. In the study, Kliber, Szyszko, and Prochniak (2023) examine forecast errors in seven Eurasian economies, and the results indicate that the main sources of inaccurate forecasting are the exchange rate volatility and inflation uncertainty. According to their findings, during turbulent periods, central banks ought to improve communication and forecasting devices in order to minimize the uncertainty in the making of expectations. Further clues can be taken from the European experience with unconventional monetary policy (UMP). Abhoff, Belke, and Osowski (2021) demonstrate that ECB UMP shocks have a short-lived effect on inflation expectations, but ultimately the effect of the shock on inflation expectations fades away because inflation expectations do not result in real inflation. This highlights the scope of the limitation of expectation management in situations where credibility or systems of transmission are poor.

On the global level, Aguilar, Guerra, and Martinez (2024) examine the inflation expectations in the context of emerging markets and report the following results: After 2021, global inflation started to influence the short-term expectations more often. However, longer-term expectations are still more susceptible to the impact of domestic factors, which underlines the continuing capacity of national central banks to anchor expectations with credible policies despite global inflationary shocks. These studies, together, demonstrate how easily inflation expectations are shattered in uncertain settings and how goals of clarity through monetary communication and consistency in policy can alleviate the destabilizing impact.

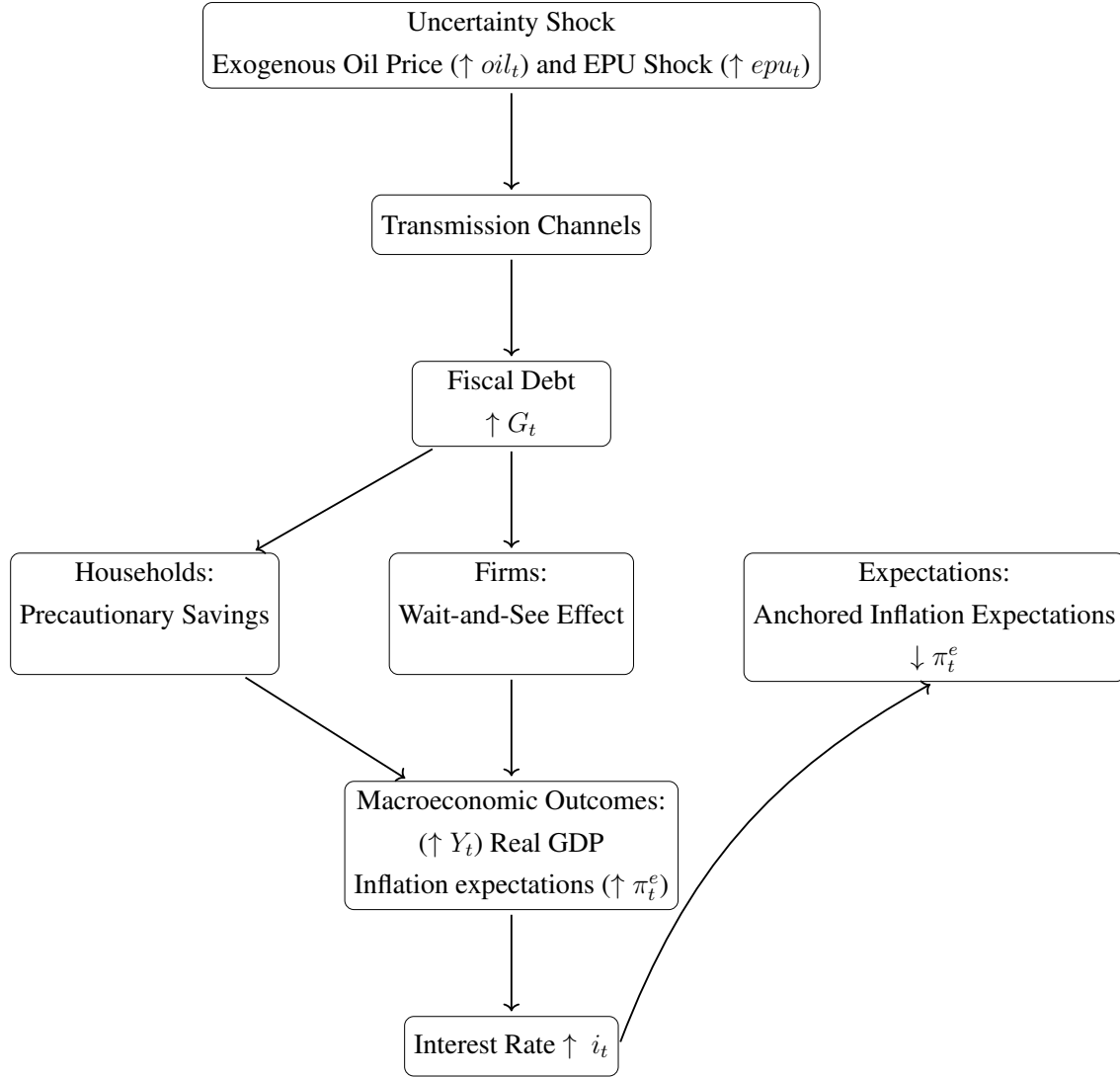
The three ideas that are closely related are observed in the reviewed studies. To begin with, uncertainty shocks, including a shift in the price of commodities, fiscal policies, or tightening of monetary policy, significantly and asymmetrically affect macroeconomic stability and propagate both locally and internationally (Anderl and Caporale, 2023; Hong et al., 2024; Azad

and Serletis, 2022). Second, these shocks are diffused and influenced by fiscal debt policies and their combinations on both inflation volatility and debt sustainability (Liu and Mustapher, 2025; Cantore and Leonardi, 2025). Third, the fact that the inflation expectations are one of the primary channels of transmission, but they are fragile, as they tend to be volatile and hard to control (Kliber et al., 2023; Abhoff et al., 2021).

Though these insights exist, there are still some gaps. There is little literature that has incorporated uncertainty shocks, fiscal debt, and inflation expectations in a single analytical model. Although past studies have indicated the significance of each variable, there is little knowledge about the way fiscal debt mitigates the impact of uncertainty shocks on the inflation expectations, particularly in resource-based and emerging economies. Thus, the thesis will address this gap by examining the interactions of uncertainty shocks, fiscal debt, and inflation expectations and how the interactions between these variables influence the monetary policy responses. Through the current research, the macroeconomic stability in conditions of uncertainty will be further understood with respect to how fiscal and monetary coordination and expectations formation work in the Russian economy.

2.1 Conceptual Framework of Uncertainty Transmission

The transmission of exogenous shocks through the Russian economy is mapped in the conceptual framework. It started with exogenous oil prices and EPU as the main triggers, disrupting the real macroeconomic outcomes. This shocks creates a logic chain revealing a pronounced interaction between fiscal debt and sentiment from the public, resulting ultimately to a contractionary policy through a hike in its interest rate by the CBR to maintain stability in the real macroeconomic outcomes.



Transmission Mechanism of Uncertainty Shocks

In this conceptual framework, I illustrate how the mechanism operates through the interaction of the macroeconomic variables. I assume that the transmission mechanism is initiated by a dual shock: an exogenous positive oil price shock and EPU. Since Russia is a resource-dependent economy, an increase in global energy prices increases the fiscal windfalls, which systematically amplifies government spending (G_t). Although an increase in global energy price and the fiscal expansion provides a positive reaction that increases the Russian GDP (Y_t), the persistent increase in uncertainty levels simultaneously triggers precautionary savings from households and, from the firm side, a wait-and-see effect; these in turn decrease private consumption and investment. The combined effects of the fiscal stimulus and supply-side uncertainty interfere with the anchoring of inflation expectations π_t^e as the public anticipates future inflationary pressure from the overheating economy (Alonso-Albarran et al., 2025). The monetary policy through the CBR raises its interest rate (i_t) as a contractionary tool in response to rising expectations. The policy of the CBR through its contractionary tool was designed to counteract the initial unanchoring effects, efficiently reducing the expectations and restoring

macroeconomic stability and budgetary resilience in the new reality of the Russian economy (Bruegel, 2025).

Although uncertainties in governmental decisions are captured in EPU index, recent macroeconomic literature, such as Baker et al. (2016), within its time series framework increasingly considers it as an endogenous variable. In the context of the Russian economy, decisions on economics and political scenarios are sensitive to volatility in aggregate demand and commodity prices; as a result, EPU is largely internal since it is amplified by the impact of the widespread state of the macroeconomy. The interplay connecting inflation, EPU and fiscal debt operates via unique channels. Firstly, the anchoring of inflation expectation is assumed to be interrupted by heightened uncertainty, as households and firms lose certainty about the macroeconomic environment (Istrefi & PiloIU, 2024). The resulting effect is an upward pressure on prices as agents price in a risk premium for the unstable future of the economy. Secondly, the impact of EPU on fiscal debt is direct and expansive. Heightened uncertainty may force a counter-cyclical government intervention, frequently funded through increased domestic borrowing (Hong & Nguyen, 2024). In addition, this gives rise to risk premium sovereignty, thus increasing the cost of servicing debt through higher yields on OFZ bonds, thereby exacerbating the burden of the total debt (Dabrowski, 2026). As a result, EPU may contemporaneously leads to a spark in fiscal expansion, which triggers a simultaneous rise in the inflationary sensitivity of the economy.

3 Data and Methodology

3.1 Data

In order to examine the dynamic relationship among uncertainty shocks, fiscal debt, and inflation expectations in the context of the Russian monetary policy in this study, I utilize quarterly time-series data between Q1. 2010 and Q2. 2025, resulting in a total of 64 observations with each variable. Major macroeconomic upheavals affecting the Russian economy during this period were the 2014 oil price collapse and international sanctions and the 2020 COVID-19 pandemic and geopolitical crisis of 2022.

Table 1: Descriptive Statistics

Symbol	Variable	Description
epu_t	Uncertainty shocks	Proxy by the Economic Policy Uncertainty (EPU) Index.
G_t	Fiscal debt	Federal government gross debt as a percentage of GDP.
i_t	Interest rate	< 24 hours call money interbank lending rate.
π_t^e	Inflation expectations	Household median Quantify inflation expectation from in-FOM survey.
oil_t	Oil price	Brent crude oil price (USD per barrel).
Y_t	GDP growth	Real GDP in constant prices.

Source: Federal Reserve Economic Data (FRED). Central bank of Russia (CBR). All series are quarterly and seasonally adjusted.

In Table 1, I show the variables that were used in this research. I chose them based on theoretical and empirical relevance to the transmission of uncertainty shocks by policy instruments of fiscal and monetary policy in economies that are dependent on oil. I use the Economic Policy Uncertainty (EPU) Index in Russia, which quantifies the level of unpredictability regarding issuing economic and policy decisions, as a proxy for uncertainty shock since high values of uncertainty indicate decreased investor confidence and more challenges in stabilizing prices and output. According to Baker, Bloom and Davis (2016), EPU index was developed through the consistent counts of policy-related uncertainty keywords in national newspapers. One profound limitation of these indices is that it may not reflect the truthfulness of institutional shocks arising due to media bias or political rhetoric. In the context of the Russian economy, this is intensified through an integrated media landscape that may raise unique narratives. However, in my study, the EPU index was utilized as an endogenous proxy of perceived publicly related uncertainty. By examining the EPU index along with the fiscal and monetary objectives, my model sufficiently captures household and firms' psychological uncertainty transmission despite the indices being influence by media sentiments.

I use the amount of outstanding public debt due within one year of international debt securities for the government sector, residence of issuer in Russia, as an indicator of the fiscal position and sustainability of the government. The choice of the variable is because of the high sensitivity of liquidity risk and vulnerability of it rollover effects, which is important for fiscal debt reactions to sudden unpredictable shocks. It also implies that fiscal policy may dissolve or increase the impact of uncertainty shocks based on the degree of debt management and discipline. I use the short-term interbank rate (< 24 rate) for the interest rate, which is one of the main operational tools used by the CBR, which reflects the price of borrowing money and the monetary policy move in a certain way to impact the inflation expectations and economic practices. I use the quarterly seasonally adjusted real GDP growth to measure the real performance of the economy; it is a measure of interaction not only of uncertainty but also of policy

actions that influence the output over time. Moreso, I use the Brent oil price as an exogenous variable; it is an external shock to the Russian economy. Since Russia relies on oil exports, Brent price movements have a direct impact on the fiscal revenues, foreign reserves, and inflation processes. Brent is selected due to its international benchmarking and close relation with the Russian export oil prices. The variables used were all taken from the Federal Reserve Bank of St. Louis (FRED) database, which offers consistent and reliable time-series records of macroeconomic variables from internationally recognized sources.

In addition, I obtained the data for inflation expectations from the Central Bank of Russia's (CBR) monthly inFOM household survey reports, which were then aggregated to quarterly averages. The inflation expectation represent the household expectation of what the price of commodity would be in the nearest future. Moreso, significant structural shocks, such as the 2014 sanctions and 2022 geopolitical crisis, are reflected by the series, and the series is expected to revert to a lower mean post-shock, which can be explained by a degree of long-term anchoring due to the inflation-targeting regime of the CBR. A methodological break, as indicated in the report, happened in April-July 2020, when surveys were conducted over the telephone instead of face-to-face because of COVID-19. To ensure continuity in the flow of the series, an interpolation was applied to the overall dynamics; thus, it is assumed that the effect is minimal. I adopt the methodological approach of Rant et al. (2024) and Stock and Watson (2001) vector autoregression in order to capture the causal inference and policy analysis of my variables using a structural VAR (SVAR). SVAR allows a recursive short run between variables where by first variable is allowed to contemporaneously affect the second one but not vice versa. Thus, the recursive short-run SVAR can be stated as:

Oil Equation:

$$oil_t = c_1 + \sum_{j=1}^6 \sum_{p=1}^p a_{1,j,p} X_{j,t-p} + e_{1t} \quad (1)$$

Fiscal Debt Equation:

$$G_t = c_2 + b_{21}oil_t + \sum_{j=1}^6 \sum_{p=1}^P a_{2jp} X_{j,t-p} + e_{2t} \quad (2)$$

EPU Equation:

$$epu_t = c_3 + b_{31}oil_t + b_{32}G_t + \sum_{j=1}^6 \sum_{p=1}^P a_{3jp} X_{j,t-p} + e_{3t} \quad (3)$$

GDP Equation:

$$Y_t = c_4 + b_{41}oil_t + b_{42}G_t + b_{43}epu_t + \sum_{j=1}^6 \sum_{p=1}^P a_{4jp} X_{j,t-p} + e_{4t} \quad (4)$$

Inflation Expectation Equation:

$$\pi_t^e = c_5 + b_{51} oil_t + b_{52} G_t + b_{53} epu_t + b_{54} Y_t + \sum_{j=1}^6 \sum_{p=1}^P a_{5jp} X_{j,t-p} + e_{5t} \quad (5)$$

Interest Rate Equation:

$$i_t = c_6 + b_{61} oil_t + b_{62} G_t + b_{63} epu_t + b_{64} Y_t + b_{65} \pi_t^e + \sum_{j=1}^6 \sum_{p=1}^P a_{6,j,p} X_{j,t-p} + e_{6t} \quad (6)$$

Where:

- $X_{j,t-p}$ represents the 6 endogenous variables at lag p .
- b_{ij} are the contemporaneous coefficients (where $b_{ii} = 1$).
- $a_{i,j,p}$ are the structural coefficients for the lagged variables.
- e_{it} are the structural shocks (white noise) such that:

$$E[e_{1t}|e_{2t}, \dots, e_{6t}, \mathcal{F}_{t-1}] = E[e_{2t}|e_{1t}, e_{3t}, \dots, e_{6t}, \mathcal{F}_{t-1}] = \dots = E[e_{6t}|e_{1t}, \dots, e_{5t}, \mathcal{F}_{t-1}] = 0$$

$$\text{and } \text{Var}[e_{it}] = \sigma_i^2 < \infty \quad \text{for all } t \text{ and } i = 1, \dots, 6$$

3.2 Methodology

Unit Root Rest

In time series econometrics, it is important to check if the variables to be estimated has a unit root. The presence of a unit root implies non-stationarity. If this is not addressed before estimating the model, the conditions of stationarity will be violated. The ADF test is used to check if variables have unit root. It is designed to determine whether a variable is stationary or contains a unit root (non-stationary). Stationarity implies $E(e_t) = 0$, $\text{Var}(e_t) = \sigma^2$, and for all t $\text{Cov}(e_t, e_{t+h}) = 0$ for $h \neq 0$. In contrast, non-stationary variables may lead to spurious regression results if used in levels without proper transformation. The ADF test extends the standard Dickey-Fuller test by including lagged differences of the variable to control for autocorrelation in the error term. The null hypothesis $H_0 : \theta = 0$ is that the variable is non-stationary, against the alternative hypothesis $H_1 : \theta < 0$ that the variable is stationary.

Table 2: Unit root tests (Augmented Dickey-Fuller)

Level			First difference		
Variable	ADF stat	Order	Variable	ADF stat	Order
oil_t	-2.313	I(1)	$\Delta \ln oil_t$	-3.131	I(0)
epu_t	-1.7253	I(1)	Δepu_t	-4.366	I(0)
G_t	-2.428	I(1)	$\Delta \ln G_t$	-5.913	I(0)
Y_t	-3.009	I(1)	$\Delta \ln Y_t$	-4.588	I(0)
i_t	-0.4647	I(1)	Δi_t	-4.291	I(0)
π_t^e	-2.4683	I(1)	$\Delta \pi_t^e$	-3.283	I(0)

Note: Stationarity is based on a 10% = 3.15 significance level with VAR (4).

Table2 reveals the result of the ADF tests. The findings show that all of the macroeconomic variables are non-stationary. at 10% significance level, this implies that all variable has a unit root. To achieve stationarity, variables were first differenced. Therefore, these findings provide me with confidence that I can freely apply the first-differenced variables to my econometric modeling, such as the VAR framework, without the risk of spurious regressions. Differencing the non-stationary series allows me to satisfy the statistical assumptions of my models and ensures that the estimated relationships between the variables are more credible.

Model Diagnostic Analysis

Prior to the structural analysis of the model, it is essential to carry out diagnostic analyses of variables. This is to ensure that the Vector Autoregression (VAR) framework is both statistically valid and internally consistent. This step includes the estimation of the ideal lag length. A better way to select the ideal lag length is to use the information criteria, which are also called "model selection criteria." Ideally, models with poor fit, i.e., the sum of squared residuals (high SSR), are not good, and models with too many parameters (high K) may lead to inaccurate estimation; they are also not good. Thus, the ideal information criteria is the one that balances between SSR and K. the Akaike information criterion (AIC): $AIC = T \log(SSR) + 2K$, while the Bayesian (Schwarz) information criterion (BIC): $BIC = T \log(SSR) + \log(T)K$, I select the one with the lowest value of the criterion. In order to achieve the balance between the model depth and parameter economy. It is also essential to test if residuals are white noise, i.e., $E(e_t) = 0$ and to ensure stability of the system equation. Stability implies that roots of the characteristics polynomial are < 1 . In another words, a system equation is only stable if and only if $|\lambda_j| < 1$ for all eigenvalues. In addition, the model should not be serially correlated at the optimal lag length to ensure that the successive Impulse Response Functions (IRFs) and Forecast Error Variance Decompositions (FEVD) are both mathematically sound and mean-reverting. The results of these foundational diagnostic tests are summarized in Table 3.

Table 3: VAR Diagnostic Tests

Panel A: Lag Length Selection	
Criterion	Optimal Lag
AIC	1
HQ	1
SC	1
FPE	1
Panel B: Autocorrelation Test (LM Test)	
Lag	Result
1	No autocorrelation (p = 0.421)
2	No autocorrelation (p = 0.261)
3	No autocorrelation (p = 0.313)
Panel C: Stability Test (Roots of the VAR)	
Roots	0.3942, 0.3858, 0.3021, 0.3021, 0.2986, 0.2986

Note: A VAR is stable if all roots lie inside the unit circle (i.e., modulus < 1). The results confirm stability. Optimal lag is determined by minimizing serial correlation in residuals (p-value < 0.05 criterion). requirements.

Table 3 shows the results of the lag length selection criteria, the LM test for autocorrelation, and the stability test. Based on these findings, all selection criteria (Akaike Information Criterion (AIC) and Hannan-Quinn (HQ) and Schwarz Criterion (BIC)) and the FPE indicated lag 1 as the optimal lag length. Implying that lag 1 is the most parsimonious. More so, the Autocorrelation LM Test (Panel B) substantiates the fact that at lag 1, the residual is white noise (p-value = 0.421), i.e., I do not reject the null hypothesis, which implies that there is no serial correlation. In addition, the VAR stability test (Panel C) shows that the largest modulus is 0.3942 and all the inverse roots of the characteristic polynomial fall inside the unit circle. All of the eigenvalues are below 1, implying that the system is stable. After fulfilling the diagnostic conditions, the VAR(1) model is said to be robust and can be used for the estimation of the Impulse Response Functions (IRFs) and Forecast Error Variance Decomposition (FEVD).

4 Granger Causality Test

After analyzing the diagnostic results, it is essential that I define the theoretical framework for predictive interactions within my endogenous system. Following standard econometric practice, I employ the Granger causality to determine whether one variable provides statistically significant information for forecasting another. A stochastic process X_t is said to Granger causal Y_t if the past information X helps predict Y_t better than the past of Y_t alone. This can be

specified as:

$$E[y_t \mid y_{t-1}, y_{t-2}, \dots] \neq E[y_t \mid y_{t-1}, y_{t-2}, \dots, x_{t-1}, x_{t-2}, \dots] \quad (7)$$

This implies that past information about X_t is not irrelevant, but rather, it contains information that reduces the forecast error of Y_t . To empirically test this relationship, I compare an unrestricted model against a restricted model using an F-test:

$$y_t = \alpha_0 + \sum_{p=1}^P \alpha_p y_{t-p} + u_t \quad (8)$$

Estimate an unrestricted model:

$$y_t = \beta_0 + \sum_{p=1}^P \beta_p y_{t-p} + \sum_{p=1}^P c_p x_{t-p} + u_t \quad (9)$$

The null hypothesis H_0 states that

$$H_0 : c_1 = c_2 = \dots = c_P = 0.$$

If H_0 is rejected, there is evidence of predictive causality.

Table 4: Granger Causality Test Results

Variable	F-Statistic	df1	df2	p-value
ddebt	0.525	4	265	0.717
depu	0.394	4	265	0.813
ggdp	1.461	4	265	0.215
die	0.909	4	265	0.459
dir	1.265	4	265	0.283

Note: The null hypothesis (H_0) states that the variable does not Granger-cause the others in the system. Robust standard errors (HC) were used for the F-tests. All results are insignificant at the 10% level.

The result of my Granger causality test provide a critical insight into the system's structure. The null hypothesis of no Granger causality cannot be rejected for any variable at the 5% significance level at lag 1. It is worthy to note that the Granger causality test was conducted at both lag $P = 1$ and a higher-order lag $P = 4$ to capture long-term predictive dynamics. At the primary model lag $P = 1$. The results show no significant Granger causality across the system. This indicated that short-term past values (3 months) do not contain sufficient information to forecast the future of other variables. However, at lag 4 $p = 4$. GDP growth

rate ($P = 0.004$ and interest rate $P = 0.006$ emerge as highly significant predictors of the system. This suggests that the transmission of macroeconomic shocks in Russia takes about a year to reveal predictive power. While lag 4 uncovers these long-term predictive links, the lag 1 specification was maintained for the final SVAR estimation. This choice ensures model parsimony, stability and the absence of autocorrelation, allowing for more robust identification of the contemporaneous shock.

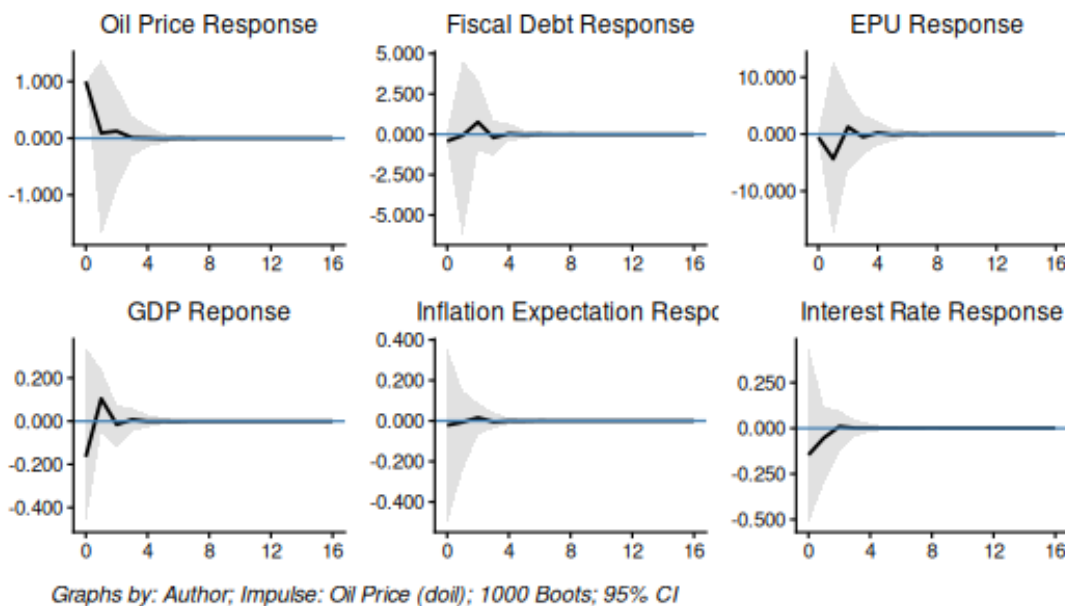
Following the theoretical definition earlier illustrated, this suggests that it X_t does not contain highly relevant past information for predicting the future Y_t in a simple linear lag relationship. Thus, Granger causality maybe insufficient to uncover the true causal relations. The lack of predictive Granger causality may imply that at a very simple lag, the transmission of shocks in the Russian economy is contemporaneous. This necessitates the use of structural identification (SVAR) and the impulse response functions (IRFs), as the primary interactions are simultaneous rather than delayed.

5 Findings

This section presents the results of the empirical findings of the Impulse Response Function (IRF) analysis. It highlights the effects of the shocks of various contemporaneous macroeconomic variables. An important aspect of such interpretation is the application of 95% bootstrap confidence intervals.

5.1 Macroeconomics Response to Oil Shocks

The impulse responses (IRFs) of the exogenous sudden shocks in global oil prices on the main macroeconomic variables of Russia over a period of 15 years were presented in the plots.



Source: Author's calculations.

Following a positive oil price shock, the oil price exhibits an immediate significant spike, peaking close to 1% in Q1. This implies that a 1% shock to the growth of oil price leads to an immediate increase in oil price by 1%, but since the confidence interval encompasses zero, it is statistically insignificant. This impact is, however, short-lived; the price returns to the steady-state zero line in Q4. The implication of this is that although oil shocks offer a sharp initial reaction, the market eventually return to its long-run equilibrium. In addition, both fiscal debt and economic policy uncertainty (EPU) are insignificant to oil price shocks because the 95% confidence interval encompasses the zero axis across all horizons. This implies that fiscal debt is not sensitive to growth in oil price shock and economic policy uncertainty remains stable despite the black line dipping -5% in Q1 since the confidence interval encompasses 0. A 1% increase in the growth rate of oil prices immediately decreases real GDP by 0.19%, it increases again in Q1 and returns to zero. This could be an indication of the resilience of the Russian real economy variable to a sudden jump in oil price for the period under review. A 1% shock to oil price growth has no significant impact on inflation expectations. The point estimate barely moves from 0; this may imply that inflation expectations are well anchored. The point estimate in interest rate response to oil price shock shows a slight dip, approximately -12.5% , suggesting a potential rate cut, but because the confidence interval encompasses 0, the effect is insignificant; it could also indicate that for the period under study, monetary policy is neutral. The CBR does not significantly adjust interest rates in response to the shock. Overall, the effect of various macroeconomic variables is transitory in nature, decoupled from or resilient to small 1% fluctuations in oil price growth.

5.2 Direct Impact of Oil on Macroeconomics Variables

Table 4 shows the immediate statistical correlation between an oil shock and the macroeconomic variables for the period under study.

Table 5: Impact of Exogenous Oil on Russian Domestic Variables

Variable	Coefficient	Std. Error	t-Statistic	p-Value
$\Delta \ln G_t$	-0.155	0.293	-0.528	0.600
Δepu	-1.074	0.946	-1.135	0.262
$\Delta \ln Y_t$	0.054	0.011	4.796	0.000***
$\Delta \pi_t^e$	-0.018	0.011	-1.703	0.095*
Δi_t	-0.008	0.016	-0.473	0.639

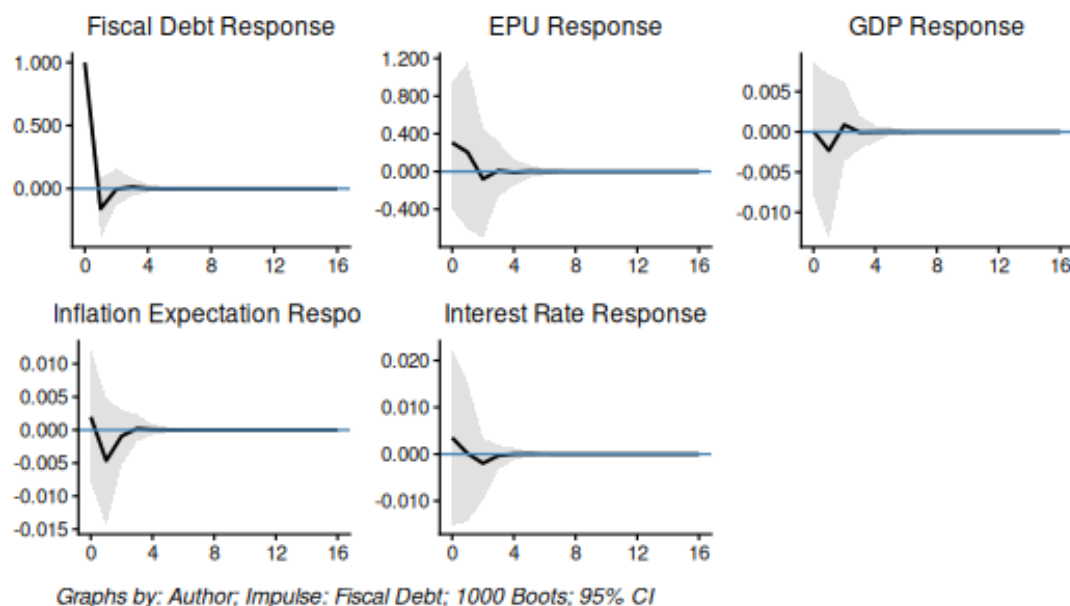
Note: *** and * denote statistical significance at the 1% and 10% levels, respectively.

Table 4 reveals that a 1 percentage point increase in oil price reduces fiscal debt and EPU by 0.15% and 1.1%, and the impact is statistically insignificant since the p-values are 0.6 and

0.2, respectively. This may imply that there is no immediate direct link between an oil price shock and changes in fiscal debt levels; in term of EPU, uncertainty falls when oil prices increase. Also, even though an increase in oil price reduces interest rates by 0.01%, the impact is statistically insignificant, as indicated by the p-value of 0.6% suggesting that the CBR does not immediately adjust its rate based on a short-period oil growth shock. In addition, a 1-percentage-point increase in the Brent oil price increase the real economy of Russia by 5% and the impact is statistically significant at 1% level. Inflation expectation was also found to be statistically significant to a sudden increase in oil price at 10% level however, the impact is negative, implying that a 1-point increase in oil price decrease inflation expectations from firms and household by 0.02%. The slight drop is likely due to a stronger ruble.

5.3 Macroeconomic Response to Fiscal Debt Shocks

This section presents the impulse responses of one standard deviation of fiscal debt shock to various macroeconomic variables in my model. The point estimates are represented by the solid lines and the shaded areas are the 95% confidence intervals with 1,000 bootstrap replicates. The horizontal axis indicates quarters following the shock



Source: Author's calculations.

The IRFs in the fiscal debt channels explain what happen to the Russian economy when the government increases its borrowing by 1 unit. The fiscal debt starts at 1.0 (100%) and drops to roughly -0.15 (15%) at Q1 and returns to 0 by Q4 suggesting that a 1% fiscal debt shock is immediately absorbed by the system. There is no evidence of debt persistence, as the response becomes statistically insignificant immediately after the initial impact. The point estimate of EPU is slightly positive, around 0.3%; this implies that uncertainty might rise when debt rises, although the impact is statistically insignificant. The economic policy uncertainty

(EPU) does not have a reliable or significant reaction to a shock of fiscal debt. The wide confidence intervals suggest that the relationship between government borrowing and policy uncertainty is highly volatile and lacks statistical power in this model. A 1% shock to fiscal debt growth does not yield a significant response in real GDP. While the point estimate suggests a marginal contraction of 0.2%, the wide confidence intervals indicate that the relationship is statistically indistinguishable from 0. This suggests that government borrowing, in this specific context, does not act as a primary short-term driver of economic growth. Inflation response to fiscal debt shock is approximately -0.05%, while interest rates increase immediately to 0.004% but drop sharply to approximately -0.003%. The result suggests a state of fiscal neutrality. A 1% shock to fiscal debt growth does not trigger a statistically significant reaction in either inflation expectations or interest rates. This indicates that, for the sample period studied, an increase in government borrowing were not perceived as inflationary or as a threat to monetary stability.

5.4 Variance Decomposition of Debt Shocks

The Forecast Error Variance Decomposition (FEVD) of fiscal debt offers an interesting insight into the true drivers of fluctuations in fiscal debt in Russia over 16 quarters (4 years). While the IRFs showed how variables react to shock, this table explains the source of the volatility.

Table 6: Forecast Error Variance Decomposition (FEVD) for Fiscal Debt

Quarter	$\Delta \ln G_t$	Δepu	$\Delta \ln Y_t$	$\Delta \pi_t^e$	Δi_t
1	100.00%	0.00%	0.00%	0.00%	0.00%
4	88.02%	1.24%	2.46%	0.42%	7.86%
8	88.01%	1.24%	2.46%	0.42%	7.86%
16	88.01%	1.24%	2.46%	0.42%	7.86%

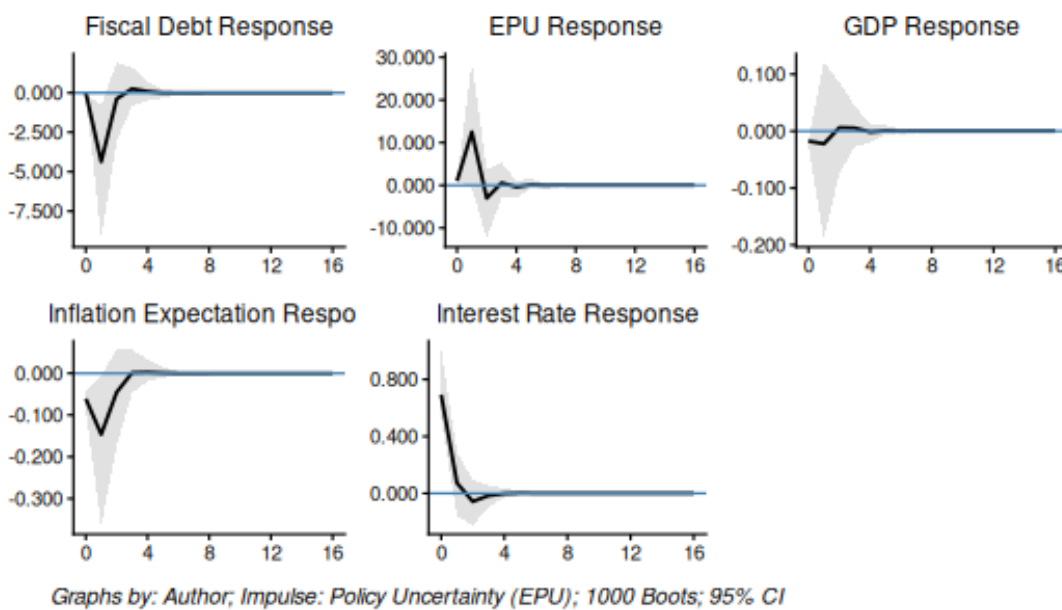
Note: Values represent the percentage contribution of each variable to the forecast error variance of fiscal debt ($\Delta \ln G_t$) over the forecast horizon.

At the start, 100% of the movement in fiscal debt is explained by its own shocks. This confirms that debt doesn't immediately react to other economic news like GDP, interest rates, etc. within the first three months. Even after 4 years (Q16), fiscal debt still explains 88% variance of its own shocks, while only 12% is caused by other variables in the system. Interest rate explains 7.86% suggesting that nearly 8% of fluctuations in debt are caused by changes in the cost of borrowing. As rates rise, debt dynamics shift. Interestingly, fiscal debt is remarkably insensitive to both the real economy and economic policy uncertainty, as they both explain only 2.46% and 1.24% by Q16. The variance decomposition results indicate that fiscal debt is largely self-determined, with 88% of its variance explained by its own shocks even after Q16. The only notable influence comes from interest rates, while GDP and EPU contribute

minimally. This confirms that the fiscal channel in this model is relatively exogenous to the broader macroeconomy.

5.5 Macroeconomic Response to Economic Policy Uncertainty Shocks

This section presents the impulse responses of all macroeconomic variables' responses to one standard deviation of economic policy uncertainty shocks. (EPU The solid lines indicate point estimates, and the shaded lines indicate 95% confidence intervals using 1,000 bootstrap replications. Quarters after the shock are measured on the horizontal axis.



Source: Author's calculations.

Fiscal debt is negative and significant to EPU shocks. Following a 1-unit (standard deviation) shock to EPU, fiscal debt drops sharply to approximately -4.5% at Q1, demonstrating that policy nervousness has a tangible, immediate impact on fiscal dynamics, but since the confidence interval is entirely below the 0 line, this implies that an increase in economic policy causes a statistically and negative significant, decrease in fiscal debt growth. However, the effect is transitory, returning to insignificant in Q4. The shock also caused EPU to spike to approximately 12% at Q1. This is highly positive and significant since the shaded area is far above the 0 line at Q1. Uncertainty is self-reinforcing in the short term. A shock to uncertainty today leads to a massive, significant jump in the next period however the impact is short-lived.

Although GDP reveals a small dip at Q1, reaching roughly -0.02%, the impact is statistically insignificant since the confidence interval in GDP is very wide at the start and at Q1, and it encompasses the 0 axis. The null hypothesis is not rejected, as it is statistically indistinguishable from zero. In this model, Russian GDP appears resilient to spikes in policy uncertainty. While an EPU causes a significant contraction in fiscal debt, the response of real GDP is insignificant. This suggests that policy uncertainty directly impacts government behavior, but

it does not immediately spill over into the real economy. Inflation expectations appear to be significant in Q1 following an EPU shock. The point estimate drops to approximately -0.15% demonstrating that an increase in policy uncertainty in Russia leads to a significant decrease in inflation expectations. This suggests that in Russia, uncertainty is viewed as disinflationary. Markets expect that high uncertainty will reduce consumer demand, leading to lower future prices. Interest rates are highly significant to EPU shocks. At the time of the shock, the confidence area is above the 0 line; it spikes to approximately 0.70% (70 basis points). The findings suggest that an increase in policy uncertainty triggers a significant immediate hike in interests. This could be seen as a classic risk premium response: when policy uncertainty spikes, the CBR or market demands higher rates to compensate for the increased risk of holding Russian assets.

5.6 Variance Decomposition of EPU Shocks

The forecast error variance decomposition (FEVD) of economic policy uncertainty (EPU) gives insight into the relative significance of each structural shock in explaining fluctuation in uncertainty over time. The decomposition in the chosen horizons, according to the recursive ordering, is shown in Table 6. Values are also reported as percentages of the total forecast error variance that explains EPU shocks.

Table 7: Forecast Error Variance Decomposition (FEVD) for Policy Uncertainty (%)

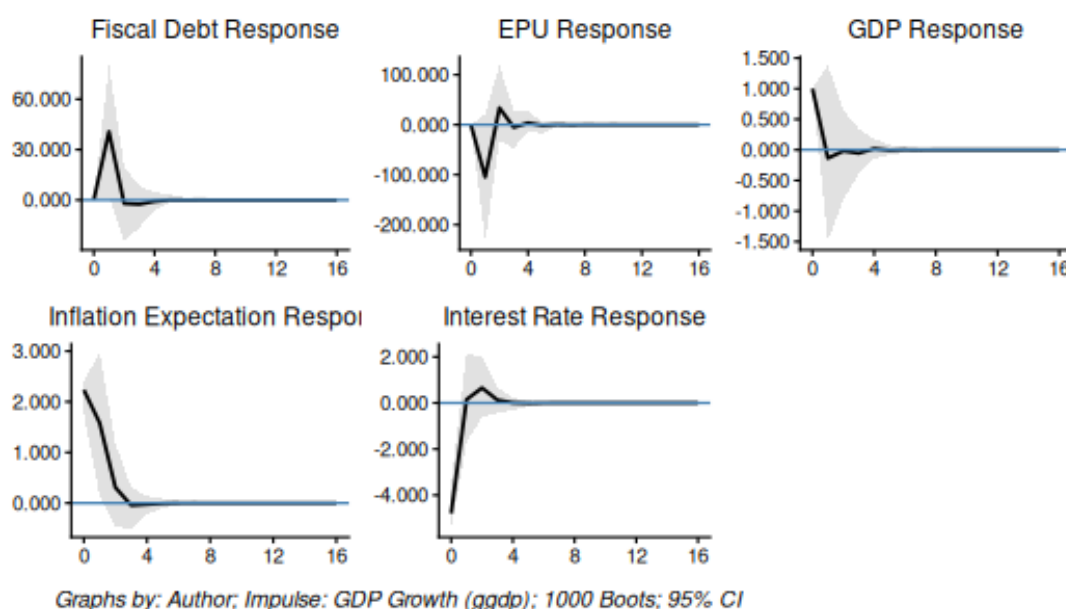
Quarter	$\Delta \ln G_t$	Δepu	$\Delta \ln Y_t$	$\Delta \pi_t^e$	Δi_t
1	0.90%	99.10%	0.00%	0.00%	0.00%
4	1.08%	91.64%	0.44%	0.28%	6.56%
8	1.08%	91.63%	0.44%	0.28%	6.56%
16	1.08%	91.63%	0.44%	0.28%	6.56%

Note: Values represent the percentage contribution of each variable to the forecast error variance of policy uncertainty (Δepu) over the forecast horizon.

At the start, the variance of EPU are generated by it own shocks, and it sustains even after 4 years, by over 91% of its variance. This could imply that EPU in Russian acts as an exogenous force. It is driven by policy shifts, geopolitical events, or internal government decisions rather than being a passive response to macroeconomic indicators like GDP or inflation. since 91% is own shocks, other variables combined explain only about 9% of the movement in uncertainty. Interest rates explain 6.56% in EPU; this is the only external variable with a noticeable impact. Suggesting that changes in monetary policy—interest rate hikes contribute to about 6.6% of the nervousness of uncertainty in the policy environment.

5.7 Macroeconomics Response to Real GDP Shocks

This section explains the findings of a positive output shock to various macroeconomic variables in my model. This test gives the answer to whether fiscal expansion, monetary tightening, or inflationary pressure is caused by an increase in national production.



Source: Author's calculations.

After a positive output shock, GDP responds with an immediate spike approximated to 1%; this is significant at time 0, i.e., immediately after the shock happens. However, the effect is transitory as it quickly returns to its baseline in Q2. While the economy is resilient to oil and fiscal debt shock, it reacts strongly to its own shock. EPU drops sharply to approximately -100% at Q1. This is statistically significant. This means that a 1% boost in GDP growth leads to a massive significant reduction in EPU. This confirms that growth is a primary stabilizer for the Russian policy environment. When the economy performs well, policy nervousness vanishes. Interestingly, fiscal debt is also statistically significant to a positive GDP shock. It spikes to approximately 40% at Q1. The confidence interval is entirely above the 0 line. This could imply a procyclical fiscal policy in Russia. When growth is high, the government takes the opportunity to expand its borrowing or spending programs.

In response to a 1% GDP shock, both inflation expectations and interest rates show statistically significant movements at the start. Inflation expectation peaks to approximately 2.2% in Q1 and stay elevated through Q3. The confidence interval stays high about the 0 line for the first 2 quarters. This may imply that a 1% boost in GDP leads to an immediate and significant increase in inflation expectations of about 2.2%. This also indicates that in the Russian economy, growth is perceived as inflationary; as the economy heats up, firms and households quickly adjust their price expectations upward. Interest rates, on the other hand, drop sharply to approximately -4.8%. This is highly significant as the confidence interval is completely above

the 0 line immediately the shock happens.

While a standard Taylor rule suggest hiking rates during growth, the CBR's institutional stance is driven by the exchange rate-inflation nexus. As stated in the Bank of Russia (2025) monetary policy guideline, a floating exchange rate smooths out the impact of external factors on the economy, and the exchange rate pass-through rate is monitored when setting the key rate. Thus, positive GDP shocks in Russia are typically associated with ruble appreciation, which acts as a natural disinflationary mechanism. This provides the CBR with the policy maneuverability to cut rates during expansions, a pro-cyclical stance designed to support non-inflationary recovery and transition the economy toward a neutral interest rate regime. This aligns with Gali's (2008) focus on price stability; if growth does not threaten the target, the CBR will prioritize liquidity and investment.

5.8 Variance Decomposition of Real GDP Shock

The Forecast Error Variance Decomposition (FEVD) of Real GDP shows that the drivers of economic activity change dramatically in the short run versus the long run. These findings are empirical evidence of the shift of the supply-side/commodity drivers to the monetary and psychological drivers.

Table 8: Forecast Error Variance Decomposition (FEVD) for GDP Growth (%)

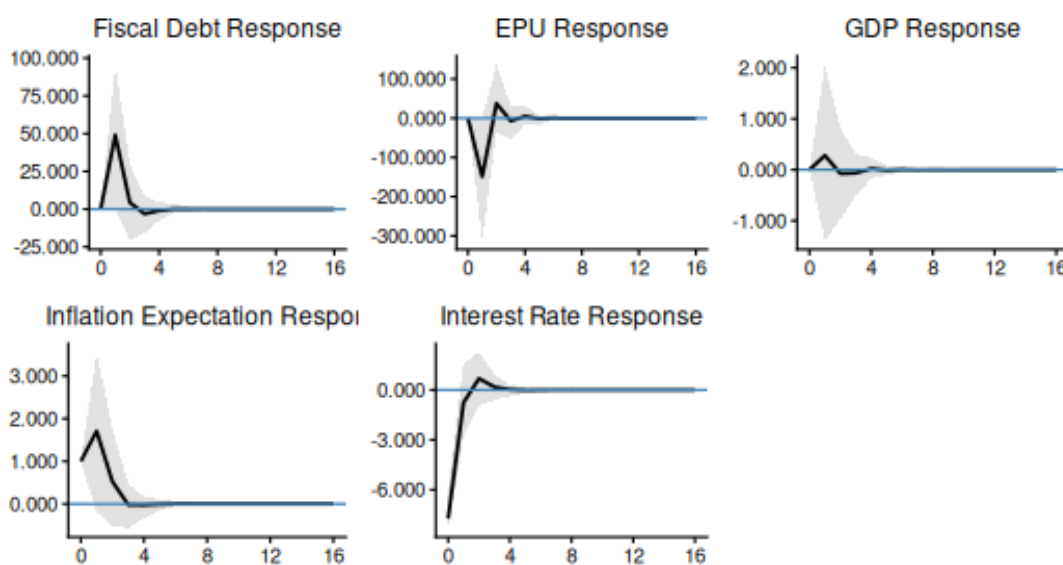
Quarter	$\Delta \ln G_t$	Δepu	$\Delta \ln Y_t$	$\Delta \pi_t^e$	Δi_t
1	0.00%	25.51%	74.49%	0.00%	0.00%
4	0.39%	24.24%	74.82%	0.26%	0.29%
8	0.39%	24.24%	74.81%	0.26%	0.29%
16	0.39%	24.24%	74.81%	0.26%	0.29%

Note: Values represent the percentage contribution of each variable to the forecast error variance of GDP growth ($\Delta \ln Y_t$) over the forecast horizon.

The FEVD for GDP reveals that while GDP is mostly self-driven (74.49%), policy uncertainty (EPU) is a massive driver of the Russian economy. In Q1, EPU explains 25.51% of GDP and roughly 24% by Q16; this could mean that GDP reacts immediately to policy news. Implying that policy stability is just as important as structural factors for economic performance. The direct shifts in fiscal debt, interest rates, and inflation expectations have negligible predictive power for growth in GDP in this model. This reinforce that perception that uncertainty is a primary mechanism of transmission through which policy affects the real economy, rather than direct interest rate or debt changes.

5.9 Macroeconomics Response to Inflation Expectation Shocks

The following section examines the transmission of a positive innovation in inflation expectation across the macroeconomic variables in my model.



Graphs by: Author; Impulse: Inflation Expectations (die); 1000 Boots; 95% CI

Source: Author's calculations.

In the inflation expectation scenario, fiscal debt is statistically significant. Following a positive inflation expectation shock, fiscal debt growth spikes sharply to approximately 50% in Q1 and the confidence interval is clearly above the 0 line. This may imply that an increase in inflation expectation leads to a significant surge in government debt growth, suggesting that the government might increase borrowing to front-load spending before actual price rises or that the servicing cost of normal debt reacts instantly to inflation fears. The point estimate in EPU shows a huge drop to -150% which implies a drop in uncertainty. The finding is statistically significant since the confidence interval drops immediately after the shock, so there is accurate precision to conclude that inflation expectation drive policy uncertainty in this model. GDP reveals a tiny bump of approximately 0.5% following an immediate inflation expectation shock. However, the impact is statistically insignificant. It appears that the real economy is insulated from immediate shifts in market price expectations.

Inflation expectation is highly significant to its own innovation. The shock starts at 1% and actually amplifies to nearly 1.8% in Q1. This may mean that inflation expectations are sticky and self-reinforcing. A 1% jump today leads to higher expectations tomorrow before the effects fade. Following a 1% shock to inflation expectations, monetary policy is surprisingly expansionary. The interest rate drop sharply to approximately -7.5%. This implies that when inflation expectations rise, interest rates decrease significantly. The standard Taylor Rule implies that rates should increase as a result of a positive innovation in inflation expectations. However, this model reveals a procyclical narrative. It might imply that the CBR appears to

maintain an expansionary stance, perhaps to support growth or due to a specific policy regime. In addition, a rise in inflation expectations might be due to a structural transformation stance in the post-2022 context. If a rise in inflation expectations is seen as a symptom of a structural shift rather than excess demand, the CBR may prioritize economic reorganization over immediate aggressive tightening. In addition, since the period covered in this study includes several massive crisis era, the CBR stated in its report, the summary of the key interest rate (2025), that it is moving towards normalization of a neutral rate. Following this spike, the CBR's primary goal has been to return the key rate to its long-term neutral range, historically 5.0 - 6.0%, revised to 7.5 - 8.5% in recent years. If inflation expectations rise from a very low base or are seen as temporary, the CBR may continue its scheduled easing to reach this neutral level. This is to avoid over-tightening the economy.

5.10 Variance Decomposition Inflation Expectation Shocks

The Forecast Error Variance Decomposition (FEVD) inflation expectation shows the forces that influence public sentiments and choices in Russia.

Table 9: Forecast Error Variance Decomposition (FEVD) for Inflation Expectations (%)

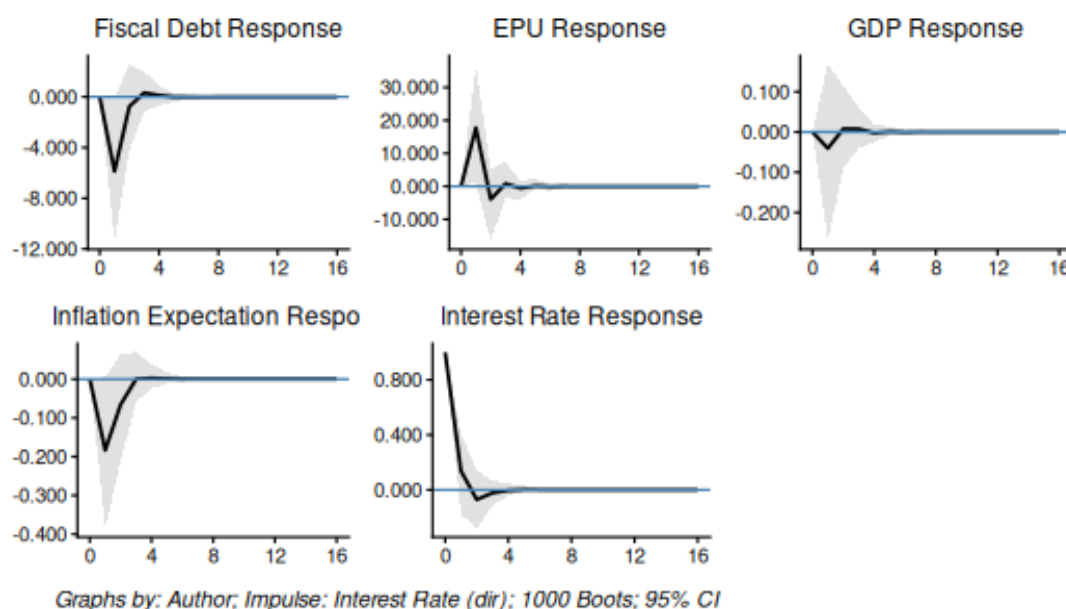
Quarter	$\Delta \ln G_t$	Δepu	$\Delta \ln Y_t$	$\Delta \pi_t^e$	Δi_t
1	0.28%	0.37%	7.83%	91.51%	0.00%
4	1.66%	1.62%	7.79%	82.65%	6.28%
8	1.66%	1.62%	7.79%	82.65%	6.28%
16	1.66%	1.62%	7.79%	82.65%	6.28%

Note: Values represent the percentage contribution of each variable to the forecast error variance of inflation expectations ($\Delta \pi_t^e$) over the forecast horizon.

Inflation expectation explains 91.51% to its own shock in Q1 and only declined to 82.65% in Q16; it is largely self-perpetuating. The vast majority of inflation expectation is explained by it own shocks. This confirms that once people are worried about inflation, it sustains itself regardless of what is happening in the rest of the economy. GDP happens to be the most significant external driver of inflation expectations in this model. It explains approximately 8% of the fluctuations in inflation expectations, suggesting that inflation is not just random noise but is partially anchored in the real economy. When GDP grows, it sends a signal to agents that price pressures are coming, causing them to revise their psychological outlook upward. Interest rates explain about 6.3% of the variance in inflation expectation in Q4. The result of the FEVD supports the sentiment-based nature of inflation expectations. While over 80% of its movement is self-driven, it is significantly anchored by real economic growth (7.8%) and interest rates (6.3%). This suggests that while inflation expectations are subjective, Russian agents are rational enough to adjust their sentiment based on growth and policy signals.

5.11 Macroeconomic Response to Interest Rate Shock

This section examines the transmission of a positive innovation in the interest rate (monetary tightening) across the macroeconomic system



Source: Author's calculations.

Fiscal debt growth drops sharply to approximately -6% after a positive monetary policy shock and the confidence interval is strictly below 0, revealing that fiscal debt is negative and significant to a positive innovation in interest rates. This implies that a 1% interest rate hike causes a significant contraction in fiscal debt growth. This is a classic debt service or budgetary effect. As borrowing becomes more expensive, the government significantly reduces its new debt issuance. EPU is highly significant to interest rate innovation. At Q1, the confidence interval is completely above the 0 line. Following an interest rate hike, EPU spikes to approximately 20% suggesting that an interest rate shock triggers a significant increase in EPU. This may indicate that sudden monetary tightening create nervousness in the policy environment, possibly due to concerns about debt sustainability or the future path of fiscal policy. GDP is insignificant through out the entire horizon. The point estimate dip to approximately -0.3% but it is statistically indistinguishable from 0, demonstrating that in this model, real GDP is resilient to interest rate shocks and that the transmission from monetary policy to the real production sector in Russia is weak or lagged compared to the fiscal and policy channels. Thus interest rate can be seen as a policy tool instead of a growth tool.

Inflation expectations are highly significant to a positive innovation in interest rates. After a positive interest rate shock, inflation expectations drop by approximately -0.20% and at Q1, the confidence interval are strictly below the 0 line. The result implies that monetary policy is effective at anchoring expectations. A 1% rate hike significantly reduces inflation expectations, suggesting that the market agents view the CBR actions as a credible commitment to price

stability. Interest rate shocks to its own innovation is transitory. The shock starts at 1% and quickly returns back to the 0 line by Q3. Thus, an interest rate hike happens immediately, but the central bank does not keep rates elevated for long; the rate eventually normalizes within a few quarters. While monetary policy may have a limited impact on real economic output in Russia, it remains a powerful tool for managing market sentiment and anchoring inflation expectations.

5.12 Variance Decomposition of Interest Rate Shocks

Table 10 presents the result of the Forecast Error Variance Decomposition (FEVD) of Interest Rate (IR) that is the forces that influence monetary policy choices in Russia.

Table 10: Forecast Error Variance Decomposition (FEVD) for Interest Rate (%)

Quarter	$\Delta \ln G_t$	Δepu	$\Delta \ln Y_t$	$\Delta \pi_t^e$	Δi_t
1	0.40%	0.18%	2.54%	12.19%	84.70%
4	0.47%	2.08%	4.25%	16.51%	76.69%
8	0.47%	2.08%	4.25%	16.51%	76.69%
16	0.47%	2.08%	4.25%	16.51%	76.69%

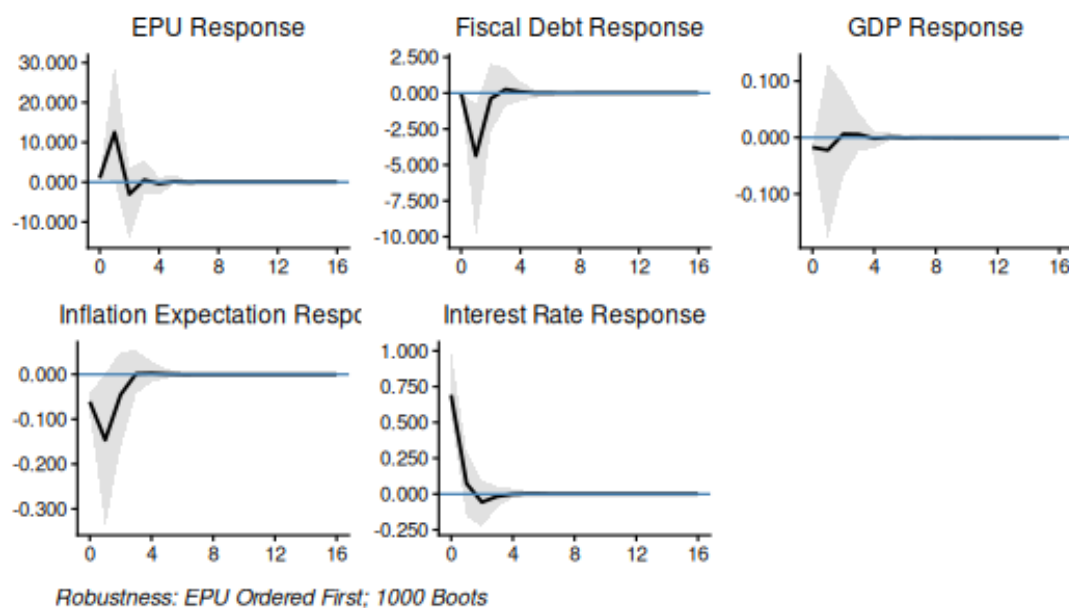
Note: Values represent the percentage contribution of each variable to the forecast error variance of the interest rate (i_t) over the forecast horizon.

In this model, the FEVD result reveals that the monetary policy reaction is primarily driven by inflation expectations rather than the real economy. Inflation expectations explains 16.5% of the movement in interest rates. This confirms that the CBR follows an inflation-targeting framework, and this could be the primary factor that the bank reacts to when deciding to change rates. Over 76% of interest rate variance is explained by its own history. The Russian interest rate is highly persistent. Once the bank starts a hiking or cutting cycle, it tends to follow its own internal momentum. Real GDP explains 4.25% of interest rate fluctuations in Q16. This could mean that the CBR prioritizes price stability over growth. Rates are 4 times more sensitive to inflation expectations than they are to actual GDP performance. My research shows that the Russian macroeconomy is a system driven by public sentiment. While GDP is resilient to external oil shocks, it is highly sensitive to policy uncertainty. Conversely, the CBR ignores debt and uncertainty focusing almost exclusively on managing inflation expectations which explains 16.5% of its policy variance.

6 Robustness Check

In this section, I carry out a robustness test by changing the Cholesky decomposition. The model was re-estimated by using an alternative recursive ordering, placing economic policy

uncertainty first to validate the primary findings in my model.



Source: Author's calculations.

As revealed in the robustness result, the signs, magnitudes and significance levels remain entirely the same as the previous runs. Fiscal debt remains significant and drops to roughly -4.5% at Q1, inflation expectations shows a significant drops roughly -0.16% at Q1, interest rate reveal a significant spike to roughly 0.7% at Q1 and GDP remains statistically insignificant. This confirms that the identified transmission channels are robust to changes in the model's structural assumptions.

7 Discussion of Findings and Conclusion

My empirical findings reveals a unique pro-cyclical policy stance by the CBR where interest rates exhibit a significant decrease following positive shocks to both real GDP and inflation expectations. Although these results initially appear to contradict the conventional Taylor rule, which typically mandates rate hikes to cool an expanding or inflationary economy, they move in tandem with the institutional mandate and the structural constraints of the Russian economy during the 2010-2025 period. A refined perspective on the Russian economy characterized by structural and institutional firewalls that allow the real economy and fiscal sector to remain largely decoupled from external shocks.

Another notable finding of my research is that a positive GDP shock leads to a rate cut of approximately -4.8%. This reflects the CBR's reliance on the exchange rate-inflation nexus. In Russia, positive real sector economy growth shocks such as revenue arising from export activities are historically correlated with ruble appreciation. As stated in the Bank of Russia's monetary policy guidelines (2024-2027), a floating exchange rate acts as a primary shock absorber. Thus, when the ruble appreciates, import prices decline, and the resulting impact is a

natural disinflationary mechanism. During growth period i.e., positive GDP shocks, the ruble already acts like a buffer, preventing the economy from overheating. This market-led tightening gives the CBR the policy room to normalize rates toward a neutral range of 7.5% - 8.5% during periods of growth, provided that the output gap is closing toward its potential rather than overheating. The result of my IRFs also shows that although a 1% exogenous oil shock provides a transitory boost to GDP, the effect is quickly neutralized. This supports the findings of Tiron and Zeynalov (2022), suggesting that commodity shocks in Russian are consumed by monetary adjustments rather than causing long-term shifts in industrial production.

In addition, another important finding of my research is the monetary-expectations nexus and resilience, which dominates the system's dynamics. While exogenous oil prices and EPU exhibit high initial autonomy, their influence is rapidly processed by the monetary environment. The CBR (2025) has explicitly argued that in a state of structural economic reorganization, some relative price adjustments are necessary. If inflation expectations rise due to supply-side shocks or one-off factors e.g., changes in VAT or logistics, the CBR may prioritize the liquidity and investment needed for structural shifts over aggressive interest rate hikes. This pro-cyclical easing ensures that domestic production capacity can catch up with demand, ultimately stabilizing prices in the long run without strangling the transformation process. The findings of my variance decomposition (FEVD) results further validate this institutional story. Inflation expectations explain 16.51% of interest rate fluctuations, confirming that the CBR's policy is more sensitive to psychological market sentiment compare to real output since GDP only explains 4.25% of this variance. This aligns with the Gali (2008) framework, where the central bank focuses on anchoring the psychological inflation target. By cutting rates in a controlled manner, the CBR maintains policy credibility, signaling that it can manage price stability through structural means rather than just traditional demand suppression.

More so, the connection between fiscal and monetary pillars aligns with the framework of Liu and Mustapher (2025). The relationship between fiscal debt and monetary pillars in my study provides empirical support for the coexistence regime framework proposed by Liu and Mustapher (2025). They opined that a system where public debt is partially unbacked and thus influenced by the monetary signals achieves superior welfare outcomes by balancing the stabilization of both inflation and debt. Contrary to the standard contractionary theories, my IRF analysis reveals that a 1% shock to fiscal debt triggers an immediate hike to interest of 0.005%. This aligns with the findings of Hong, Ke, and Nguyen (2024), who argue that increased government borrowing can drive up the cost of capital. In the Russian context, this suggests that the market or CBR views a spike in debt as a signal of potential future inflation or fiscal risk, leading to a higher required interest rate. In addition, while the FEVD results confirm that fiscal debt controls high administrative autonomy, i.e., it is self-explained by 88.01%, the fact that the interest rate is the largest external driver of debt, explaining the variance of debt by approximately 7.9%, validates the partial backing theory of Liu and Mustapher (2025). It confirms that a coordinated policy mix is in place, ensuring that fiscal expansion does not

undermine the monetary authority's commitment to long-term price stability.

The highly significant impact of real GDP on oil price shocks is consistent with the findings by Connolly (2018), who is of the opinion that a yearly 7% increase in GDP between 1999 and 2008 was due to energy prices and the increasing foreign investment. Thus, oil prices are the main driver of real economic growth. As Bloom and Baker (2014) suggest, while uncertainty typically deters investment, the Russian economy exhibits remarkable resilience. While Hong, Ke, and Nguyen (2024) find the fiscal uncertainty generally harms industrial output globally, my results show that Russian real GDP remains statistically insignificant to these shocks. This implies that Russia's institutional firewalls such as the budget rule successfully prevent domestic policy frictions (EPU) from evolving into systemic output collapses. While a traditional Taylor rule would suggest a contractionary rate increase in response to positive GDP growth, my findings align more closely with Gali's (2008) price stability rule. In this framework, the central bank prioritizes anchoring inflation expectations over the output gap. This is evidence by the fact that 16.5% of interest rate variance is explained by expectations' FEVD, while GDP growth explains only 4.25%. This suggests that the CBR follows a modified policy rule where the management of psychological price sentiment takes precedence over real activity, a strategy that Aguilar et al. (2024) identify as critical for emerging market credibility.

The empirical evidence from my findings demonstrates that the Russian economy acts as a resilient-reactive system where the real economic sector is successfully decoupled from external energy shocks through institutional firewalls like the budget rule yet exhibits a pronounced sensitivity to internal policy uncertainty and inflation expectations. since growth in GDP is the key engine that stabilizes and anchors the system, I would recommend that the CBR implement a triple anchor strategy to navigate the current structural transformation. Particularly, the CBR should continue its transparent normalization towards the neutral range of 7.5% - 8.5% of the key rate to anchor psychology in the market, while the government, through its fiscal rule, must ensure that temporary volatility in oil price growth does not destabilize national welfare. Ultimately by utilizing the ruble's natural shock absorber effect, the authorities can maintain the necessary policy that supports reorganization in the economy without compromising long-term price stability.

8 Limitation of The Study

Although the findings of this research provide notable insights into the macroeconomic landscape of Russia, several methodological and data-driven limitations must be acknowledged. Firstly, the study was constrained by the relatively short historical availability of consistent household inflation expectations, such as inFOM from the CBR which only started gathering data for inflation expectation in 2010, and due to the small sample size ($N = 64$), a VAR(1) specification is the only lag that passed all initial diagnostic tests, as further lags produce autocorrelation leading to oscillating and/or explosive IRFs. While a single lag ensures stability

of the model and sufficiently captures the contemporaneous interactions, it may underrepresent long-term complex predictive dynamics that higher-order lags would capture.

Secondly, the suspension of survey data in Q2 2020 due to COVID-19 required linear interpolation to maintain continuity in time series. Although this is a standard econometric adjustment, it introduces a localized smoothing effect that may marginally dampen the measure of volatility of expectations during that specific quarter. Thirdly, the search restricts the optimal lag to a maximum of 4 lags across the standard information criteria (AIC, SC, and HQ); this is to ensure that the degree of freedom is sufficiently preserved and estimations are reliable. While higher-order lags might reveal more sophisticated lead-lag relations, the VAR(1) remains the most robust choice for the sample length in my study. This is to avoid the risk of explosive IRFs and over-parameterization. Additionally, due to the constraint in VAR (1) and the evidence of multiple structural breaks in the Russian economy, such as the 2014 inflation targeting transition and the geopolitical crisis of 2022, the long-run forecast error variance decomposition (FEVD) should be interpreted with great caution. These results are best viewed as indicative of general structural trends rather than precise long-term forecasts.

Finally, due to the structural shifts in 2022 sanctions, the Russian environment underwent a structural transformation after February 2022. It is therefore necessary to account for pre-sanction reality by isolating post-sanction new reality of the Russian economy; however, my model becomes mathematically unfeasible. Attempts to carry out a robustness check by estimating the sign-restricted SVARs and pre-sanction analysis on the truncated model sub-sample (2010-2021) resulted in a numerical variation insufficiency and a loss of degree of freedom, which hinders my model from achieving convergence.

As a result, my model maintained the full sample to ensure the statistical power and IRFs validity. It is therefore necessary for readers to interpret my findings in this study as an average of unique economic regimes and it is encouraged that as more data becomes available, future studies should utilize the Markov-switching models or the Bayesian estimation to more precisely disentangle the new reality from the preceding decades of the economic transition.

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