Spillover Effects of Geopolitical Risk on the Banking Sectors of Post-Soviet Countries

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Abstract

Purpose: This study examines the spillover effects of geopolitical risks on the banking sectors of a sample of post-Soviet countries, focusing on the consequences of the Russian–Ukrainian conflict.

Design/methodology/approach: We use the geopolitical risk (GPR) index from Caldara and Iacoviello (2022) as a global measure of geopolitical risk and the Diebold-Yilmaz (2012) connectedness model to estimate the spillover effects of the conflict on the performance of financial institutions. We also conduct a network analysis to examine the transmission effects among banking sectors further.

Findings: Our results show little or no significant evidence of GPR transmissions on the financial sectors' performance (returns) and risk in the countries examined.

Originality: This study bridges the existing gap in the literature by examining the effects of GPR events that occurred in the post-Soviet region from 2017 to 2023 on the banking sectors of a selected sample of CIS countries. These economies have not yet received as much academic attention as other developed and developing countries. However, the geographical, historical, and cultural proximity of the post-Soviet countries examined to the parties involved in the Russia – Ukraine conflict makes this research particularly relevant.

Practical Implications: This study allows for a better understanding of GPR transmission mechanisms and the consequences of the conflict on Russia's neighbouring countries. It can also support policymakers and financial institutions in formulating risk management strategies.

Keywords: Geopolitical risk; post-Soviet countries; Banks; Spillover; Russian Ukrainian conflict
JEL codes : F30, G20, G21

1. Introduction

Geopolitical risk (GPR, hereafter) and extreme exogenous events are known to have disruptive effects on the stability of economic systems and financial markets. GPR has been defined as the "threat, realisation, and escalation of adverse events associated with wars, terrorism, and any tensions among states and political factors that affect the peaceful course of international relations" (Caldara & Iacoviello, 2022). Shocks to the banking system may affect a country's general economic stability, owing to the critical role played by financial institutions in economic growth and development (Pham et al., 2021). Further, the levels of vulnerability of banking systems to external shocks can have significant consequences on investment decisions and lead to sub-optimal allocation of resources, with cuts in lending levels and disruptions to credit supply (Calomiris et al., 2017).

The importance of the role of financial institutions in economic growth has led to extensive academic interest in the study of their stability, performance, and risk levels during and after extreme events, such as 2008 global financial crisis and the wave of bank failures that ensued (Acharya and Ryan, 2016; Berger and Bouwman, 2013; Morgan, 2002; Elfeituri ,2022; Zheng and Wu, 2023), or the more recent COVID-19 pandemic (Colak and Oztekin, 2021; Duan et al., 2021). However, while much of the existing literature focuses on the heightened global economic uncertainty triggered by extreme events and how they adversely impact the performance and stability of banking systems within specific countries (see Shabir et al., 2023; Salisu et al., 2022; Tabash et al., 2022; Pham et al., 2021), the extent of GPR spillover effects from neighbouring conflicts, and their consequences on financial institutions are still under-researched. This study bridges the existing gap in the literature by examining the effects of GPR events that occurred in the post-Soviet region from 2017 to 2023 on the banking sectors

of a selected sample of countries. These economies have not yet received as much academic attention as other developed and developing countries. However, the geographical, historical, and cultural proximity of the post-Soviet countries examined to the parties involved in the Russia – Ukraine conflict makes this research particularly relevant. Due to data constraints, this study limits its analysis to a sample of countries, it examines GPR effects and transmission channels on the financial systems of Georgia, Kazakhstan, Uzbekistan, Russia, and Ukraine. The implications and extent of spillover effects on financial institutions caused by the Russian-Ukrainian conflict are investigated and explained. Despite their importance, understanding post-Soviet financial institutions under stress conditions is still limited, with the notable exceptions of Bayramov et al. (2020) and Pham et al. (2021). The economic effects of Russia's military intervention in Eastern Ukraine in 2014 and the ensuing conflict on Ukraine's banking sector become weaker for banks (or bank branches) that are further away from the conflict area (Pham et al., 2021) in support of the argument that interconnectedness and geographical proximity are essential channels for shock transmission (Balli et al., 2022).

We use a unique collection of data on risk and returns of selected banks' share prices and find that contrary to expectations, despite their geopolitical closeness to the conflict area, the banking systems examined have not been significantly affected by the latest events in Ukraine. Crucially, the sample of countries is restricted by data availability, as we employ a sufficiently large number of observations, stretching from January 2017 to January 2023 to include as many geopolitical events as possible. The results show no directional connectedness between measures of geopolitical risk caused by the conflict and banks' returns. This implies that the banks examined have not been significantly and negatively affected by the geopolitical risks captured by the indices used. Like our findings on returns, we provide strong evidence of

each country's banking institutions' connectedness in terms of volatility, while cross-country connectedness is again negligible. Crucially, outside Russia, there is no evidence of direct or indirect spillover effects of the sanctions imposed on the Russian economy. These findings point to uniquely insulated financial systems, which so far have enabled local central banks to shield financial institutions from the negative effects of the exogenous developments in the nearby area. However, importantly, these findings apply to our short-term analysis. At this stage, it is impossible to provide insights as to whether a long-drawn-out conflict will ultimately affect banks in the long term.

The key contributions of this study add to the literature on financial economics in several ways. We shed light on the spillover effects of geopolitical risk on the performance of financial institutions; this adds to previous work which has measured and explained the transmission mechanisms of GPR across countries in terms of changes in macro-economic variables (Balli et al., 2022) or for other strategic industries such as defence (Zhang et al., 2022), or energy (Smales, 2021). So far, the strand of literature on GPR effects on banks has concentrated mainly on the impact of the transmission of economic and financial shocks (positive as well as negative) to banks' own credit supply, lending practices, and the broader economy (Degryse et al., 2019; Gilchrist & Zakrajšek, 2011; Korinek et al., 2010; De Haas & Van Horen, 2013). The literature agrees that after liquidity constraints caused by financial or economic shocks, banks become more cautious with their lending practices and often pass liquidity constraints on to their customers, for example, through higher interest rates. So far, the only study that has investigated the effects of the geopolitical risk caused by the conflict in Eastern Ukraine on local banks' asset values found that the extent of the effect is proportional to the exposure of the banks' operations in the affected region (Pham et al., 2021). Our study

extends the scope and geographical reach of spillover effects that may result from the interconnectedness/transmission mechanisms between countries neighbouring the conflict areas.

Secondly, we contribute to the discussion on the stability of financial systems, which depends on the structure and levels of intervention by governments and central banks (Coombs & Thiemann, 2022; Masciandaro & Volpicella, 2016). Crucially, the key drivers of the role of central banks in macroprudential governance are found to be linked to involvement in micro supervision, which grants central banks information advantages, discretion for monetary policy, and institutional independence from governments, which reduces the level of macro supervisory power (Masciandaro & Volpicella, 2016). Our findings of low interconnectedness between geopolitical events in Russia and our sample of banks confirm and support previous empirical evidence on the importance of micro supervision and institutional (in)dependence in explaining the relative insulation of post-Soviet banks to external geopolitical shocks.

Thirdly, we provide empirical evidence on the effects of economic sanctions imposed in response to military interventions. The literature on the sanctions imposed on Russia, so far, has focused on the impact of restrictive economic measures in the wake of the annexation of Crimea and consequent military intervention in Eastern Ukraine, with evidence of significant negative effects on the neighbouring CIS economies, as measured by the accumulated impact on their GDP (Bayramov et al., 2020). We examine how the ongoing Russian-Ukrainian conflict has impacted post-Soviet banks, test the spillover effects of this crisis in several countries and provide evidence that the Russian invasion of Ukraine has, so far, had negligible impact on the performance and volatility of such institutions.

The remainder of the paper is organised as follows: Section 2 presents the literature review, and section 3 describes the data and methodology. Section 4 presents the findings and discussion. Section 5 concludes the paper.

2. Related Literature

The literature to date shows the effects of GPR events on commodity prices, stock market volatility and asset price returns (see Berkman et al., 2011; Manela & Moreira, 2017; Balcilar et al., 2018; Bouras et al., 2019; Smales, 2021; Lo et al., 2022; Izzeldin et al., 2023 and Velip and Jambotkar, 2024), however, the effects of GPR on banking industries have not attracted much attention within the academic literature, despite the critical role played by banks within financial systems and their contribution to economic stability. Laeven and Valencia (2013) report losses of about 30 per cent of GDP during the 2007 global financial crisis, showing how costly banking crises can be and justifying the substantial efforts devoted to averting them. Halaj et al. (2024) document that interconnectedness exists in the financial system and argue that shock transmission would impact all financial sectors and affect the financial stability of a country.

This paper examines the empirical evidence of the transmission of geopolitical risk caused by the Russian-Ukrainian war on post-Soviet banks. The potential long-term effects of the Russia-Ukraine conflict on bordering economies have prompted the need to understand its short-term consequences better. The former Soviet Republics, collectively represent an essential part of global GDP, with a combined economic growth of 5.4% in 2021. The geopolitical and economic developments within or around the Russian Federation are expected to have significant repercussions on the economic systems of its neighbouring countries, many

of which have maintained significant cultural and economic ties with the Federation since the Commonwealth's foundation in 1991.

2.1 The banking sectors in post-Soviet countries

Since1991 the banking systems of post-Soviet Union countries evolved into a two-tier system, relinquishing the Soviet model, which had a unique bank (monobank) that controlled and regulated both monetary policy and commercial banking within all member states (Djalilov & Piesse, 2016). The banking sectors in this region exhibit some common characteristics across member countries, such as the dominance of state-owned banks, which often hold a significant market share in terms of assets and deposits (Sherif et al., 2003) despite the involvement of private and foreign banks having significantly increased recently (Ko & Min, 2019); highly concentrated banking sectors (Cojocaru et al., 2016), with systematically important banks being state-owned; the regulatory frameworks, which allocate crucial roles to central banks in overseeing and regulating the banking industries (Keller & Richardson, 2003); increasing challenges and risks owing to fluctuations in commodity prices, geopolitical tensions, and political instability (Hartwell, 2013; Ponomarenko et al., 2020).

There are specific bank characteristics which vary across countries. The banking system of Georgia has undergone significant reforms, recommended by the Bank of International Settlements through Basel III, including strengthening capital requirements, and improving risk management practices. The National Bank of Georgia guarantees the financial stability of the system. Although the number of commercial banks operating in the country is still small (14), foreign banks' presence is notable (Mercan et al., 2022; Khvtisiashvili, 2012). Kazakhstan's banking sector is one of Central Asia's largest and most developed and is regulated and supervised by the National Bank of Kazakhstan. The market is dominated mainly by several

large state-owned banks, which in recent years faced increases in non-performing loans (NPLs) and corporate governance issues (Giammanco et al., 2022). In Uzbekistan, banks are gradually transitioning from a primarily state-dominated system to a more market-oriented one. The Uzbek government and the Central Bank have taken extraordinary measures of liberalisation and privatisation of state-owned banks, leading some large foreign banks to show interest in entering the Uzbek market (Abdurakhmanov, 2016).

Russia has a large and developed banking sector, although the role of state-owned banks is significant, accounting for most assets share (Love & Rachinsky, 2015). The Central Bank of Russia is the key regulator and supervisor of the banking system. Like Kazakhstan, the Russian banking sector has faced high NPL ratios (Giammanco et al., 2022), weak corporate governance, and money laundering concerns, all of which have increased further after the start of the Russian-Ukrainian war (Umar et al., 2023; Babar et al., 2023). Similarly, the Ukrainian banking sector experienced a period of recapitalisation, consolidation, and improved regulatory framework, along with an increasing presence of foreign banks (Athari, 2021) in the years preceding the 2022 conflict.

2.2 Impact of GPR on financial markets and institutions

Russia has historically maintained significant political and economic influence within the post-Soviet region. As the largest country in the area, it has close ties with many neighbouring countries through trade, energy dependence, and regional organisations like the Eurasian Economic Union (EAEU) and Collective Security Treaty Organization (CSTO) (Roberts & Moshes, 2016; Sakhariyev, 2022). Regional conflicts have also impacted geopolitics in this region, including the recent Russia-Ukraine war, with consequent strained relations amongst countries (Malyarenko & Wolff, 2018).

Starting in 2014, Western sanctions were progressively imposed on Russia over its annexation of Crimea and military intervention in Eastern Ukraine. Sanctions included restrictions on Russian banks, trade, investment, and access to systems like SWIFT for cross-border transactions (Berner et al., 2022). The 2022 Russian invasion of Ukraine elicited further sanctions, expected to impact the Russian economy severely. Previous research found that CIS countries dependent on Russia suffered GDP declines after the 2014 sanctions, with a 1% drop in Russian GDP, reducing CIS GDP by 0.72% (Bayramov et al., 2020). Reports project current sanctions will also produce spillovers, with currency devaluations and rising prices already observed across the region (Fitch, 2023; EBRD, 2022).

The evidence so far suggests the limited impact of sanctions. While Ukrainian and Belarusian banks struggled, other regional banks saw gains from currency arbitrage and trade diversion, however, these could represent short-term improvements. Fitch Ratings Agency forecasts long-term economic spillovers may be significant for the region depending on their connectivity with the Russian economy (Fitch, 2023). Increasing non-performing loans and public interventions are already revealing vulnerabilities. Similarly, the European Bank for Reconstruction and Development (EBRD, 2022) forecasts that economic sanctions on Russia are expected to remain for the foreseeable future, exacerbating the stagnation in the Russian economy, with potential negative spillovers for several neighbouring countries in Eastern Europe, the Caucasus, and Central Asia, depending on their links with the Russian Federation (See Figure 1).

This study examines the actual versus projected effects of sanctions and geopolitical tensions on some of the post-Soviet banking sectors; given their dependency on Russia, their resilience so far warrants further investigation. Russia is the largest and most influential

country in the region. It maintains close political, economic, and security ties with many neighbouring countries, so the geopolitical dynamics of any individual country usually depend on its relationships with Russia. Crucially, the region is rich in energy resources, particularly oil and natural gas (Russia, Kazakhstan, Azerbaijan, Turkmenistan); changes in the prices of these commodities, their control and transportation will have critical geopolitical implications and affect relationships between countries both within and outside the region.

****Insert Figure 1 here****

3. Data and Methods

3.1 Data

The data set used for this work covers (i) measures of market performance of banking sectors and (ii) measures of geopolitical risk. Measures of performance of banking sectors are captured by the daily nominal stock market price industry indices covering the period January 2017 to January 2023, consisting of 2214 daily observations. The price indices are composite indices of available bank data in Georgia, Kazakhstan, Uzbekistan, Russia, and Ukraine. Table 1 reports further information on the number of banks in each composite price index. The choice of these banks and countries is based mainly on the availability of a reasonably large sample. Table 1 gives an overview of the data series and their sources.

****Insert Table 1 here****

All data are obtained as price indices in their raw form. Since we aim to measure connectedness in the returns and risk series, the returns of each stock are computed as the change of the natural logarithm of prices (i.e. $r_{it} = \Delta(\ln P_{it})$, for stock *i* and over $t = 1,2,\cdots, T$). The risk series is obtained by estimating each stock return series' GARCH (1,1) specification. In this context, the risk is based on the following model:

$$r_{it} = \mu_i + \varepsilon_{it}, \tag{1a}$$

$$\sigma_{it}^2 = \omega_i + \alpha_i \varepsilon_{it-1}^2 + \beta_i \sigma_{it-1}^2 + v_{it} \tag{1b}$$

where $\varepsilon_{it} \sim (0, \sigma_{it}^2)$, $v_{it} \sim (0, \sigma_{iv}^2)$ for stock *i* and over $t = 1,2,\cdots, T$.

We use four measures of geopolitical risk, all based on Caldara and Iacoviello (2022). We employ daily values of the Global Geopolitical Risk Index (GGRI) and monthly values of Russia's GRI, Ukraine's GRI, and the United States' GRI. All indices are expressed in natural logarithms.

3.2. Econometric Methodology

We apply Diebold and Yilmaz's generalised variance decomposition approach (2009, 2012, 2014), DY hereafter. This concept of connectedness assesses the shares of forecast error variation of different stock returns series in response to a shock occurring in other stock returns. The idea is modelled in Vector Autoregressive, VAR, and set-up. Suppose there are *n* endogenous variables; the general form of this dynamic model can be expressed as:

$$y_t = c + \sum_{i=1}^{p} \Phi_i y_{t-i} + u_t \tag{2}$$

where the maximum number of lags is *p* (i.e. the optimal lag length). The term is a vector of constants and coefficients matrices. The error term is a vector with zero mean and variance–covariance matrix; it is a symmetric – and possibly non-diagonal – matrix.

The VAR (*p*) model allows for reverse causality and interdependence across all variables. The structure of this model, in which every endogenous variable is regressed on its own lagged values and the lags of the other variables in the system, allows the coefficients matrices to include all the information about the interactions and connectedness between these variables. Furthermore, all the series in the vector y_t are assumed to be covariance stationary. This requires that the roots of the characteristic equation (i.e. $|\phi(z)|$) lie outside the unit circle. Using the lag operator, *L*, and combined with the stationarity assumption of the model in (2), the VAR(*p*) can be written as a function of moving averages of infinite order, or $MA(\infty)$. In other words:

$$y_t = \Theta(L)u_t \tag{3}$$

where the endless lag polynomial can be computed recursively $\Phi(L)= I_N - \Phi_1 L - \Phi_2 L^2 - \ldots - \Phi_p L^p = [\Theta(L)]^{-1}$. The term does not need to be diagonal and captures the contemporary features of connectedness, while the terms $\Theta_1, \Theta_2, \cdots$ capture the dynamics of connectedness. The measure of connectedness based on this structure is best obtained using variance decompositions.

The literature of econometrics offers various methods of variance decompositions. In the context of connectedness, Diebold and Yilmaz (2012) employ Cholesky factorisation, which depends on the ordering of variables. In the context of Cholesky decompositions, the first variable in the system is affected contemporaneously only by its shocks. The second

variable in the system is affected contemporaneously by the innovations of the first and second variables, and so on. Although Diebold and Yilmaz (2014) argue that total connectedness is robust in the ordering of variables, this does not rule out the possibility that the connectedness is sensitive to the order assigned to variables in the VAR system. To overcome this issue, we use generalised variance decompositions, proposed by Pesaran and Shin (1998), which do not rely on variable ordering. Generalised variance decomposition treats each variable as the first variable in the ordering. In other words, correlated shocks are allowed while accounting for their historical correlation. Formally, for the *h*-step generalised variance decomposition matrix

$$D_t^{gH} = [d_{ij,t}^{gH}] \tag{4}$$

With the elements

$$d_{ij,t}^{gH} = \frac{\sigma_{jj}^{-1} \sum_{h=0}^{H-1} \left(e'_i \Theta_{h,t} \Sigma_t e_j\right)^2}{\sum_{h=0}^{H-1} \left(e'_i \Theta_{h,t} \Sigma_t \Theta'_{h,t} e_j\right)^2} \tag{5}$$

where,

σ_{jj}^{-1} *jth* diagonal element of the covariance matrix is a section vector with jth element unity and zeros elsewhere, Θ_h is of moving average coefficients at lag h,

$d_{ij,t}^{gH}$ refers to the contribution of the *jth* variable to the variance of the forecast error of the element i at horizon h. Since the shocks under the generalised variance decomposition are not necessarily orthogonal, the row sums are not necessarily equal to one (i.e. forecast error variance contribution does not necessarily sum to one). Therefore, the generalised connectedness index – and its other variations – are based on the normalised $d_{ij,t}^{gH}$, which is defined as:

$$\widetilde{d_{ij,t}^{gH}} = \frac{d_{ij,t}^{gH}}{\sum_{j=1}^{N} d_{ij,t}^{gH}} \tag{6}$$

whereby definition $\sum_{j=1}^{N} \widetilde{d_{ij,t}^{gH}} = 1$ and $\sum_{i,j=1}^{N} \widetilde{d_{ij,t}^{gH}} = N$. Using the definition in (5), we can compute the following measures of connectedness:

Total Connectedness Index (TCI): This captures the interconnectedness among different variables and is defined as:

$$C_t^{gH} = \frac{\sum_{i,j=1,i\neq j}^{N} \widetilde{d_{ij,t}^{gH}}}{\sum_{j=1}^{N} \widetilde{d_{ij,t}^{gH}}} \times 100 \tag{7}$$

The directional spillover from all variables j to the variable i:

$$C_{i\leftarrow j}^{gH} = \frac{\sum_{j=1,i\neq j}^{N} \widetilde{d_{ij,t}^{gH}}}{\sum_{i=1}^{N} \widetilde{d_{ij,t}^{gH}}} \times 100 \tag{8}$$

The directional spillover from all variables i to variable j:

$$C_{i\rightarrow j}^{gH} = \frac{\sum_{i=1i\neq j}^{N} \widetilde{d_{ij,t}^{gH}}}{\sum_{j=1}^{N} \widetilde{d_{ij,t}^{gH}}} \times 100 \tag{9}$$

The net pairwise directional spillover takes the difference between the two directional spillover measures above. In other words, the net pairwise directional spillover takes the difference between total directional connectedness to others (from all *I variables to the j variable) and total directional connectedness from others (from all j variables to the I* variable). Thus, the measure is defined formally as:

$$NPDC_{ij}^{gH} = \left(\widetilde{d_{ji,t}^{gH}} - \widetilde{d_{ij,t}^{gH}}\right) \times 100 \tag{10}$$

3.3. Network Analysis

In addition to the connectedness analysis, we conduct a network analysis to examine further the transmission effects among the banking sectors of the countries in our sample. This allows us to visualise the interconnectedness and directional spillovers. Sensoy et al. (2017) document that networks are an effective way to show and examine a range of intricacies in financial systems.

The variance decomposition matrix from the Diebold-Yilmaz methodology can be interpreted as an adjacency matrix representing the network connections. The degree of a node (country) indicates the linkages it maintains with other nodes. The pairwise directional connectedness values give the strength of interconnectedness between nodes. Expressly, the row sums of the adjacency matrix represent the total directional connectedness "from" a given country to others. The column sums indicate the total directional connectedness "to" a country from others. The combination of the "from" and "to" linkages forms the edges between nodes in the network graph. By mapping the linkage strengths and directional relationships, the network visualisation provides additional insights into how geopolitical risks and shocks are transmitted across banking sectors. The presence or absence of network interconnectedness can further elucidate the apparent insulation of these banking systems.

4. Results and Discussion

4.1. Primary Results

Table 2 provides the descriptive statistics for the returns and risk series of banking sectors of five post-Soviet countries: Georgia (GEO), Russia (RUS), Ukraine (UKR), Uzbekistan (UZB), and Kazakhstan (KAZ), and four geopolitical risk index series, GGRI, RGRI, UGRI, and USGRI, representing the Global, Russian, Ukraine and US geopolitical risk

indexes respectively. The returns series for these countries show significant mean and standard deviation variations. For instance, the mean return for Ukraine is almost negligible, whereas Georgia, Kazakhstan and Russia have a negative mean return of -0.044, -0.04 and -0.004, respectively. Uzbekistan has the highest mean return. The standard deviation and reported range of the returns series is highest for Georgia, which shows the most significant volatility within the banking sector. Similarly, the risk series shows significant variations. Georgia has the highest risk score, with a mean of 2.307, while Ukraine has the lowest, with a mean of 0.015. The standard deviation of the risk series is highest for Kazakhstan at 0.439 and lowest for Ukraine at 0.006. Interestingly, the risk series for Russia is significantly lower than that of other countries, with a mean score of only 0.32. The geopolitical risk series, expressed as natural logarithms of the original indices, exhibit significant differences in their ranges. The log-transformed Global Geopolitical Risk Index (GGRI) ranges from 1.272 to 6.291, while the log-transformed Ukraine Geopolitical Risk Index (UGRI) ranges from -3.158 to 2.183. These negative values in the log-transformed indices occur when the original risk values are between 0 and 1, which is common in periods of lower geopolitical tension. The logarithmic transformation is applied consistently across all indices to improve statistical properties while preserving the relative risk relationships.

****Insert Table 2 here****

4.2 Connectedness of returns and volatility

Figures 2 and 3 illustrate the total connectedness based on returns and risk.

****Insert Figures 2 & 3 here****

Total connectedness reports the overall index considering all variables in the VAR specification. This includes all measures of geopolitical risk indices. The total connectedness

of returns and risk is, on average, 20.9% and 29.6%, respectively, from 2017 to 2023. The total connectedness for the returns series ranges between 12.4% and 31.1%, with the highest spillover index values on 1 April 2022, which is post the start of the Ukrainian–Russian conflict. The total connectedness for the risk series ranges between 17% and 62.8%, with the highest spillover index values on 8 January 2022, close to the beginning of the Ukrainian–Russian conflict. Table 3 reports the summary statistics of the total connectedness.

****Insert Table 3 here****

Panel A of Table 4 shows the degree of spillovers or connectedness among the economies bank stock returns of Georgia (GEO), Russia (RUS), Ukraine (UKR), Uzbekistan (UZB), Kazakhstan (KAZ) and measures of geopolitical risk, captured by the four geopolitical risk series. The values in the table represent the percentage of spillovers from one series to another. The connectedness is measured as the estimated contribution to the forecast error variance of a stock return i due to the shock to stock return j. The column 'From others' reports the row sums, which refer to the total spillovers from other stock returns. The row 'Contribution to others' is the column sums of total spillovers to other stock returns. Both are computed using Equation (6). In addition, the values in the middle of the table or ij-th entries represent decompositions of the Spillovers Index for each pair computed using Equations (7) and (8).

****Insert Table 4 here****

Based on the table, there is a high level of 'own' spillovers among the countries. For instance, Georgia is highly connected to itself, with 99.4% spillovers within the country, while Russia and Ukraine within country spillovers are 98.8% and 99.4%, respectively. Uzbekistan

and Kazakhstan also exhibit high spillovers within their borders, with 99.0% and 99.1%, respectively. The spillovers across countries are negligible or non-existent, showing no bank interdependencies. Our findings suggest no directional connectedness between measures of geopolitical risk and banks' returns. Similarly, banks in the post-Soviet economies do not contribute to the variations in the geopolitical risk measures. This implies that, according to the four measures of geopolitical risk employed, the banking sectors are not exposed to geopolitical risk captured by the indices in the data.

Panel B of Table 4 reports the connectedness across banks' volatility and geopolitical risk. Like returns, we find strong evidence of the country's connectedness. Cross-country connectedness is again negligible or non-existent. Furthermore, the measures of geopolitical risk are not connected, in either direction, to countries' bank risk.

Table 4 suggests that geopolitical risk has a relatively low spillover effect on the banking sectors in our sample. Several factors can help explain our findings; firstly, the closed nature of the economies examined. These countries tend to have less integrated financial systems and rely more on domestic sources of financing than European countries, for example. Therefore, the impact of global geopolitical risk on their banking sectors may be limited, as they are less exposed to external financing and investment flows. Another factor likely to insulate the banking sectors in post-Soviet countries is the relatively high level of government control and ownership. Many banks in these countries are state-owned or have close government ties, which may limit their exposure to external shocks. Furthermore, the regulatory environment in these countries may be less responsive to external shocks, as governments may prioritise stability over market-driven reforms.

'Our empirical findings demonstrate that geopolitical risk has limited impact on post-Soviet banking sectors, as evidenced by the low spillover effects in both returns and risk measures. This resilience to geopolitical shocks is particularly noteworthy given the significant economic ties these countries maintain with Russia. However, this finding should be considered within the broader context of banking sector vulnerability to other risk factors. Previous studies document that post-Soviet banking sectors are influenced by domestic political conditions (Hartwell, 2013), macroeconomic factors (Djalilov & Piesse, 2016), commodity price fluctuations (Ponomarenko et al., 2020), and changes in global market sentiment (Bayramov et al., 2020). Our results therefore suggest that while these banking sectors demonstrate resilience to geopolitical risks, they operate within a complex risk environment that merits continued investigation. The network analysis provides insights into banking sectors' interconnectedness and directional spillovers.

The maps, as in Figures 4 and 5, illustrate the linkages between countries, with arrow thickness representing the magnitude of impact.

****Insert Figures 4 & 5 here****

A key observation across both maps is the high interconnectedness between the global geopolitical risk index (GGRI) and Russia, Ukraine, and Kazakhstan. This indicates the GGRI, as a proxy for overall geopolitical tensions, strongly influences these countries. The returns map (Figure 4) shows notable two-way spillovers between Kazakhstan and Georgia, reflecting growing economic and financial integration as Kazakhstan has become a significant investor in Georgia. Both maps also reveal Russia's banking sector volatility, which has pronounced effects on Kazakhstan, Uzbekistan, and Georgia. Kazakhstan's spillover impact on returns and risk seems exceptionally robust, highlighting close Russia-Kazakh financial linkages. However, despite Russia's regional influence, its banks' returns and risk surprisingly show no

spillovers onto Georgia. This points to potential financial resilience or insulation within Georgia's banking system. Furthermore, Uzbekistan exhibits strong interconnectedness with the GGRI in both maps, suggesting global geopolitical factors shape its financial markets.

In summary, the network maps demonstrate the complex interlinkages between banking sectors, with the GGRI exerting broad influence across countries. The presence and asymmetry of bilateral spillovers highlight how geopolitical shocks transmit based on economic and financial ties. The findings have critical implications for understanding regional crisis transmission.

4.3 Robustness tests: the analysis of the connectedness index

We further apply the multiple structural break test of Kejriwal and Perron (2010) on the trend of the total connectedness indices - returns and risk - to examine the stability of the estimated indices. Identifying any break dates and associated events can provide insight into the potential causes of the breaks. Kejriwal and Perron (2010) propose a sequential test to determine the number of breaks in a time series trend. The null hypothesis is a model with *l* breaks. The alternative is *l+1* breaks. The test applies *l+1* individual tests of no break versus one break in each of the *l+1* segments, obtained using the estimated l break model. Critical values can be derived from the limit distribution of a single break test. This sequential approach enables consistent estimation of the number of breaks.

Table 5 reports the results when we apply the Kejriwal and Perron (2010) break tests to the returns and risk connectedness indices. We present the test statistics for the final number of breaks, three for both series.

****Insert Table 5 here****

Constitutional changes can create political uncertainty and affect economic connections between countries. The first break in returns connectedness on 27/09/2020 coincides with Russia's constitutional reform allowing President Putin to remain in power for two additional terms until 2036, while another proposal explicitly prohibited the Russian government from returning any territory to its previous status once it has been declared part of Russia (Reuters, 2020). The break on 31/03/2021 aligns with political instability and elections in several post-Soviet countries in early 2021, including protests in Belarus, an election in Turkmenistan, and a snap election in Armenia. The final returns break on 20/10/2021 follows Russia's September 2021 parliamentary elections, where the ruling party, led by President Vladimir Putin, maintained its majority in the State Duma (lower house of parliament). Voters simultaneously elected regional parliaments in 39 of Russia's 85 regions and governors in nine areas. However, the main event was the election of 450 deputies for a five-year term in the State Duma, the lower and more influential house of the federal assembly (Reuters, 2021). Changing political dynamics may impact economic ties.

For risk connectedness, the first break on 19/04/2019 is near Uzbekistan's December 2019 parliamentary election, which introduced political reforms, such as televising Senate sessions (Reuters, 2019), while the 29/12/2020 break coincides with the Nagorno-Karabakh war between Armenia and Azerbaijan leading to an increase in uncertainty and risk transmission (BBC, 2020). The final risk break on 08/01/2022 follows Kazakhstan's January 2022 unrest. Overall, the returns and risk connectedness breaks align with periods of political change and instability in the region and highlight how political events continually disrupt its economic and financial links.

5. Conclusion

The Russian-Ukrainian war has considerably increased the levels of geopolitical risk in the region and beyond. The sanctions imposed by Western countries on Russia were expected to have spillover effects on the economies of other neighbouring countries, particularly those with close economic ties with Russia. Our study examines the spillover effects of geopolitical risk on the banking sector of a sample of post-Soviet countries using several GPR indices. We find a low spillover effect of geopolitical risk on the banking sectors for all the countries examined. The findings can be explained by considering these economies' low levels of external financing and investment flows, which help insulate them from external risks. Also, many banks are under tight government controls, limiting their exposure to external shocks.

The resilience of post-Soviet financial systems to geopolitical risk has critical implications. The lack of observable contagion suggests existing governance structures effectively insulate domestic institutions from external shocks. This highlights the presence of potentially strong institutional control and prudential oversight in shielding economies when crises strike nearby. For policymakers, these findings indicate current regulatory approaches promote stability amidst regional tensions. However, ongoing vigilance is vital as sanctions could yet reverberate over time as trade and financial flows reshape. Future studies can explore the impact of geopolitical risk on bank-level and macroeconomic indicators to identify the specific mechanisms through which geopolitical risk affects the banking sector.

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Tables

Table 1: Data Definitions and Sources

Country/ Series	Symbol	Definition	Freq	Source
		Bank Data		
Georgia	GEO	Composite price index of two banks	Daily	https://gse.ge/en/
Kazakhstan	KAZ	Composite price index of five banks	Daily	https://kase.kz/ru/subscribers/
Russia	RUS	Composite price index of six banks	Daily	https://www.investing.com/
Ukraine	UKR	Price index of one bank	Daily	https://www.ux.ua/ru/
Uzbekistan	UZB	Composite price index of 13 banks	Daily	https://uzse.uz/
		Geopolitical Risk		
Global Geopolitical Risk Index	GGRI	Index	Daily	https://www.matteoiacoviello.com/gpr.htm
Russia Geopolitical Risk Index	RGRI	Index	Monthly	https://www.matteoiacoviello.com/gpr.htm
Ukraine Geopolitical Risk Index	UGRI	Index	Monthly	https://www.matteoiacoviello.com/gpr.htm
United States Geopolitical Risk Index	USGRI	Index	Monthly	https://www.matteoiacoviello.com/gpr.htm

Table 2: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Returns Series					
GEO	2214	-.044	2.316	-10.864	6.281
RUS	2214	-.004	.285	-5.102	4.819
UKR	2214	9.39E-05	.016	-.189	.116
UZB	2214	.002	.044	-.629	.462
KAZ	2214	-.040	1.247	-4.523	4.476
Risk Series					
GEO	2214	2.307	.776	1.596	4.757
RUS	2214	.32	.091	.284	1.962
UKR	2214	.015	.006	.008	.112
UZB	2214	.045	.012	.03	.381
KAZ	2214	1.197	.439	.64	3.299
Geopolitical Risk Series					
GGRI	2214	4.479	.557	1.272	6.291
RGRI	2214	.034	.665	-1.228	2.194
UGRI	2214	-1.327	1.328	-3.158	2.183
USGRI	2214	.837	.313	.261	1.947

Notes: GEO: Georgia RUS: Russia. UKR: Ukraine. UZB: Uzbekistan. KAZ: Kazakhstan. GGRI: Global. Geopolitical Risk Index. RGRI: Russian Risk Geopolitical Risk. UGRI: Ukrainian Geopolitical Risk Index. USGRI: United States Geopolitical Risk Index. All geopolitical risk measures are expressed in natural logarithm.

Table 3: Descriptive Statistics of Total Connectedness

Variable	Obs	Mean	Std. Dev.	Min	Max
Returns	1761	20.819	6.215	12.444	31.095
Risk	1759	29.569	10.097	12.962	62.849

Table 4: Estimates of Connectedness

	GEO	RUS	UKR	UZB	KAZ	GGRI	RGRI	UGRI	USGRI	From Others
Panel A: Returns										
GEO	99.4	0.0	0.1	0.2	0.0	0.0	0.1	0.0	0.1	0.6
RUS	0.0	98.8	0.2	0.3	0.5	0.1	0.0	0.0	0.0	1.2
UKR	0.0	0.2	99.4	0.0	0.1	0.2	0.0	0.0	0.1	0.6
UZB	0.1	0.2	0.0	99.0	0.1	0.5	0.0	0.0	0.0	1.0
KAZ	0.1	0.3	0.1	0.1	99.1	0.1	0.1	0.0	0.1	0.9
GGRI	0.0	0.2	0.1	0.4	0.1	78.5	6.9	6.0	7.8	21.5
RGRI	0.1	0.0	0.0	0.0	0.0	1.8	38.6	35.7	23.7	61.4
UGRI	0.0	0.0	0.0	0.0	0.0	2.1	37.2	41.3	19.3	58.7
USGRI	0.2	0.0	0.0	0.0	0.0	2.0	29.6	22.9	45.3	54.7
Contribution to others	0.7	1.0	0.5	1.1	0.8	6.8	73.8	64.7	51.2	200.6
Contribution including own	100.2	99.8	99.8	100.1	99.9	85.3	112.5	106.0	96.5	22.3%
Panel B: Risk										
GEO	97.4	0.1	0.2	0.2	1.7	0.3	0.0	0.0	0.1	2.6
RUS	0.1	97.7	0.0	0.2	0.1	0.9	0.4	0.3	0.4	2.3
UKR	0.1	0.1	98.0	0.0	0.1	0.8	0.4	0.3	0.2	2.0
UZB	0.3	0.1	0.2	99.0	0.0	0.1	0.0	0.0	0.2	1.0
KAZ	1.5	0.3	0.1	0.2	96.8	0.6	0.1	0.0	0.4	3.2
GGRI	0.0	1.5	0.4	0.5	0.4	77.0	6.7	5.9	7.7	23.0
RGRI	0.0	0.1	0.0	0.1	0.1	1.7	38.6	35.7	23.7	61.4
UGRI	0.0	0.0	0.0	0.0	0.1	2.0	37.2	41.3	19.3	58.7
USGRI	0.0	0.1	0.0	0.3	0.1	1.8	29.5	22.9	45.3	54.7
Contribution to others	2.1	2.3	0.9	1.5	2.5	8.3	74.3	65.1	52.0	208.9
Contribution including own	99.5	99.9	98.9	100.5	99.3	85.3	112.9	106.4	97.3	23.2%

Notes: GEO: Georgia RUS: Russia. UKR: Ukraine. UZB: Uzbekistan. KAZ: Kazakhstan. GGRI: Global Geopolitical Risk Index. RGRI: Russian Risk Geopolitical Risk. UGRI: Ukrainian Geopolitical Risk Index. USGRI: United States Geopolitical Risk Index. Contribution to others: The portion of the spillover effects

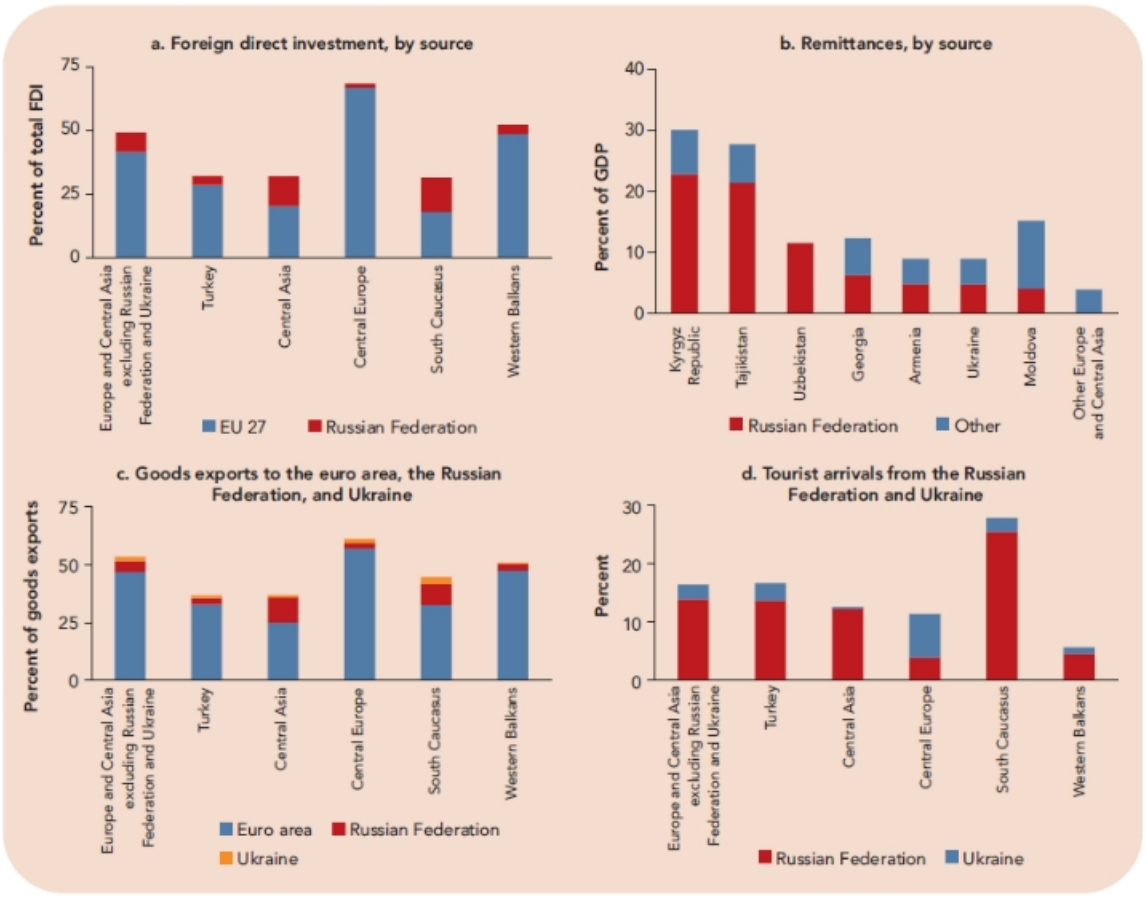
originating from a specific variable and affecting other variables. It represents the influence that one variable exerts on others without considering its reactions to external shocks. Contribution including own: It considers the spillover effects originating from the variable of interest and the feedback effects from other markets. It represents the total impact or contribution, including the variable's responses to external shocks from others: The portion of spillover effects transmitted from one variable to the variable of interest. It assesses the influence other variables have on the variable of interest, capturing how shocks or volatility in external markets impact the market in focus.

Table 5: KP Test Results

Total Connected Index Series	ExpW (3/2)	CV (10%)	Break Dates
Returns	2.34*	1.97	27/09/2020, 31/03/2021, 20/10/2021
Risk	42.07*	1.97	19/04/2019, 29/12/2020, 8/01/2022

KP refers to Kejriwal and Perron (2010). ExpW (3/2) is the sequential test proposed by Kejriwal and Perron (2010). It tests, in general, the null of *l* breaks versus the alternative of *l*+1 breaks

Figure 1. Regional economic linkages with the Russian Federation, Ukraine, and the Euro area



Source: World Bank,2022.

Figure 2. Returns Total Connectedness Index

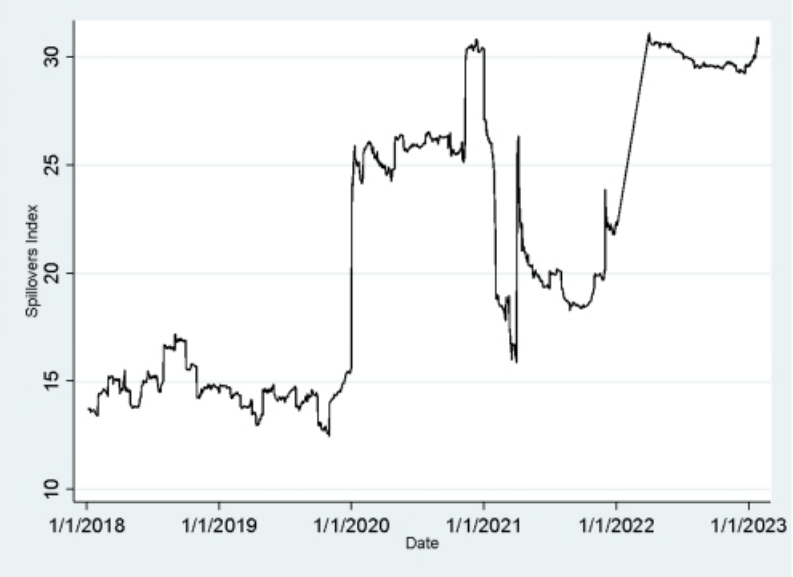


Figure 3. Risk Total Connectedness Index

Figure 4. Connectedness Network – Returns Series

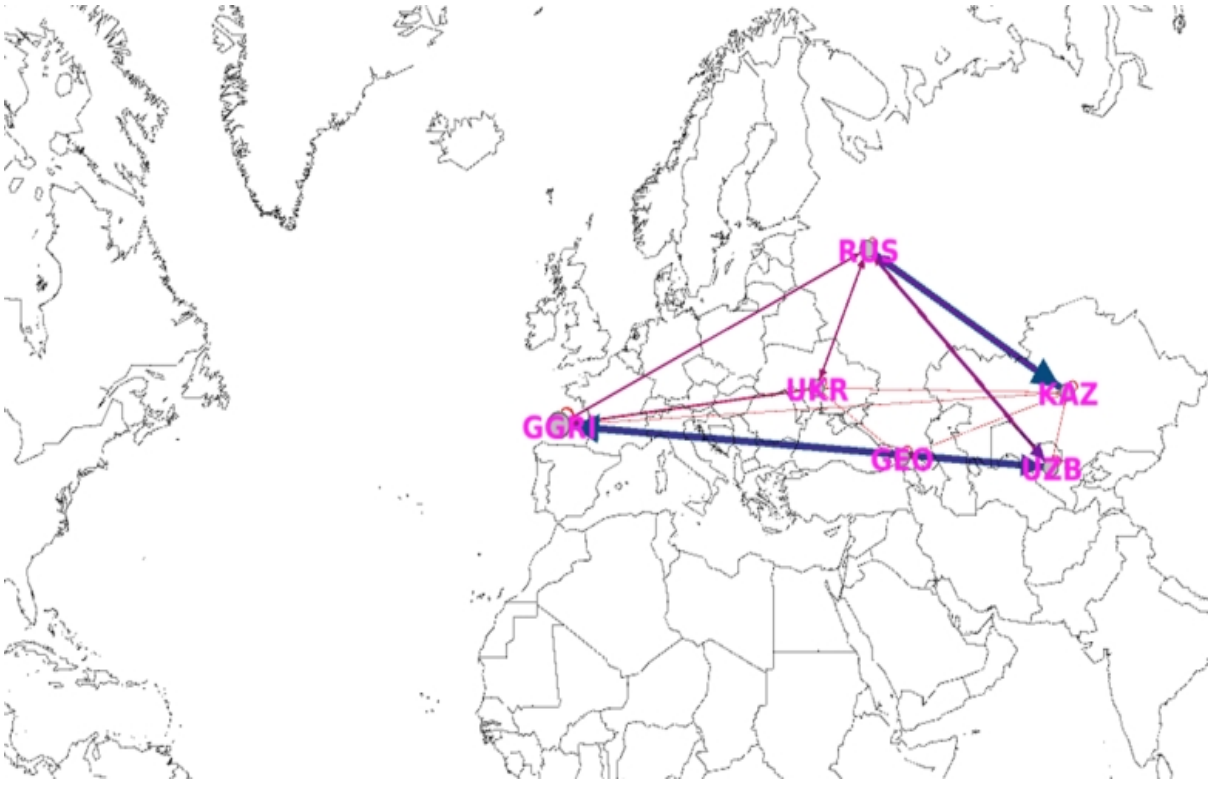


Figure 5. Connectedness Network – Risk Series