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A Simple Model of Geopolitical Risk and Sanctions*

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August 22, 2025

Abstract

Geopolitical risk (GPR) shocks that trigger the imposition of sanctions tend to lower output and raise inflation in the sanctioned country. We develop a three-equation small open economy New Keynesian model where GPR shocks are modeled as negative productivity shocks and sanctions manifest as import tariffs in response to GPR increases. We calibrate the GPR process, sanction rule, and interest rate rule to match the observed dynamics of the GPR index, output, inflation, and the policy rate in Russian data. The sanction response to GPR allows the resulting model to capture the empirical impulse responses well. Additionally, we find that Russia's monetary policy rule is more accommodative than prescribed by the standard Taylor rule. While this may reflect policy preferences, recent theoretical results indicate that such a policy stance may be optimal when sanctions act as cost-push shocks that shift the Phillips Curve.

Keywords: geopolitical risk, monetary policy, New Keynesian model, sanctions

JEL classification: E31, E32, E58, F42, F51.

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1 Introduction

Geopolitical events can have dire economic consequences. Caldara and Iacoviello (2022) show that geopolitical risk (henceforth GPR) shocks have significant adverse effects on economic activity in the US.[1] In a study of 44 countries, Caldara et al. (2022) report that GPR shocks lead to higher inflation, and can therefore be labeled 'supply shocks'. What distinguishes regular supply disruptions from GPR shocks, however, is that the latter may trigger sanctions, which can have additional economic repercussions on top of the effects of the GPR shocks themselves. Despite their increasing importance for macroeconomic fluctuations, the transmission of GPR shocks is not yet well understood or modeled, in particular when such shocks lead to sanctions.

Here, we are interested in the effects of geopolitical risk shocks on a country that is the *target of sanctions*. More specifically, our focus will be on Russia. As in Bondarenko et al. (2024), we first estimate the effects of geopolitical risk shocks on the Russian macroeconomy using a vector autoregression (VAR). An unexpected rise in geopolitical risk leads to a drop in output, a spike in inflation and a monetary policy tightening. Second, we investigate how far a simple business cycle model with supply shocks can get us in replicating the observed dynamics. Which model features do we need to add in order to capture the contractionary and inflationary consequences of the shock?

To our knowledge, this paper is among the first attempts to capture, within a theoretical framework, the effects of geopolitical risk shocks in a country subject to sanctions. The work by Caldara and Iacoviello (2022) and Caldara et al. (2022) focuses on the effects of geopolitical risk on Western economies. A vast empirical literature studies the economic effects of sanctions on sender countries and target countries, see Morgan et al. (2023) for an overview. As for theoretical work on sanctions, some recent papers study the optimizing behavior of the sender and/or the target in game-theoretic settings (Bianchi and Sosa-Padilla, 2023, 2024; Becko, 2024). Those models are fairly stylized and thus do not lend themselves directly to (monetary) policy analysis. Elaborate dynamic multi-country models can be found in Ghironi et al. (2024) and Federle et al. (2024); however, they do not consider

[1] Geopolitical risk is defined here as a threat to, or outright disruption in, the relation between countries.

sanctions as a response to geopolitical events, as we do here.

The remainder of the paper is structured as follows. Section 2 discusses empirical evidence and prior work. In Section 3, we capture GPR shocks as negative shocks to productivity in a New Keynesian model of a small open economy. We introduce sanctions in the form of import tariffs, which act as cost-push shocks in the Phillips Curve, and we impose a sanctions policy rule that relates sanctions to geopolitical risk. Section 4 estimates the model parameters by matching the empirical impulse responses of GPR, output, inflation and the policy rate. We discuss the estimated monetary policy rule. Also, we vary the sanctions policy rule and analyze how this changes the dynamics predicted by the model. Finally, we review recent results regarding optimal monetary policy in the face of import tariffs, which can be applied in our context. Section 5 concludes.

2 Evidence and prior work

This section presents VAR evidence on GPR shocks in Russia (and in the US). We then review the literature modeling geopolitical risk and sanctions in a business cycle framework.

2.1 The transmission of geopolitical risk to the Russian economy

We estimate a vector autoregression on Russian macroeconomic data over the sample period 2002m7 – 2021m12. We do not extend the sample to include data after the attack on Ukraine in February 2022. Official statistics post-2022 are either withheld (Mamonov and Pestova, 2024), or are unreliable due to political pressure on institutions – such as the statistical agency or the central bank – to paint an overly favorable picture of the economy, e.g. by overstating output and understating inflation (SITE, 2024). To identify the structural shocks, we assume a recursive ordering, such that only geopolitical risk shocks move the GPR index contemporaneously. Figure 1 displays estimated impulse responses to a GPR shock for the main variables of interest: a news-based index of geopolitical risk (derived using textual analysis of Russian-language newspapers), output, inflation (annualized quarter-on-quarter), and the policy rate.

The figure shows very clearly that a geopolitical risk shock in Russia is recessionary,

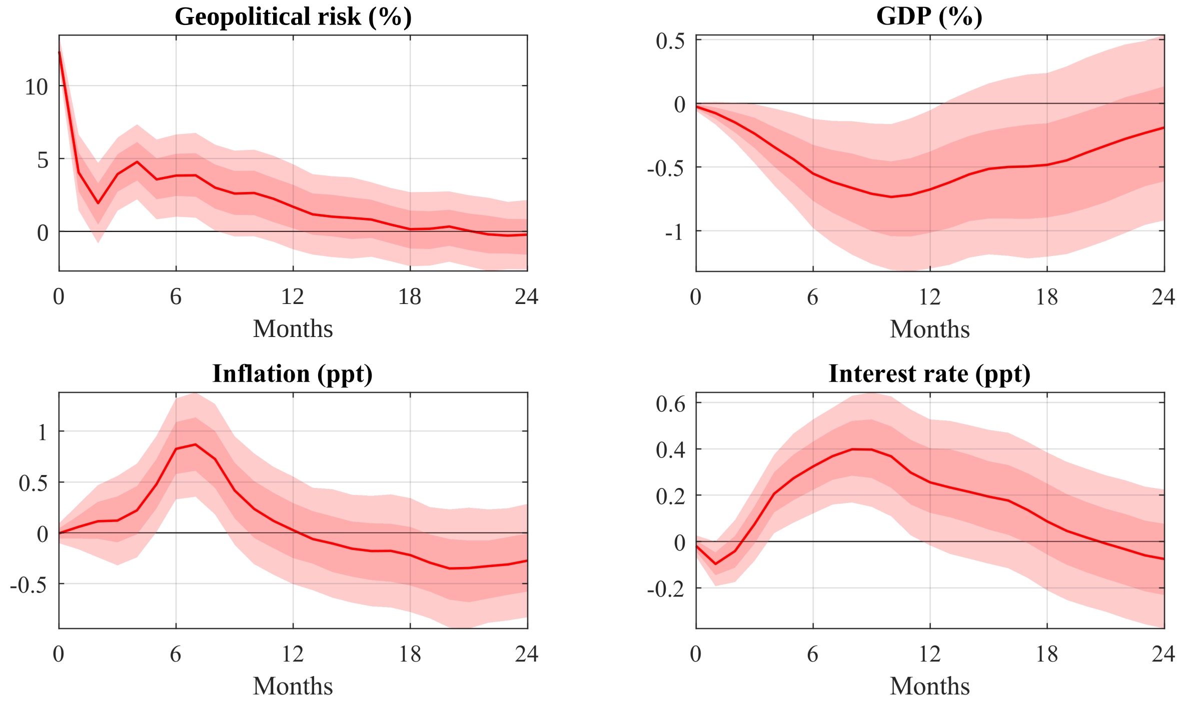

Figure 1: Estimated impulse responses to geopolitical risk shock in Russia

Notes: Figure shows impulses responses of Russian macroeconomic aggregates to a one-standard-deviation shock in the geopolitical risk index (based on Russian-language newspapers) up to 24 months after the shock. The estimation method is a Bayesian VAR identified with short-run zero restrictions. The estimation is based on data from 2002M7 until 2021M12 following the method and specification explicated in Bondarenko et al. (2024). For further details on the construction of the GPR index and the data sources, see Bondarenko et al. (2024). The shaded areas reflect the 95% confidence bands backed-out from the BSVAR exercise in Bondarenko et al. (2024).

pushes up inflation and leads to a monetary policy tightening by the central bank. For comparison, we carry out the same exercise for the US economy over the sample period 1985m1 – 2024m12, see Figure 2. The model specification and identification scheme is identical, while the GPR index is the 'global' index replicated from Caldara and Iacoviello (2022). The dynamic responses to a geopolitical risk shock in the US are significantly recessionary and inflationary, as they are in Russia. However, there is an important difference in amplitude: the peak of the inflation response in Russia is roughly five times that in the US; likewise, at its trough, the contraction in Russian output is five times the contraction in US output.

The different responses observed in Russia vs in the US could be related to: first, different economic structures that affect the propagation of GPR shocks, second, different monetary policies, and third, the fact that Russia is a target, rather than a sender, of economic sanctions. We will focus on the latter two candidate explanations.

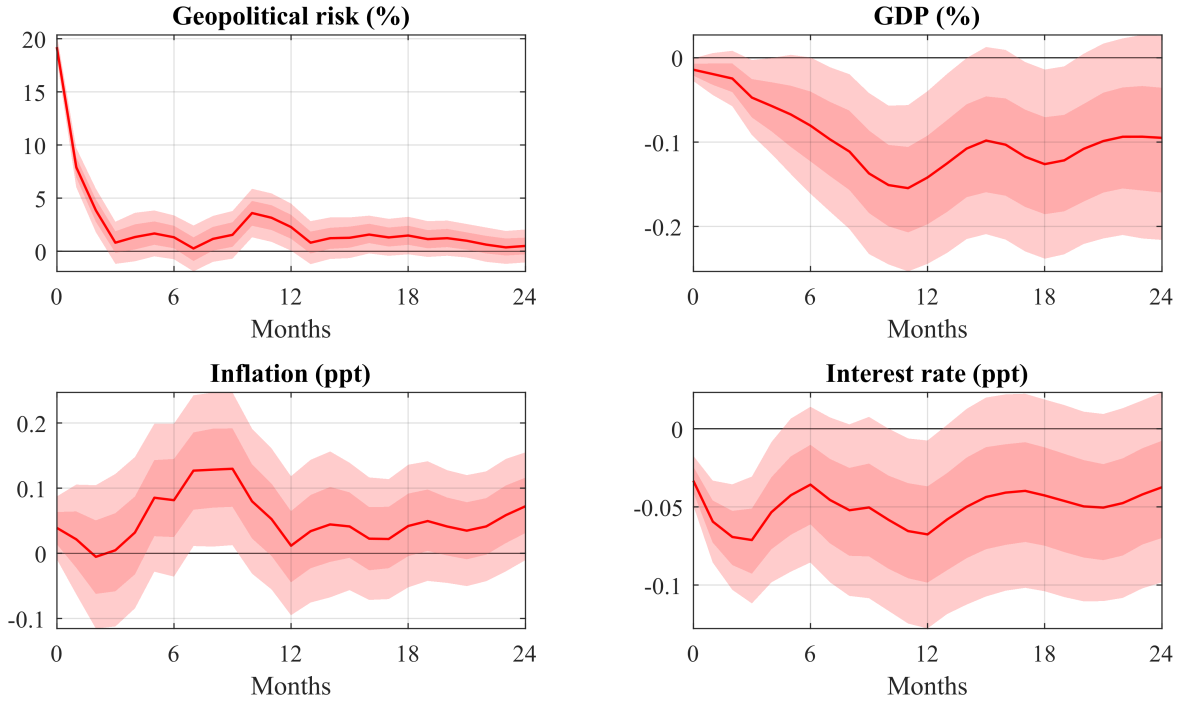

Figure 2: Estimated impulse responses to Anglosphere geopolitical risk shock in US

Notes: Figure shows impulses responses of US macroeconomic aggregates to a one-standard-deviation shock in the Anglosphere GPR, constructed by Bondarenko et al. (2024) up to 24 months after the shock. The estimation method is a Bayesian VAR identified with short-run zero restrictions. The time span and specification follows Bondarenko et al. (2024) and the Russian's SBVAR exercise to facilitate comparisons. The darker shaded areas reflect the 68% confidence bands from the BSVAR exercise while the lighter shared areas represents 95% confidence bands backed-out from the BSVAR exercise.

In our simple framework, we model geopolitical risk as adverse supply shocks and sanctions as cost shocks triggered by geopolitical events. This section provides a comprehensive justification for our modeling choices.

2.2 Modeling geopolitical risk

Economists largely agree that most geopolitical events are exogenous to the business cycle, and we can therefore treat them as shocks in our models (Caldara and Iacoviello, 2022; Federle et al., 2024). We might then ask as what kind of shocks we should best model them? The literature has not yet reached a consensus regarding the latter question. Here, we model geopolitical risk shocks as adverse technology shocks, a choice which is informed by the following considerations.

First, our own work and other empirical evidence finds that GPR shocks – in most countries and time periods – result in a fall in output and a rise in inflation (Bondarenko et al., 2024; Caldara et al., 2022), a pattern that characterizes negative supply shocks.

Second, Ramey and Shapiro (1998) document that military buildups reduce output per hour, while Federle et al. (2024) present evidence that 'war shocks' significantly reduce total factor productivity (TFP) in war sites. This result likely stems from resource misallocation when labor input is needed for the war effort, such that labor is no longer put to its most productive use. When we add labor productivity, measured as output per worker, to our VAR for Russia, we also find a significant drop of this productivity measure in response to a rise in the GPR index, see the left panel in Figure 3.

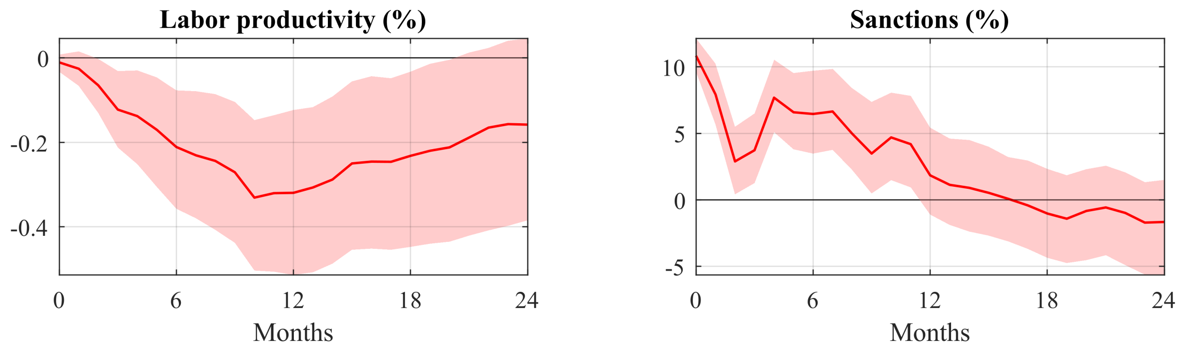

Figure 3: Estimated impulse responses to geopolitical risk shock (Russia)

Notes: Figure shows impulses responses of Russian labor productivity and sanctions intensity to a one-standard-deviation shock in Russian GPR, constructed by Bondarenko et al. (2024) up to 24 months after the shock. The estimation method is a Bayesian VAR identified with short-run zero restrictions. The time span and specification follows Bondarenko et al. (2024). The shaded areas reflect the 68% confidence bands from the BSVAR exercise.

Third, we regard alternative candidate specifications for the GPR shock as less suitable for our exercise. In Federle et al. (2024)'s model, 'war shocks' directly affect monetary policy, destroy capital and boost military spending – in addition to reducing TFP. In our model, (a) we do not allow for GPR to affect the monetary policy rule directly as we are interested in the endogenous response of the central bank to geopolitical developments, (b) we abstract from capital and thus see a decline in TFP as a short-cut to capturing a reduction in the capital stock, (c) we do not model GPR primarily as a rise in military spending as this would manifest as an expansionary demand shock, which is inconsistent with our VAR evidence.

We also refrain from modeling geopolitical risk shocks as (second-moment) uncertainty shocks. These shocks are generally thought to reduce demand, for instance in the presence of precautionary saving motives, see e.g. Caggiano et al. (2014), Leduc and Liu (2016), Basu and Bundick (2017). A contractionary demand shock lowers inflation in the model. Clearly, this is inconsistent with the inflationary effects of GPR shocks presented above. Ruling out the uncertainty channel as a propagation mechanism for geopolitical risk means we might miss a – possibly relevant – effect of heightened risk on inflation. There is a literature that links aggregate uncertainty to price flexibility and inflation, either because uncertainty makes firms more willing to invest in price setting capability (Arndt and Enders, 2023; Khalil and Lewis, 2024) or because firms engage in precautionary pricing (Fernández-Villaverde et al., 2015).

2.3 Modeling sanctions

Sanctions are policies that restrict or prohibit economic activities with another country. In their global sanctions database, Syropoulos et al. (2024) provide a classification of sanctions objectives, which are often political in nature. Many of the sanctions imposed on Russia had the objective to prevent or end a war, see Table 5 in Bondarenko et al. (2024). The sanctions imposed after Russia's annexation of Crimea in 2014 and after the Russian attack on Ukraine in 2022 were clearly triggered by geopolitical events (Yalcin et al., 2025; IMF, 2025). This suggests that sanctions might be modeled as a policy response to geopolitical risk, rather than as an exogenous shock as assumed e.g. in Ghironi et al. (2024) and Mamonov and Pestova (2024).

To further strengthen our argument, consider again Figure 3, which shows the response of the Russian sanctions intensity index from Bondarenko et al. (2024) to an exogenous increase in geopolitical risk. Sanctions intensity rises significantly following the shock, which confirms that sanctions are imposed in response to greater geopolitical risk.

Through which channels do trade sanctions impact the Russian economy? Given that sanctions act as trade shocks from the perspective of the sanctioned country, a key insight from trade theory applies: the greatest effect is observed in the short run when trade elasticities are low. This is because import substitution takes time as the sanctioned country shifts expenditure to domestic goods or to imports from third countries. Itskhoki and Ribakova (2024) report that Russia's import share almost halved on impact as sanctions were imposed, while import and consumer price inflation spiked.

Consider the counterfactual exercise in Figure 4, which shows the effects of geopolitical risk shocks in Russia with sanctions (in red) and without sanctions (in blue).[2] We see that the main effect that sanctions had on Russia was to push up inflation and the policy rate; the output response is not significantly altered by the sanctions policy. This evidence suggests that sanctions on Russia have acted mainly as cost-push shocks.

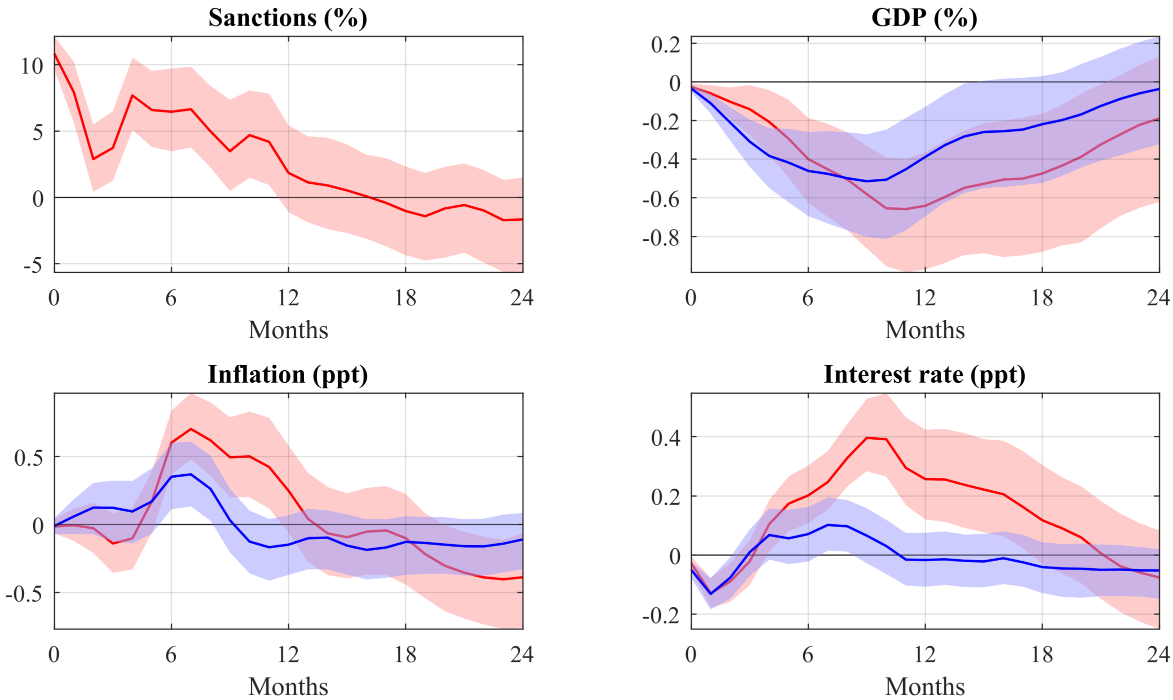

Figure 4: Estimated impulse responses to geopolitical risk shock in Russia

Notes: Figure shows impulses responses of Russian macroeconomic aggregates to a one-standard-deviation shock in the geopolitical risk index (based on Russian-language newspapers) up to 24 months after the shock. The estimation method is a Bayesian VAR identified with short-run zero restrictions. The estimation is based on data from 2002M7 until 2021M12 following the method and specification of Bondarenko et al. (2024). For further details on the construction of the GPR index and the data sources, see Bondarenko et al. (2024). The shaded areas reflect the 95% confidence bands backed-out from the BSVAR exercise in Bondarenko et al. (2024).

In an open economy setting, trade shocks in the form of tariffs or quantity restrictions may generate the observed effects of sanctions. Tariffs increase import prices directly. Quantity restrictions increase import prices indirectly as they lead to re-routing and a diversion of trade to less efficient producers in third countries. Either way, trade shocks are felt by the home country as supply disruptions, lowering output and raising production costs, which ultimately lead to higher inflation (Amiti et al., 2019; Barattieri et al., 2021). For simplicity, we incorporate a price-restriction-type sanction as an import price/tariff shock. This allows for a simple and tractable linear system in a small number of equations. Indeed, Werning

[2] For methodological details, see Bondarenko et al. (2024). Note that the sanctions variable is a text-based measure of sanctions intensity as in Laudati and Pesaran (2023).

et al. (2025) show that the imposition of tariffs maps into a cost-push shock in the standard New Keynesian (closed-economy) model.

Another simplification is that we consider a one-sector model, which has the disadvantage that we cannot simulate sector-specific sanctions that are applied to exports of, for instance, commodities or energy products. Furthermore, we assume a fixed number of symmetric producers. Unlike Ghironi et al. (2024), we cannot model the effects of sanctions on firm entry and exit, which may matter for product diversity and aggregate productivity changes through selection effects. The effects of financial sanctions, which restrict international borrowing, are qualitatively similar to trade sanctions to the extent that they reduce trade by limiting access to foreign exchange (Mendoza, 1991; Tamirisa, 1999; Besedeš et al., 2024). Therefore, we do not model financial sanctions separately here.

Similarly to Mamonov and Pestova (2024), we model Russia as a small open economy. Itskhoki and Ribakova (2024) point out that Russia is larger and more integrated into global markets than other sanctions targets such as Iran, North Korea, or Venezuela. This likely matters for the repercussions that sanctions can have on the sender countries; we abstract from these characteristics as we focus the effects of sanctions within the target economy.

In Section 3, we derive our simple 3-equation model from a small open economy microfoundation à la Galí and Monacelli (2005), which allows us to trace our 'reduced-form' supply shocks back to an open-economy origin. The resulting model closely resembles the one in Monacelli (2025).

3 Model

Following the empirical evidence and the review of the literature in Section 2, we model geopolitical risk shocks in a very simple way as negative productivity disturbances. Suppose that the aggregate production function is $Y_t = Z_t \, N_t$, where Z_t is productivity and N_t is labor input. Further, productivity is a negative function of exogenous geopolitical risk, g_t, $Z_t = Z(g_t)$, where $Z'(g_t) < 0$. Modeled in this way, geopolitical risk shocks will manifest as supply disruptions that lower output and raise inflation. In order to make the magnitudes of impacts on output and inflation comparable to the empirical findings (Figure 1), we make additional assumptions concerning the pass-through effect of GPR shocks to the productivity level, $\Theta^{g,z} > 0$. Formally,

$$z_t = \rho_z \, z_{t-1} - \Theta^{g,z} \, g_t + \varepsilon_t^z, \tag{1}$$

where $z_t \equiv \ln(Z_t)$ with geopolitical risk following an AR(1) process, similar to news shocks in Barsky and Sims (2012),

$$g_t = (1 - \rho_g) \, g + \rho_g \, g_{t-1} + \varepsilon_t^g. \tag{2}$$

Now, suppose that the rest of the world imposes sanctions on the country in question. Sanctions are imposed in response to geopolitical risk, $\mathcal{S}_t = \mathcal{S}(\varepsilon_t^g)$, where $\mathcal{S}'(\varepsilon_t^g) > 0$. For simplicity, suppose that sanctions come in the form of a linear policy rule, i.e.

$$\mathcal{S}_t = \tau_k \, g_{t-k} + \rho_{\mathcal{S}} \, \mathcal{S}_{t-1} + \nu_t, \tag{3}$$

where $\tau_k > 0$ captures the responsiveness of sanctions to GPR and k captures the lagged effect of such process. Furthermore, $\rho_{\mathcal{S}}$ is the autocorrelation of sanctions and ν_t is a mean-zero normally distributed 'sanctions policy shock'. Under a standard representation, sanctions, $\mathcal{S}_t$, will show up as cost-push shocks in the Phillips Curve.

As discussed in Section 2, sanctions are modeled as an import price or tariff shock to Russia. We extend Galí and Monacelli (2005)'s small open economy New Keynesian framework to incorporate these sanction effects. To capture the persistent hump-shaped responses observed empirically, we enrich the model with habit formation in consumption and backward-looking inflation indexation. The resulting analytical framework closely resembles the case analyzed in Monacelli (2025) on import tariffs. In the following, we discuss the most important model equations.[3] Home is the sanctioned country. All lower-case variables are expressed in deviations from their respective steady-state levels.

Sanctions directly impact home demand for imports, $C_{F,t} = \alpha[P_{F,t}(1+\mathcal{S}_t)/P_t]^{-\eta} C_t$, where $P_{F,t}$ is the price index of imported goods (in the absence of sanctions) in terms of the domestic currency, $\alpha \in (0, 1)$ is the degree of openness of the domestic economy, and $\eta > 0$ is the

[3] For a full derivation of the model, see the online appendix.

substitutability between domestic and foreign goods. Sanctions reduce domestic demand for foreign goods as they become more expensive, ceteris paribus. P_t is the domestic consumer price index, $P_t = [(1-\alpha)(P_{H,t})^{1-\eta} + \alpha(P_{F,t}\,(1+\mathcal{S}_t))^{1-\eta}]^{1/(1-\eta)}$. As shown in Monacelli (2025), using the definition of inflation $\Pi_t = P_t/P_{t-1}$, and the terms of trade, $S_t = P_{F,t}/P_{H,t}$ and log-linearizing around the steady state, domestic inflation can be expressed as a function of the change in the price of domestically produced goods, $\pi_{H,t}$, the change in the terms of trade in the absence of sanctions, Δs_t, and the change in sanctions themselves, $\Delta\mathcal{S}_t$,

$$\pi_t = \pi_{H,t} + \alpha(\Delta s_t + \Delta\mathcal{S}_t). \tag{4}$$

Equation (4) indicates that the degree to which international prices and sanctions affect inflation depends on the country's degree of openness.

Using the international risk sharing condition implied by complete financial markets, we derive domestic consumption relative to foreign consumption c_t^* as follows,

$$c_t - c_t^* + \frac{\vartheta - 1}{\vartheta}\,(c_{t-1} - c_{t-1}^*) = \frac{1}{\sigma}\,q_t, \tag{5}$$

where the real exchange rate, q_t, is increasing in the terms of trade and decreasing in sanctions,

$$q_t = (1-\alpha)s_t - \alpha\mathcal{S}_t. \tag{6}$$

The term $\vartheta \equiv \frac{\sigma}{\sigma + h(\sigma-1)} \in (0,1)$ reflects habit formation in consumption of degree $h \in (0,1)$; if there is no habit formation, $h = 0$ and thus $\vartheta = 1$. The parameter $\sigma > 1$ is the household's relative risk aversion. Ceteris paribus, equation (5) implies that sanctions, manifesting through unanticipated increases in import prices, decrease domestic consumption. The magnitude of this impact depends on the degree of openness of the home economy, given the degree of risk aversion.

The system of model equations characterizing the economy are described by the following dynamic IS equation, New Keynesian Phillips Curve and monetary policy rule:

$$y_t = \vartheta \left[\mathbf{E}_t\{y_{t+1}\} - \frac{1}{\sigma}(r_t - \mathbf{E}_t\{\pi_{H,t+1}\} - \rho)\right] + (1-\vartheta)\, y_{t-1}$$
$$+ \vartheta\Big(\sigma_s\, \mathbf{E}_t\{\Delta s_{t+1}\} + \sigma_{\mathcal{S}}\, \mathbf{E}_t\{\Delta \mathcal{S}_{t+1}\}\Big) + (1-\vartheta)\left[\Big(\frac{\alpha}{\sigma} - \sigma_s\Big)\, \Delta s_t - \Big(\sigma_{\mathcal{S}} - \frac{\alpha}{\sigma}\Big)\, \Delta \mathcal{S}_t\right], \quad (7)$$

$$(1+\beta\chi)\, \pi_{H,t} = \frac{\varepsilon - 1}{\kappa}\, mc_t + \beta\, \mathbf{E}_t\{\pi_{H,t+1}\} + \chi\, \pi_{H,t-1}, \quad (8)$$

$$r_t = \rho_r\, r_{t-1} + (1-\rho_r)\, (\phi_\pi\, \pi_t + \phi_y\, y_t), \quad (9)$$

where y_t is output, r_t is the nominal interest rate, mc_t represents real marginal costs, and $\mathbf{E}_t$ is the expectations operator based on information available at time t. The parameter $\kappa > 0$ captures price adjustment costs, and $\varepsilon > 1$ is the elasticity of substitution across varieties. The policy coefficients $\rho_r \in (0,1)$, $\phi_\pi > 0$ and $\phi_y > 0$ measure interest rate smoothing, the response to inflation and the response to output, respectively.

Equation (7) is derived from the household's Euler equation. Equation (8) is derived from the firm's optimal price-setting condition. Habit formation through $\vartheta < 1$ gives rise to lagged adjustment terms in both (7) and (8). Inflation indexation of degree $\chi \in (0,1)$ introduces lagged producer price inflation, $\pi_{H,t-1}$, in equation (8).

The composite parameters $\sigma_s \in \mathbb{R}$ and $\sigma_{\mathcal{S}} > 0$ are functions of deep parameters including the home country's degree of openness, the substitutability between home and foreign goods $\eta > 0$, the trade elasticity $\gamma > 1$, and the household's relative risk aversion. Specifically, $\sigma_s \equiv \frac{\alpha}{\sigma}(1-\omega)$ and $\sigma_{\mathcal{S}} \equiv \frac{\alpha}{\sigma}(1 + \alpha(\eta\,\sigma - 1))$ with $\omega \equiv \sigma\gamma - (\sigma - 1)(\eta\sigma - 1)$. The size of σ_s and $\sigma_{\mathcal{S}}$ relative to the ratio α/σ govern the extent to which the terms of trade and tariffs impact domestic output.

4 Geopolitical risk shocks, sanctions, and monetary policy

This section estimates the parameters of our model by impulse response matching, where we minimize the distance between the model-predicted responses to a geopolitical risk shock and their VAR counterparts displayed in Figure 1. We interpret the estimated monetary policy coefficients and compare them to other estimates. In a counterfactual exercise, we vary the sanctions policy coefficient and analyze how the model dynamics are affected. Finally, we briefly discuss the monetary policy tradeoffs that emerge in our model.

4.1 Estimation and model fit

Table 1 presents our parameterization at a monthly frequency. The discount rate takes the standard value of $0.99^{1/3}$. The coefficient of relative risk aversion σ is set to 2 following the upper bound implied in Chetty (2006), as is the inverse Frisch elasticity of labor supply, φ, which is consistent with Keane and Rogerson (2012). The home country's degree of openness is set to 0.34, with the parameter governing the substitutability between home and foreign goods set to 0.82, following Andreyev (2020)'s calibration for Russia. The trade elasticity is set to 2 as in one of the scenarios analyzed in Baqaee and Malmberg (2025).

For a number of dynamic parameters, we use the values estimated by Andreyev (2020) for the Russian economy. The degree of habit formation is set to $0.64^{1/3}$, and inflation indexation takes the value of $0.44^{1/3}$. The price adjustment cost parameter, κ, is set to 12.79, a value that corresponds to a price duration of around 6-7 months under the Calvo mechanism.[4] The inflation response in the interest rate rule is set to 1.58. Finally, the autocorrelation of the technological shock is set to $0.85^{1/3}$.

The shock process of the GPR index, the pass-through of GPR to productivity, the parameters governing the sanction rule (3), and the interest rate parameters (interest rate smoothing and the coefficient on output) are estimated to match the empirical dynamics of the GPR index, output, inflation, and interest rate presented in Figure 1. We use minimum distance estimation to match the impulse responses, following Christiano et al. (2005).

Let $\mathbf{\Psi}(\mathbf{\Xi})$ denote the vectorized model impulse responses based on the vector of parameters $\mathbf{\Xi} \equiv [\,\rho_g, \Theta^{g,z}, \tau_k, \rho_\tau, \rho_r, \phi_y\,]$, and let $\hat{\mathbf{\Psi}}$ denote the vectorized empirical responses. We include the first 25 elements of each response function in the estimation. The estimate of $\mathbf{\Xi}$ solves:

$$\min_{\mathbf{\Xi}} \big(\mathbf{\Psi}(\mathbf{\Xi}) - \hat{\mathbf{\Psi}}\big)' \mathbf{V}^{-1} \big(\mathbf{\Psi}(\mathbf{\Xi}) - \hat{\mathbf{\Psi}}\big), \tag{10}$$

[4] Ascari and Rossi (2012) explain how the Rotemberg price adjustment cost can be 'translated' into a Calvo price contract length in the standard New Keynesian model.

Table 1: Parameter values

Parameter	Value	Description	Target/Reference
Calibrated parameters			
β	$0.99^{1/3}$	Discount rate	4% real interest rate p.a.
σ	2	Coefficient of relative risk aversion	Chetty (2006)
φ	2	Inverse Frisch elasticity of labor supply	Keane and Rogerson (2012)
γ	2	Trade elasticity	Baqaee and Malmberg (2025)
η	0.82	Substitutability home and foreign goods	Andreyev (2020)
α	0.34	Degree of home's openness	Andreyev (2020)
κ	12.79	Price adjustment cost	Andreyev (2020)
ε	10	Substitutability across home varieties	Andreyev (2020)
h	$0.64^{1/3}$	Habit formation	Andreyev (2020)
χ	$0.44^{1/3}$	Inflation indexation	Andreyev (2020)
ϕ_π	1.58	Monetary policy coefficient on inflation	Andreyev (2020)
ρ_z	$0.85^{1/3}$	Auto-correlation of technological progress	Andreyev (2020)
Estimated parameters			
ρ_g	0.754 (0.017)	Auto-correlation of GPR	
$\Theta^{g,z}$	0.004 (0.001)	Pass-through of GPR to productivity	
τ_5	0.028 (0.001)	Sanctions form GPR shock	
$\rho_{\mathcal{S}}$	0.833 (0.016)	Autocorrelation of sanction policy	
ρ_r	$0.853^{1/3}$ (0.008)	Monetary policy coefficient on lagged interest rate	
ϕ_y	0.06/3 (0.006)	Monetary policy coefficient on output	

Notes. For each estimated parameter, the standard error is given in parentheses.

where $\mathbf{V}$ is the diagonal matrix with the sample variances of $\hat{\mathbf{\Psi}}$ along the diagonal. The standard errors are computed following Mertens and Ravn (2011) and Hall et al. (2012).

Figure 5 presents the model impulse responses of geopolitical risk, output, annualized inflation, and the policy rate from the IRF matching exercise. Under the estimated GPR persistence, ρ_g, GPR pass-through, $\Theta_{g,z}$, sanction parameters, $\{\tau_k, \rho_\tau\}$, and interest rate rule parameters, $\{\rho_r, \phi_y\}$, the model's GPR index, output, inflation, and interest rate align with their empirical counterparts. The model's inflation response slightly overshoots the empirical impulse responses in months 5-10 following the GPR shock. With indexation, the model produces humped-shaped inflation responses in accordance with the empirical observations. Meanwhile, the model's nominal interest rate response largely coincides with its empirical counterpart. Note that k is set to 5, as this value minimizes the objective function (10).

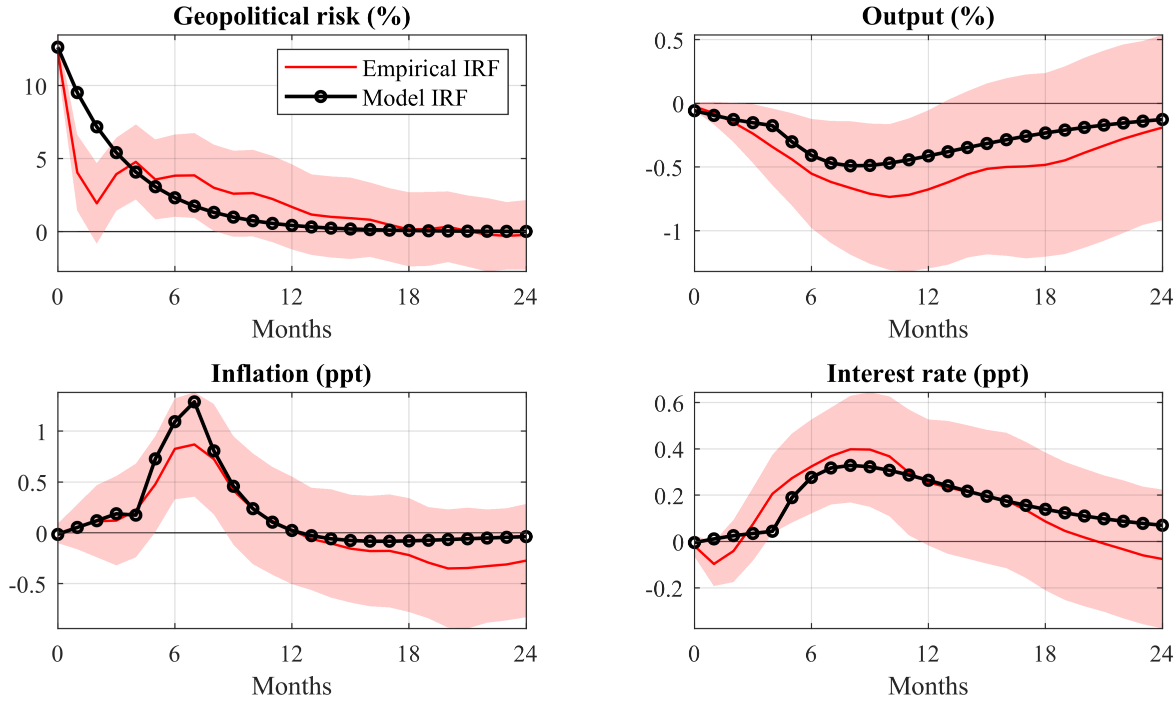

Figure 5: Impulse responses from IRF matching exercise

Notes: Figure shows empirical responses of Russian economy (in red) against the model impulse responses (in black) to a one-standard-deviation shock in the geopolitical risk index. The shaded areas reflect the 95% confidence bands backed-out from the BSVAR exercise presented in Bondarenko et al. (2024).

4.2 Monetary policy responses to geopolitical risk shocks

In the following, we discuss what our estimation results tell us about the sanctions target's monetary policy in the face of geopolitical risk events.

The estimated monetary policy coefficient on output stands at $\phi_y = 0.06/3$, which indicates that monetary policy actively responds to real economic fluctuations, unlike the inflation-only targeting approach presumed in Andreyev (2020), where ϕ_y is set to zero. Our estimate of the monetary policy coefficient on lagged inflation, $\rho_r = 0.85^{1/3}$, indicates greater interest rate smoothing than in the US, where Smets and Wouters (2007) estimate a value of $\rho_r = 0.81^{1/3}$ and Iacoviello (2005) estimates a value of $\rho_r = 0.73^{1/3}$. Relative to the benchmark interest rate rule parameters $\phi_\pi = 1.5$ and $\phi_y = 0.125/3$ in Taylor (1993), our estimated interest rate rule is less responsive to inflation and output fluctuations (after adjusting for interest rate smoothing).[5] This suggests that the estimated monetary

[5] The estimated Russian responses to inflation and output after adjusting for interest rate smoothing are approximately $(1 - 0.85^{1/3}) \times 1.58 \approx 0.083$ and $(1 - 0.85^{1/3}) \times 0.02 \approx 0.001$, respectively. The corresponding values for the US are about 0.10 and 0.003 under the estimated interest rate smoothing parameter in Smets and Wouters (2007), and 0.15 and 0.004 under Iacoviello (2005).

policy reaction function is more accommodative than the benchmark Taylor rule prescribes, potentially reflecting institutional constraints or different policy objectives in the modeled economy.

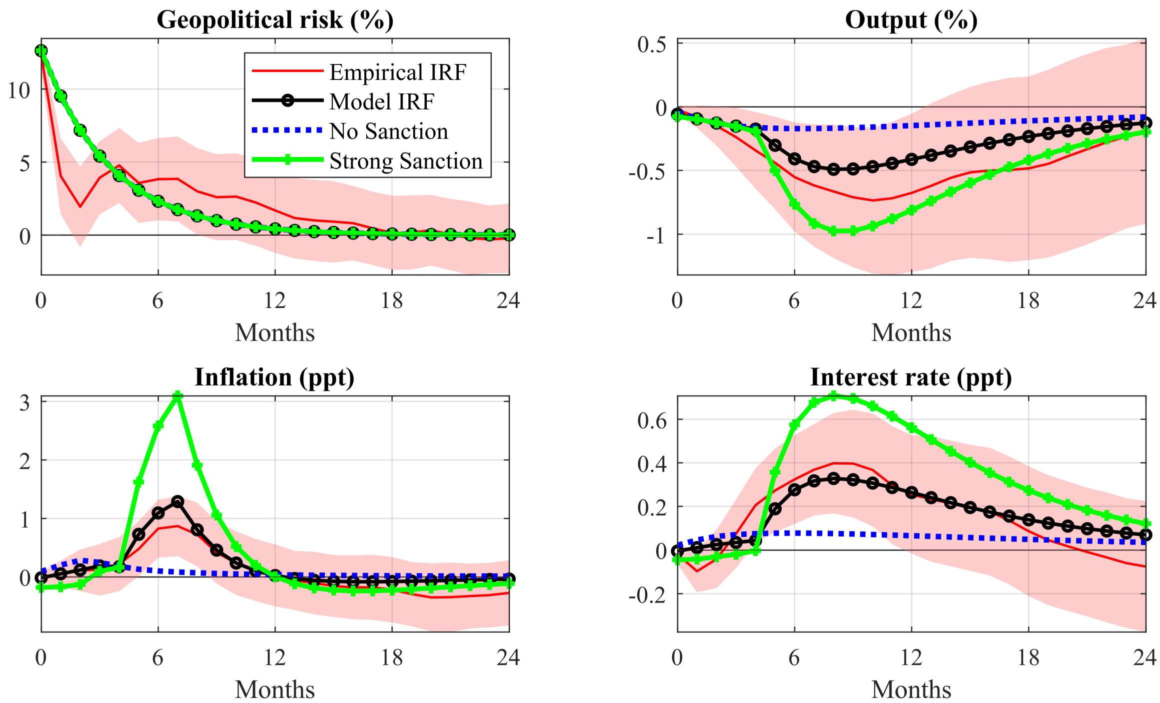

Figure 6: Model impulse responses with sanctions policy

Notes: Figure shows empirical responses of Russian economy (in red), the model impulse responses with estimated sanction parameters (in black), the model impulse responses without sanction (in blue) and the model impulse responses with strong sanction pass-through (in green) to a one-standard-deviation shock in the geopolitical risk index. The shaded areas reflect the 95% confidence bands backed-out from the BSVAR exercise presented in Bondarenko et al. (2024).

4.3 The effect of sanctions

In a counterfactual policy exercise, we now investigate to what extent the observed dynamics in response to geopolitical risk shocks in Russia were shaped by sanctions. What would the economic effects be if no sanctions had been imposed? How would the Russian economy respond to geopolitical risk shocks if sanctions were more severe?

Figure 6 depicts the impact of a one-standard-deviation increase in the GPR index on output, inflation, and the nominal interest rate in our estimated model. The baseline model responses, shown as black lines in the figure, correspond to the case where $\tau_5 = 0.028$. In the absence of sanctions ($\tau_5 = 0$), a positive GPR shock operates solely through the productivity channel, reducing output by less than 0.1% and generating modest increases in both inflation and the interest rate. This scenario is shown as blue dotted lines in Figure 6. Thus, according to our analysis, the adverse effects of GPR shocks on the Russian economy are primarily driven by sanctions rather than by the shocks themselves.

More severe sanctions deepen the contraction in output and, more importantly, induce much additional inflationary pressure. The green lines in Figure 6 depict a counterfactual exercise where τ_5 set approximately 2.5 times larger than its estimated value. In this scenario, output shrinks by 1% at its trough, a response that is still within the VAR confidence bands. The responses of inflation and the interest rate become much more pronounced, with the peak responses far beyond the VAR confidence bands.

4.4 Monetary policy tradeoffs

In our model, sanctions imposed in reaction to geopolitical events act as a cost-push shock, driving up import prices and creating inflationary pressure. The central bank responds by raising the nominal interest rate to contain inflation. However, the monetary tightening creates a policy trade-off. While the higher interest rate helps restrain prices, it dampens domestic consumption and strengthens the currency, further weakening output through reduced export competitiveness.

Monetary policymakers in sanctions targets face trade-offs similar to those generated by import tariffs, see Werning et al. (2025) and Monacelli (2025). While the geopolitical risk shock itself lowers potential output, it does not alter the monetary policy trade-off as discussed in Werning et al. (2025). Instead, the central bank's dilemma is driven primarily by the sanction-induced wedge that shifts the Phillips curve upward and forces the central bank into a tension between stabilizing inflation and output. The optimal course, as shown in Werning et al. (2025) and Monacelli (2025), is to accept some temporary inflation above target in order to cushion the fall in economic activity. This implies that the central bank of an economy subject to sanctions should avoid an abrupt contraction that would result from strict inflation targeting, but accept temporarily higher inflation to smooth the adjustment path.

5 Conclusion

In this paper, we develop a simple model of geopolitical risk and sanctions. In a vector autoregression estimated on Russian data, geopolitical risk shocks lead to a recession, a surge in inflation and a tightening in the policy interest rate. We aim at replicating these responses in a small open economy New Keynesian model augmented with consumption habits and price indexation to inflation. Geopolitical risk (GPR) shocks are modeled as negative technology shocks, while sanctions are modeled as import price/tariff shocks triggered by GPR increases. Sanctions act as cost-push shocks, which deepen the contraction in output and induce additional inflationary pressure in response to geopolitical risk events. We estimate the parameters by matching the VAR responses to GPR shocks. Our estimated model generates impulse responses that fit their empirical counterparts rather well. This good model fit is achieved mainly thanks to the sanctions channel: without sanctions, the output drop would be mild and short-lived, as would be the rise in inflation. Moreover, the estimated parameters indicate that the Russian interest rate policy responses are more accommodative than prescribed by the standard Taylor rule. Recent theoretical contributions to the monetary policy literature suggest that a temporary rise in inflation above target may indeed be optimal when sanctions come in the form of import tariffs.

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