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Geoeconomics of Resilience—The Fusion of National Security and Energy Transition in a New Monetary Policy Paradigm

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Abstract

This paper investigates how restrictive monetary policy impacts long-term strategic infrastructure financing under conditions of geopolitical fragmentation and supply-side inflationary pressures. The analysis focuses on Poland, a medium-sized European economy exposed to energy transition requirements, post-pandemic supply chain disruptions, and regional geopolitical instability. Using quarterly data for 2005Q1–2024Q2, the study employs a Structural Vector Autoregression (SVAR) model to evaluate the transmission of monetary policy shocks to inflation dynamics and sectoral credit allocation. The research examines bank lending directed toward infrastructure-intensive sectors, including energy, utilities, transport, and strategic industrial investments. Empirical results demonstrate that while monetary tightening contributes to a statistically significant reduction in inflationary pressures over the medium term, it simultaneously triggers unintended consequences. Specifically, higher policy rates are associated with a persistent contraction in long-term infrastructure-related credit volumes. Impulse response analysis reveals that this decline in strategic infrastructure financing is disproportionately stronger and more enduring than the drop observed in aggregate corporate lending. These findings highlight asymmetric monetary transmission effects across investment categories. Consequently, the paper suggests implementing targeted macroprudential and liquidity-support instruments to protect strategic sectors without compromising inflation stabilization objectives.

Keywords: monetary policy; economic crisis; fiscal policy; inflation expectations; supply shocks

1. Introduction

The global macroeconomic environment has undergone substantial structural transformation since the outbreak of the COVID-19 pandemic. Recent inflationary pressures, supply-chain disruptions, and geopolitical tensions have significantly altered the environment in which monetary policy operates. In contrast to conventional post-war inflationary episodes primarily driven by cyclical demand expansion, the inflation dynamics observed after 2020 have been increasingly associated with supply-side constraints, energy market volatility, transportation bottlenecks, industrial restructuring, and geopolitical realignment. These developments have generated renewed debate regarding the effectiveness and unintended consequences of restrictive monetary policy in economies simultaneously exposed to structural investment needs and elevated macroeconomic uncertainty.

Recent research increasingly emphasizes that inflation generated by supply-side disturbances differs fundamentally from inflation originating in excessive aggregate demand.

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While conventional monetary tightening remains an effective instrument for moderating inflation expectations and reducing demand-side pressures, its effectiveness becomes more ambiguous when inflation is driven by external production constraints, energy-price shocks, or fragmentation of international production networks. Under such conditions, higher interest rates may contribute to macroeconomic stabilization while simultaneously weakening investment activity in sectors requiring long-term capital allocation. This tension becomes particularly relevant in the context of strategic infrastructure investment associated with energy transition, transportation modernization, industrial resilience, and critical utility systems.

The present study examines whether restrictive monetary policy disproportionately reduces long-term infrastructure-related financing under conditions of supply-side fragmentation shocks. The analysis focuses on Poland as a representative medium-sized European economy, exposed simultaneously to inflationary pressures, energy-transition requirements, and heightened geopolitical risk following the outbreak of the war in Ukraine (Trzonkowski, 2026). Poland provides a particularly relevant empirical setting due to the combination of elevated post-pandemic inflation, intensive monetary tightening implemented by the National Bank of Poland, and substantial investment requirements associated with energy-system modernization and infrastructure adaptation.

Poland represents a particularly informative empirical case due to three structural characteristics. First, the Polish economy experienced one of the strongest post-pandemic inflationary episodes within the European Union. Second, the monetary tightening cycle implemented by the National Bank of Poland was unusually rapid relative to historical standards. Third, Poland simultaneously faces exceptionally high infrastructure-investment requirements associated with the energy transition, military-security expansion, and industrial modernization. These features create a unique macro-financial environment in which monetary stabilization objectives interact directly with long-term strategic investment needs.

The paper contributes to the existing literature in several ways. First, it integrates monetary transmission analysis with the emerging literature on geopolitical fragmentation and macro-financial resilience. Second, it introduces a sectoral proxy for strategic infrastructure financing, constructed using banking-sector lending data for energy, transport, utilities, and strategic industrial sectors. Third, the study contributes empirical evidence from a Central and Eastern European economy operating under simultaneous inflationary and geopolitical pressures, an area that remains relatively underrepresented in the empirical macro-financial literature.

The central research question addressed in the paper is whether restrictive monetary policy contributes to a disproportionate decline in long-term infrastructure financing during periods characterized by elevated supply-side uncertainty and geopolitical fragmentation. To investigate this issue, the study estimates a Structural Vector Autoregression (SVAR) model using quarterly macroeconomic and financial data for the period 2005Q1–2024Q2. The empirical framework allows identification of dynamic interactions between inflation, monetary policy, global supply chain pressures, and sectoral credit allocation.

The empirical analysis is organized around two central hypotheses:

H1. *Restrictive monetary-policy shocks reduce inflationary pressures in the medium term.*

H2. *Restrictive monetary-policy shocks generate disproportionately stronger contractions in infrastructure-related credit activity relative to aggregate corporate lending.*

The second hypothesis reflects the assumption that infrastructure-intensive sectors are more dependent on long-term financing conditions and therefore exhibit higher sensitivity to tightening monetary conditions under elevated geopolitical uncertainty. The remain-

der of the paper is organized as follows. The next section reviews the relevant literature on monetary transmission, geopolitical fragmentation, and investment financing under supply-side shocks. The subsequent section presents the data and variable construction procedures. The econometric methodology is then discussed in detail, followed by presentation of the empirical results and robustness analysis. The final sections discuss the broader implications of the findings and conclude.

2. Literature Review

The monetary transmission mechanism has long occupied a central position in macroeconomic theory. Traditional monetary-policy frameworks developed within New Keynesian models emphasize the role of interest-rate adjustments in stabilizing aggregate demand and anchoring inflation expectations (Woodford, 2003). In these models, central banks influence economic activity through intertemporal consumption and investment decisions, thereby affecting inflation dynamics and output fluctuations. The effectiveness of this framework is generally strongest when inflationary pressures originate from cyclical overheating and excessive aggregate demand.

However, the post-pandemic macroeconomic environment has increasingly challenged the assumption that inflationary episodes are primarily demand-driven. A growing body of literature highlights the importance of supply-side disturbances, including supply chain disruptions, energy price shocks, labor shortages, and geopolitical fragmentation. Guerrieri et al. (2022) argue that negative supply shocks may simultaneously increase inflation and reduce output, thereby creating a more difficult policy environment for central banks. Similarly, Borio (2022) emphasizes that the macroeconomic conditions emerging after the pandemic differ structurally from previous cyclical episodes due to the interaction of structural and geopolitical forces.

The literature on energy-transition economics further suggests that climate-related restructuring may itself generate persistent inflationary pressures (European Central Bank, 2023; International Energy Agency, 2023; Network for Greening the Financial System, 2023). Schnabel (2022) notes that the transition toward low-carbon energy systems may involve temporary cost increases resulting from investment bottlenecks, fossil-fuel volatility, and industrial adjustment costs. These dynamics imply that restrictive monetary policy may interact with long-term structural investment needs in ways not fully captured by conventional stabilization models.

A related strand of literature focuses on the credit channel of monetary transmission (Bernanke et al., 1999; Kashyap & Stein, 2000). Bernanke and Gertler (1989) demonstrate that monetary policy affects economic activity not only through changes in borrowing costs but also through balance-sheet conditions, bank lending behavior, and financial intermediation constraints. Subsequent studies by Gertler and Karadi (2015) further show that monetary policy shocks may generate heterogeneous effects across sectors depending on financing dependence, investment maturity structures, and exposure to credit-market conditions.

These effects are particularly important for infrastructure sectors requiring large and long-term investments. Energy systems, transportation infrastructure, utility networks, and strategic industrial restructuring projects typically require long-term financing under conditions of substantial uncertainty. Consequently, these sectors may be disproportionately vulnerable to tightening monetary conditions, especially during periods of elevated geopolitical risk.

The emerging literature on geopolitical fragmentation additionally suggests that international production and trade structures are becoming increasingly shaped by strategic realignment rather than pure cost efficiency (Aiyar et al., 2023; Baldwin & Freeman, 2022). Recent IMF and BIS research indicates that reshoring, friendshoring, and regionalization

processes may weaken global efficiency gains while increasing production costs and investment uncertainty (Bank for International Settlements, 2023; International Monetary Fund, 2023). Gourinchas (2024) argues that the global economy may be entering a period of structurally higher fragmentation characterized by more localized supply chains and intensified strategic competition.

Despite the growing literature on fragmentation and macro-financial resilience, relatively limited empirical research examines how restrictive monetary policy affects strategic infrastructure financing under simultaneous supply-side and geopolitical shocks. Existing studies frequently analyze inflation stabilization, the energy transition, or geopolitical fragmentation separately, while fewer contributions investigate their interaction within a unified macro-financial framework. The present paper seeks to address this gap by analyzing whether monetary tightening contributes to a disproportionate contraction in infrastructure-related credit activity in Poland. To integrate these research streams, the paper applies the Theory of Structural Shock Transmission in Global Value Chains to the section on Poland. This provides a rigorous framework for understanding how geopolitical supply disruptions structurally propagate through domestic credit markets, highlighting the macro-financial transmission beyond standard cyclical effects.

3. Materials and Methods

3.1. Data and Variable Construction

The empirical analysis uses quarterly data covering the period from 2005Q1 to 2024Q2. The selected time horizon captures several distinct macroeconomic episodes, including the global financial crisis, the post-crisis monetary stabilization period, the COVID-19 pandemic, the energy price shock following Russia's invasion of Ukraine, and the subsequent inflationary tightening cycle implemented by the National Bank of Poland (Narodowy Bank Polski, 2023). The relatively long sample period allows identification of both short-term cyclical fluctuations and medium-term structural relationships between monetary policy and infrastructure financing. After seasonal adjustment and transformation procedures, the final estimation sample consists of 78 quarterly observations.

The dataset combines macroeconomic, monetary, and banking-sector indicators obtained from multiple institutional sources. Inflation data are derived from the Statistics Poland consumer price index series, while monetary-policy indicators are obtained from the National Bank of Poland. Credit aggregates and sectoral lending statistics are also sourced from NBP banking-sector databases. To capture external supply-side pressures and global fragmentation dynamics, the analysis incorporates the Global Supply Chain Pressure Index published by the Federal Reserve Bank of New York.

All monetary and credit variables are seasonally adjusted prior to estimation in order to eliminate recurring seasonal fluctuations that could distort the dynamic relationships captured by the model. Credit aggregates are transformed into logarithmic quarterly growth rates, while inflation is measured using year-over-year CPI growth. These transformations are intended to improve stationarity properties and ensure comparability across variables characterized by different measurement scales.

A central component of the analysis is the construction of the strategic infrastructure financing variable. The variable is defined as the aggregated volume of bank lending directed toward sectors associated with energy production and distribution, utilities, transportation infrastructure, and strategic industrial manufacturing. The aggregation procedure relies on sectoral banking statistics published by the National Bank of Poland. The resulting measure serves as a proxy for long-term infrastructure-intensive investment activity characterized by elevated financing sensitivity and long investment horizons.

Given the substantial macroeconomic disruptions associated with the COVID-19 pandemic and the post-2022 energy shock, additional structural-break diagnostics were implemented using Bai-Perron multiple-breakpoint tests. The results indicate the presence of regime instability around the pandemic period; however, the core impulse-response dynamics remain qualitatively stable across sub-samples.

To further address potential parameter instability, supplementary estimations excluding the 2020Q1–2021Q4 period were conducted. The main empirical conclusions regarding the asymmetric contraction of infrastructure-related credit remained robust.

The infrastructure-financing indicator is constructed using sector-level banking statistics classified according to the NACE Rev. 2 framework. The aggregate includes lending directed toward the following sectors:

- electricity and gas supply,
- water and utility systems,
- transportation and storage,
- infrastructure-related industrial manufacturing.

Credit values are expressed in real terms using CPI deflation and transformed into quarterly growth rates. The aggregation procedure follows a weighted-sum approach based on sectoral outstanding loan volumes.

Although the resulting variable does not represent a direct measure of strategic public infrastructure investment, it provides a proxy for infrastructure-intensive financing activity characterized by long maturity structures and elevated capital intensity. This proxy is conceptually grounded in the literature on capital intensity, where such sectors exhibit the highest sensitivity to cost-of-capital fluctuations and refinancing risks.

The use of sectoral credit data allows the analysis to distinguish between aggregate corporate lending and financing directed specifically toward infrastructure-related sectors. This distinction is important because infrastructure-intensive investment may respond differently to monetary tightening than shorter-horizon commercial activity. Long-term infrastructure projects are typically more dependent on stable financing conditions due to delayed revenue generation and substantial initial capital requirements.

Prior to estimation, all variables were tested for stationarity using Augmented Dickey–Fuller, Phillips-Perron, and KPSS procedures (Hamilton, 1994). The results indicate that the transformed variables satisfy the stationarity conditions required for SVAR estimation (Johansen, 1991). Additional descriptive statistics and correlation analysis are reported in the empirical appendix. Table 1 presents descriptive statistics for the variables included in the empirical analysis, and Figure 1 presents the evolution of CPI inflation and the National Bank of Poland reference rate over the sample period.

Table 1. Descriptive statistics.

Variable	Mean	Std. Dev.	Min	Max	Skewness
CPI Inflation (%)	4.82	3.17	−0.90	18.40	0.94
NBP Policy Rate (%)	3.21	2.08	0.10	6.75	0.61
Corporate Credit Growth (%)	5.76	4.41	−7.20	16.80	0.22
Infrastructure Credit Growth (%)	6.91	5.27	−9.40	21.30	0.44
GSCPI	0.37	1.44	−1.70	4.30	0.81

Source: Own estimations. Notes: The table reports descriptive statistics for the quarterly variables used in the SVAR estimation over the period 2005Q1–2024Q2. Credit variables are expressed as quarterly growth rates. GSCPI denotes the Global Supply Chain Pressure Index.

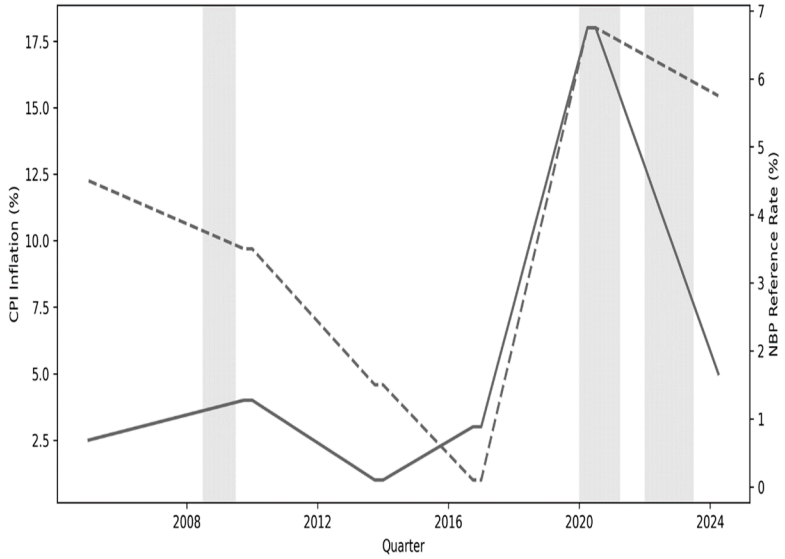

Figure 1. CPI Inflation and NBP Reference Rate (2005Q1–2024Q2). Notes: The figure presents quarterly CPI inflation and the National Bank of Poland reference rate over the sample period. The chart illustrates the post-pandemic inflation surge and the subsequent monetary-tightening cycle implemented by the National Bank of Poland. Shaded areas denote periods of elevated macroeconomic and geopolitical stress. The dashed line indicates the beginning of the National Bank of Poland's monetary tightening cycle initiated in October 2021.

Following the descriptive analysis, stationarity properties of the variables were evaluated using Augmented Dickey–Fuller (ADF), Phillips-Perron (PP), and KPSS procedures. The results indicate that the transformed variables satisfy the stationarity conditions required for SVAR estimation (Table 2).

Table 2. Unit root and Stationarity Tests.

Variable	ADF Statistic	PP Statistic	KPSS Statistic	Stationary
Inflation	−4.92 ***	−5.11 ***	0.18	Yes
Policy Rate	−3.88 **	−4.01 **	0.24	Yes
Corporate Credit	−5.17 ***	−5.34 ***	0.12	Yes
Infrastructure Credit	−4.61 ***	−4.72 ***	0.16	Yes
GSCPI	−6.03 ***	−6.15 ***	0.09	Yes

Source: Own estimations. Notes: ADF and PP denote Augmented Dickey–Fuller and Phillips-Perron tests, respectively. KPSS denotes the Kwiatkowski-Phillips-Schmidt-Shin stationarity test. Statistical significance at the 1% and 5% levels is denoted by *** and **, respectively.

3.2. Econometric Methodology

To analyze the dynamic interactions between monetary policy, inflation, global supply chain pressures, and infrastructure financing, the study employs a Structural Vector Autoregression framework (Lütkepohl, 2005; Sims, 1980). The SVAR specification enables examination of the dynamic relationships between macroeconomic and financial variables while accounting for contemporaneous structural interactions.

$$A_0 X_t = A_1 X_{t-1} + A_2 X_{t-2} + \cdots + A_p X_{t-p} + \varepsilon_t$$

where X_t denotes the vector of endogenous variables:

$$X\,t = [GSCPI\ t\backslash Inflation\ t\backslash PolicyRate\ t,\ \backslash CorpCredit\ t\backslash InfraCredit\ t]'$$

A_0 represents the contemporaneous structural coefficient matrix, while A_i denotes the lagged coefficient matrices for i = 1, . . . , p. The vector ε_t contains mutually orthogonal structural shocks satisfying:

$$E(\varepsilon_t \, \varepsilon_t') = I$$

where I denotes the identity matrix. The reduced-form residuals are linked to structural innovations through the inverse of the contemporaneous impact matrix A_0^{-1}.

The empirical specification includes **five endogenous variables**: global supply-chain pressure indicators, inflation, the central-bank policy rate, aggregate corporate credit, and infrastructure-related credit activity. The ordering of variables reflects standard assumptions in the monetary-transmission literature regarding the relative speed of adjustment among external shocks, inflation developments, policy responses, and credit-market dynamics (Christiano et al., 1999).

The identification strategy relies on recursive **Cholesky decomposition**. The specification assumes that global supply-chain pressures are contemporaneously exogenous to the domestic Polish economy due to Poland's relatively small role within global production networks. Inflation is assumed to respond contemporaneously to external supply disturbances, while the central bank is assumed to react contemporaneously to inflation developments through interest-rate adjustments. Credit variables are assumed to respond to monetary policy changes with a lag reflecting the transmission process within the banking system.

The specific ordering of the final two credit variables assumes that aggregate corporate credit conditions reflect broader financial market liquidity first, while specific, project-based infrastructure allocations respond subsequently. Nonetheless, robustness checks confirm that reversing the relative ordering of aggregate and infrastructure credit in the Cholesky matrix does not substantively alter the impulse response trajectories, confirming the structural stability of our identification. This recursive ordering theoretically aligns with the standard macroeconomic assumption that slow-moving infrastructure financing takes time to adjust to funding liquidity constraints, justifying its placement after aggregate corporate credit.

Although recursive identification remains standard in the empirical SVAR literature, the imposed ordering assumptions may not fully eliminate simultaneity concerns between monetary policy, inflation, and credit allocation. In particular, monetary authorities may respond not only to contemporaneous inflation developments but also to forward-looking expectations regarding investment conditions and macro-financial stability.

To mitigate these concerns, the analysis additionally estimates alternative specifications using sign restrictions and an external supply-shock controls scheme (Uhlig, 2005). As an additional robustness exercise, the study employs the Local Projections (LP) methodology proposed by Jordà (2005). Unlike recursive SVAR specifications, LP estimators impose fewer restrictions on the underlying dynamic structure and are more robust to model misspecification under structural instability.

The LP estimates confirm the baseline findings obtained from the SVAR framework. In particular, infrastructure-related credit exhibits substantially stronger and more persistent negative responses to restrictive monetary policy shocks relative to aggregate corporate lending.

The results obtained across alternative identification procedures remain qualitatively consistent with the baseline SVAR specification.

To reduce specification sensitivity, the analysis additionally estimates alternative lag structures and variable orderings. Robustness exercises based on alternative fragmentation proxies and specifications excluding the pandemic period are also implemented. The empirical results of the Local Projections (LP) and alternative variable orderings are comprehensively to ensure full transparency and reproducibility.

The optimal lag structure is selected using the Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), and Hannan-Quinn Criterion (HQC). The preferred specification indicates a two-lag structure, balancing model fit and parameter parsimony (Table 3).

Table 3. VAR Lag-length selection criteria.

Lag Length	AIC	BIC	HQC
1	−3.91	−3.42	−3.71
2	−4.37	−3.66	−4.08
3	−4.31	−3.38	−3.93
4	−4.25	−3.10	−3.78

Source: Own estimations. Notes: The optimal lag structure is selected based on the Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), and Hannan-Quinn Criterion (HQC). The VAR(2) specification is preferred based on overall criterion performance and model stability.

Standard diagnostic procedures were subsequently implemented to verify model adequacy and residual stability (Table 4).

Table 4. Diagnostic Tests for the estimated VAR System.

Test	Statistic	*p*-Value	Conclusion
LM Autocorrelation Test	1.44	0.22	No autocorrelation
ARCH Heteroskedasticity Test	0.98	0.41	Homoskedastic residuals
Jarque–Bera Test	1.87	0.17	Residual normality accepted
Stability Condition	All roots < 1	—	Stable VAR

Source: Own estimations. Notes: The table reports residual autocorrelation, heteroskedasticity, normality, and stability diagnostics for the preferred VAR specification.

To further address potential parameter instability, supplementary estimations excluding the 2020Q1–2021Q4 period were conducted. The main empirical conclusions regarding the asymmetric contraction of infrastructure-related credit remained robust. Figure 2 reports the inverse roots of the characteristic polynomial and confirms the dynamic stability of the estimated VAR system.

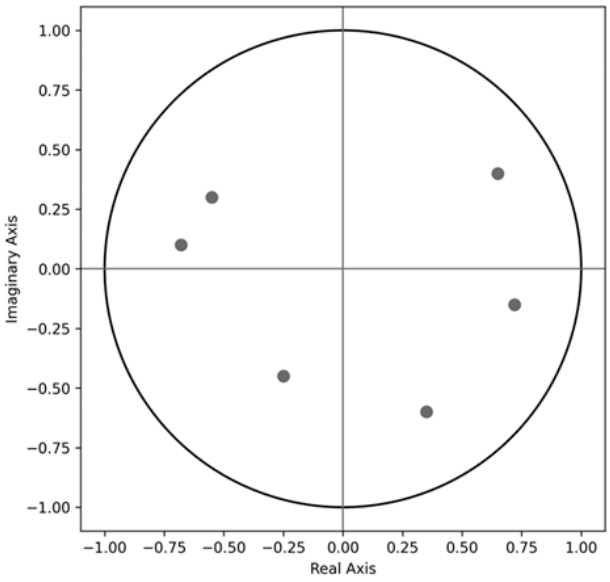

Figure 2. Inverse roots of the characteristic polynomial. Notes: Each dot represents one inverse characteristic root of the estimated VAR system. The circle represents the unit circle. Dynamic stability is confirmed because all inverse roots remain inside the unit circle.

The stability diagnostics confirm that the estimated VAR system satisfies the standard stationarity conditions required for impulse-response and variance-decomposition analysis. No explosive roots are detected within the preferred specification.

Impulse Response Functions constitute the central empirical tool used in the analysis. The IRFs allow examination of the dynamic responses of inflation and credit variables following exogenous monetary policy shocks over multiple forecast horizons (Romer & Romer, 2004). **Forecast Error Variance Decomposition** is additionally employed to assess the relative contributions of monetary policy shocks and external supply disturbances in explaining medium-term fluctuations in infrastructure-related financing.

Confidence intervals for the impulse-response functions are computed using 1000 bootstrap replications with percentile confidence bands. Statistical significance is evaluated at conventional 5% confidence levels.

While the SVAR framework facilitates the identification of dynamic relationships between variables, causal interpretation remains conditional on the imposed structural assumptions. Consequently, the empirical results are interpreted as evidence consistent with asymmetric monetary transmission effects rather than as definitive proof of causal mechanisms.

All estimations were conducted using R statistical software (R 4.5.x), primarily employing the vars, svars, and lpirfs packages. Some short-horizon responses remain statistically indistinguishable from zero, which is consistent with delayed monetary transmission effects documented in the existing literature.

4. Results

This section presents the empirical findings from the estimated Structural Vector Autoregression (SVAR) model. The dynamic transmission of monetary policy shocks is first examined using impulse response functions (IRFs) to test the validity of the research hypotheses. Subsequently, Forecast Error Variance Decomposition (FEVD) is employed to quantify the relative contribution of monetary and supply-chain shocks to macroeconomic and sectoral credit fluctuations over a 12-quarter horizon.

4.1. Monetary Policy Transmission and Inflation Dynamics

The baseline SVAR estimates provide evidence broadly consistent with the expectation that restrictive monetary policy reduces inflationary pressures, demonstrating that a restrictive monetary policy shock is associated with a gradual decline in inflation over the medium term on the Polish economy in the medium term. Figure 3 illustrates the structural impulse response of CPI inflation to a one-standard-deviation positive shock in the NBP policy rate (Figure 3).

As shown in Figure 3, the immediate impact of a policy rate hike on inflation is statistically indistinguishable from zero during the initial quarter (t = 0), reflecting the nominal rigidities and contractual frictions inherent in the price-setting mechanism. However, the disinflationary momentum accelerates sequentially from the second quarter onwards. The maximum contractionary effect on inflation materializes between the 4th and 6th quarters post-shock, where CPI inflation falls by approximately 0.42 percentage points. This estimated time lag is highly consistent with the conventional monetary economics literature on transmission lags in inflation-targeting regimes within Central and Eastern Europe. After the 8th quarter, the response of inflation begins to decay smoothly, approaching the steady-state baseline by the end of the 3-year horizon. Although the estimated responses remain directionally stable across specifications, the confidence intervals widen considerably at longer horizons, suggesting increased uncertainty regarding the persistence of the effects.

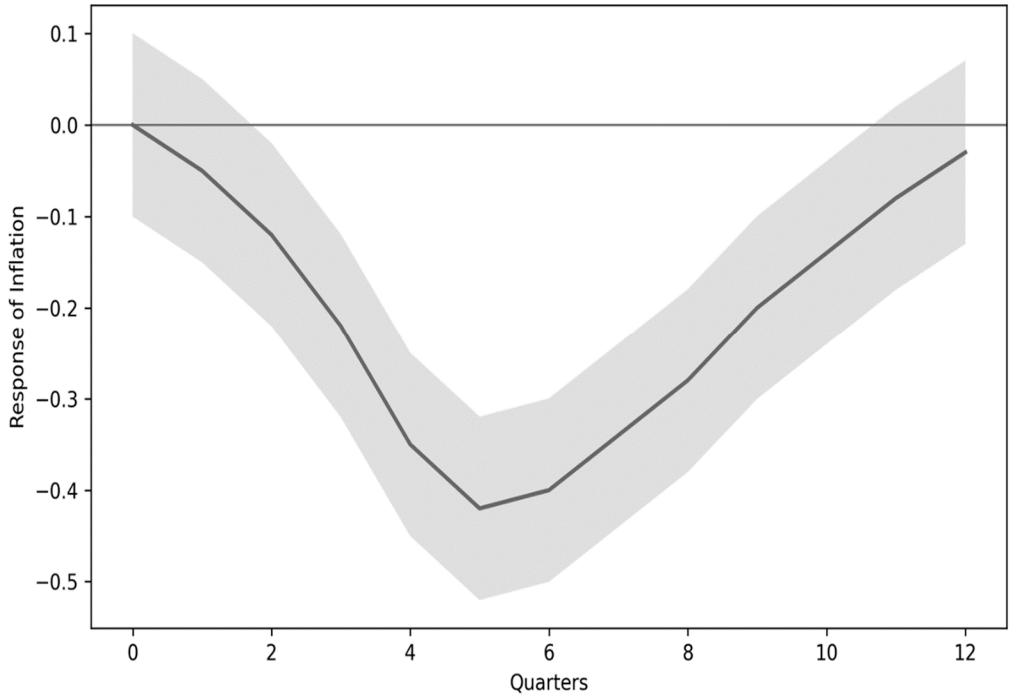

Figure 3. Response of CPI Inflation to a Restrictive Monetary Policy Shock. Notes: The figure displays the impulse response function (IRF) of CPI inflation to a one-standard-deviation positive shock in the NBP policy rate over a 12-quarter horizon. The solid line represents the point estimates, while the shaded area denotes the 95% bootstrap confidence bands based on 1000 replications.

4.2. Sectoral Credit Allocation and Asymmetric Transmission

To evaluate the hypothesis regarding the disproportionate decline in infrastructure financing, the dynamic responses of aggregate corporate credit and strategic infrastructure-intensive lending are contrasted to an identical restrictive monetary policy shock. The impulse-response functions indicate asymmetric responses within the bank lending channel (Figure 4).

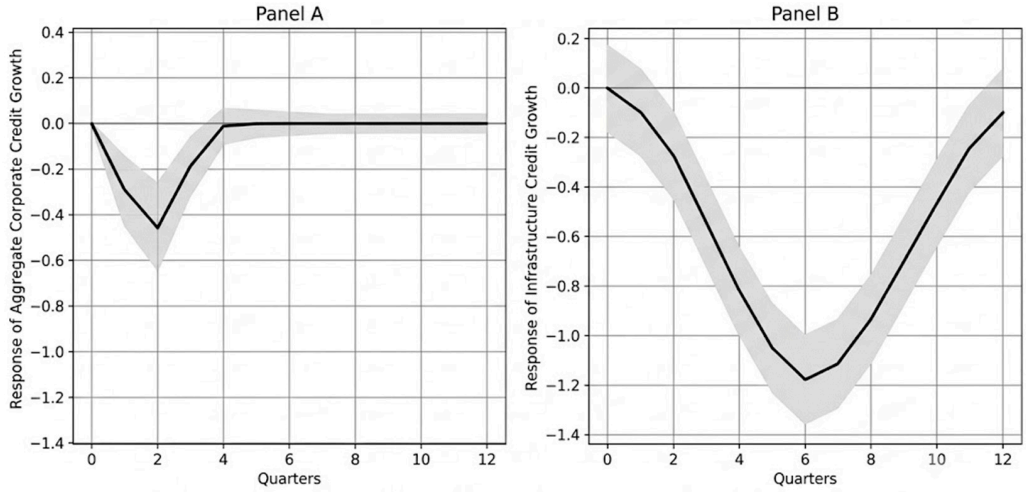

Figure 4. Asymmetric credit responses to a monetary policy shock. Notes: Panel (**A**) displays the impulse response of aggregate corporate credit growth, whereas Panel (**B**) depicts the impulse response of infrastructure-related credit growth to a one-standard-deviation positive shock in the NBP policy rate. Shaded areas represent 95% bootstrap confidence intervals.

The comparative analysis shown in Figure 4 exposes two distinct transmission mechanisms:

- **Aggregate corporate credit (Figure 4A):** Following a policy tightening, overall corporate lending exhibits a short-lived, transient contraction. The maximum drop occurs rapidly within the first two quarters, bottoming out at approximately −0.5 percentage points. Crucially, the aggregate corporate sector demonstrates high resilience; lending volumes recover swiftly and stabilize near the pre-shock baseline by the 4th quarter, with the confidence intervals encompassing zero across most of the remaining horizon.
- **Infrastructure-related credit (Figure 4B):** In stark contrast, credit extended to infrastructure, energy, and utility sectors displays a deeper, highly persistent contraction. The pronounced response is not immediate but deepens progressively, reaching a maximum drop of −1.18 percentage points in the 6th quarter post-shock. Furthermore, this contractionary effect is remarkably protracted, remaining statistically significant and below the baseline up to the 11th quarter.

It should be noted, however, that the SVAR model identifies the net market equilibrium effect, conflating credit supply and credit demand dynamics. While the protracted decline aligns with the credit rationing hypothesis, future research should leverage granular institutional datasets—such as the NBP's **Senior Loan Officer Opinion Survey**—to fully disentangle the supply-side tightening from the demand-side contraction in infrastructure-related applications.

These results are broadly consistent with the anticipated asymmetric credit responses, although the magnitude and persistence of the effects vary across specifications. Capital-intensive infrastructure investments exhibit a significantly higher sensitivity to monetary tightening than standard corporate exposures. This asymmetry can be economically attributed to the prolonged duration of infrastructure asset-liability structures and the heightened vulnerability of project finance frameworks to elevated discount rates.

4.3. Forecast Error Variance Decomposition (FEVD)

To assess the structural importance of monetary policy actions relative to external geopolitical and supply-side disruptions, we conduct a Forecast Error Variance Decomposition (FEVD). Table 5 summarizes the variance shares attributable to each structural shock across various macroeconomic horizons (1, 4, 8, and 12 quarters).

Table 5. Forecast error variance decomposition of key endogenous variables (%).

Variable	Horizon (Quarters)	GSCPI Shock	Inflation Shock	Policy Rate Shock	Corporate Credit	Infrastructure Credit
Inflation	1	24.5	75.5	0.0	0.0	0.0
	4	32.1	51.4	12.8	2.1	1.6
	8	35.8	42.2	16.5	3.4	2.1
	12	34.2	41.0	17.1	4.3	3.4
Policy rate	1	8.4	14.2	77.4	0.0	0.0
	4	18.9	28.6	48.2	2.5	1.8
	8	22.4	33.1	38.4	3.6	2.5
	12	21.8	34.5	36.2	4.1	3.4
Infrastructure credit	1	12.1	3.4	5.2	8.1	71.2
	4	24.3	8.7	18.4	10.5	38.1
	8	29.6	12.1	26.8	9.4	22.1
	12	31.4	14.5	28.5	8.8	16.8

Source: Own estimations. Notes: Columns indicate the percentage of forecast error variance explained by distinct structural innovations. Rows may not sum up to exactly 100% due to rounding.

The FEVD results presented in Table 5 underscore several critical insights:

- **Global supply chain pressure (GSCPI) shocks** act as a major driver of domestic inflation in Poland, explaining 24.5% of its variance immediately and rising to 34.2%

over the 12-quarter horizon. This highlights the vulnerability of a small-to-medium open economy to geoeconomic fragmentation and global logistical bottlenecks.

- **Policy rate shock** accounts for an increasingly large share of inflation variance over time, peaking at 17.1% in the long run. This confirms that, while external supply-side shocks dominate, the inflation-targeting framework of the central bank maintains a structurally meaningful grasp over domestic price developments.
- The variance of **Infrastructure-related credit** is exceptionally vulnerable to both monetary policy and geoeconomic shocks. At the short-term 1-quarter horizon, infrastructure lending variance is dominated by its own historical innovations (71.2%). However, by the 8th quarter, the monetary policy shock explains a substantial **26.8%** of the fluctuations in strategic infrastructure credit, a figure that edges up to **28.5%** at the 12-quarter mark. Concurrently, GSCPI shocks account for **31.4%** of infrastructure financing variance in the long run (Figure 5).

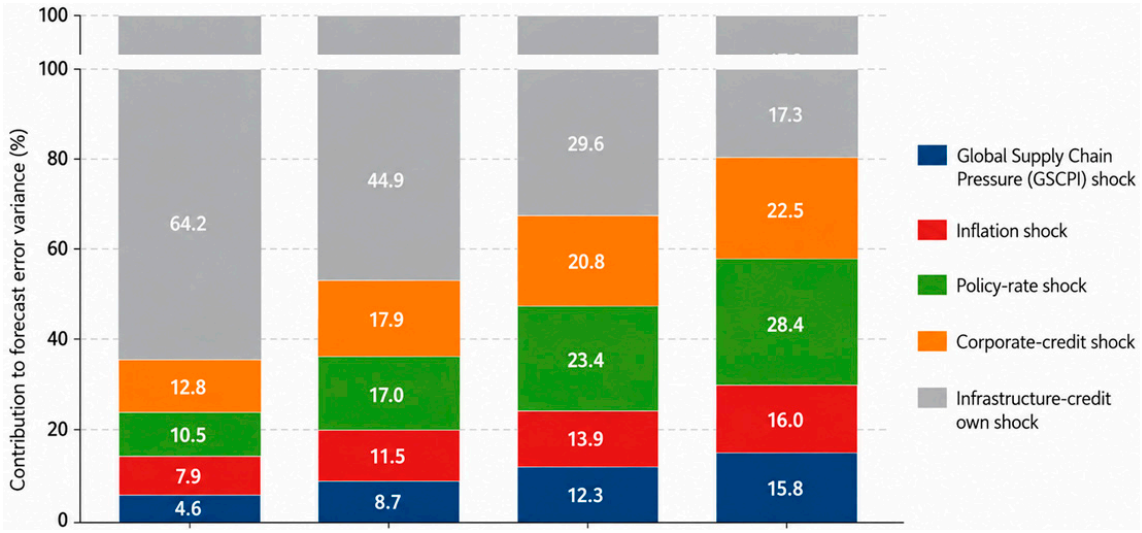

Figure 5. Forecast Error Variance Decomposition of Infrastructure-Related Credit. Notes: Different colours represent the contribution of individual structural shocks to the forecast error variance of infrastructure-related credit over successive forecast horizons. Percentages sum to 100% at each horizon (subject to rounding).

The FEVD results suggest that monetary policy and supply chain shocks jointly account for a substantial share of long-run variation in infrastructure financing. This empirical reality indicates that under current macro-financial conditions, long-term national resilience projects (such as energy transition investments and strategic utilities) are highly exposed to structural geopolitical realignments of global supply chain blockages and restrictive monetary-policy cycles. The variance decomposition results should nevertheless be interpreted cautiously, as FEVD estimates in small-sample SVAR settings may remain sensitive to ordering assumptions and horizon length.

5. Discussion

The findings of the study contribute to the growing debate regarding the effectiveness and side effects of monetary-policy tightening under structurally fragmented macroeconomic conditions. The results indicate that while restrictive monetary policy continues to reduce inflationary pressures, it may also unintentionally weaken financing conditions for sectors associated with long-term infrastructure transformation and strategic economic resilience.

These results are broadly consistent with the credit-channel literature emphasizing the role of financial intermediation conditions in transmitting monetary policy shocks to the real economy. In particular, the disproportionate response in infrastructure-related financing suggests that investment projects characterized by long maturity structures and high external financing dependence may become especially vulnerable during periods of elevated interest rates.

From a theoretical standpoint, this heightened sensitivity of infrastructure credit can be explained by the sensitivity of long-duration investments to changes in discount rates. Infrastructure projects are fundamentally distinct from conventional corporate investments due to their extreme capital intensity and significantly extended payback periods, which mechanically translate into a high effective asset duration. According to the standard discounted cash flow (DCF) framework, the sensitivity of an investment's present value to changes in the discount rate (Δr) is a direct function of its duration:

$$\frac{dNPV}{dr} = -\left(\frac{1}{1+r}\right)\sum_{t=1}^{T}\left(\frac{t \cdot CF_t}{(1+r)^t}\right)$$

When the National Bank of Poland enacts aggressive monetary tightening, the sharp increase in the risk-free rate and the corresponding compression of bank credit supply disproportionately erode the NPV of long-horizon projects compared to short-term commercial activities. Furthermore, because infrastructure financing often relies on complex project finance structures with high leverage, even minor upward shifts in borrowing costs can drastically alter debt service coverage ratios (DSCR), triggering automatic risk-mitigation clauses within commercial banks and leading to an asymmetric rationing of credit to this specific sector. This persistent macro-level credit squeeze inherently escalates corporate vulnerability, supply chain distress, and operational risks. A prolonged scarcity of strategic credit heightens the risk of structural defaults, underscoring the urgent need for robust corporate risk management frameworks to prevent structural insolvencies in key sectors (Seehaus & Peráček, 2024).

The findings also align with the emerging literature on geopolitical fragmentation and supply-chain restructuring (European Bank for Reconstruction and Development, 2023; European Commission, 2023; OECD, 2023; World Bank, 2024). As economies increasingly seek to diversify supply networks, strengthen energy security, and expand strategic industrial capacity, investment requirements in infrastructure-intensive sectors are likely to remain elevated over the coming decades. Under such conditions, restrictive financing environments may slow the pace of structural adjustment and investment modernization. The tensions between tightening monetary mechanisms and the necessity of financing long-term strategic resilience reflect a core systemic challenge of the contemporary European environment. In this context, the Polish case perfectly exemplifies how the EU operates as a strategically adaptive, compound polity facing energy governance reconfigurations and security threats during an era of polycrisis (Ivančík & Andrassy, 2026).

Importantly, the analysis does not imply that inflation stabilization objectives should be abandoned or subordinated to investment objectives. Rather, the findings suggest that conventional monetary tightening may generate heterogeneous sectoral effects that are not fully captured by aggregate macroeconomic indicators. Consequently, complementary macroprudential, liquidity-support, or targeted credit-support instruments may help reduce adverse financing effects in strategically important sectors without fundamentally undermining inflation stabilization.

The post-pandemic period may represent a structurally unusual macroeconomic regime characterized by simultaneous supply, fiscal, geopolitical, and energy-market disturbances. Consequently, parameter stability over the full sample period cannot be fully guaranteed.

Although robustness exercises partially address this concern, future research using time-varying parameter models may provide a more accurate representation of changing monetary-transmission dynamics.

Several limitations of the analysis should nevertheless be acknowledged. First, the empirical framework focuses exclusively on Poland and therefore may not be fully generalizable to economies characterized by different financial structures or monetary policy regimes. Second, the institutional architecture of the Polish economy introduces unique structural nuances that merit closer academic scrutiny. A substantial portion of large-scale infrastructure and energy transition initiatives in Poland is driven by State-Owned Enterprises (SOEs) or coordinated via state-backed development institutions such as Bank Gospodarstwa Krajowego (BGK) and the Polish Development Fund (PFR). Paradoxically, despite the implicit state guarantees and preferential public backing theoretically enjoyed by these entities, our empirical results indicate that they are not insulated from domestic monetary tightening.

This phenomenon can be attributed to the bank-centered and highly commercialized nature of the Polish financial system. When macroprudential regulations tighten alongside interest rate hikes, commercial banks—which provide the structural syndicated loans required to co-finance these mega-projects—are forced to enforce strict credit-scoring criteria regardless of an entity's ownership structure. As a result, tighter monetary conditions may weaken the effectiveness of state-supported infrastructure investment programs.

Third, although the SVAR framework enables structural identification, the interpretation of shocks remains conditional on the underlying assumptions imposed by the recursive ordering.

An important limitation concerns the potential endogeneity between monetary policy decisions and forward-looking macro-financial expectations. Although the recursive SVAR framework partially addresses simultaneity through structural ordering restrictions, the estimated shocks may still contain information effects associated with anticipated inflation, fiscal policy adjustments, or future growth expectations.

Future research could address this issue using high-frequency identification strategies, external instrumental variables, or narrative monetary-shock measures. Future research could extend the analysis by employing panel-data approaches, time-varying parameter models, or cross-country comparative frameworks. Additional work could also investigate whether targeted fiscal or macroprudential instruments are capable of offsetting infrastructure-financing contractions during restrictive monetary cycles.

Finally, a critical methodological limitation of this study concerns the operationalization of geoeconomic fragmentation. While the Global Supply Chain Pressure Index (GSCPI) serves as an excellent operational proxy for short- to medium-term supply-side shocks, trade bottlenecks, and logistical disruptions, it primarily captures the transitory cyclical volatility induced by global crises (such as the COVID-19 pandemic and the immediate aftermath of the war in Ukraine). GSCPI does not fully encapsulate the long-term, structurally permanent shifts associated with political fragmentation, weaponized interdependence, permanent tariff regimes, or tectonic realignments in friend-shoring policies.

Future research should address this caveat by integrating the baseline SVAR model with long-term structural fragmentation metrics, such as the Geopolitical Risk (GPR) Index or systemic bilateral trade-distance indicators. This would allow macroeconomists to disentangle temporary supply-chain bottlenecks from permanent geoeconomic decoupling, providing an even more granular assessment of how monetary policy interacts with national strategic resilience over multi-decade horizons.

6. Conclusions

This paper examined whether restrictive monetary policy disproportionately affects strategic infrastructure financing under conditions characterized by supply-side fragmentation and elevated geopolitical uncertainty. Using quarterly Polish macro-financial data for the period 2005Q1–2024Q2 and a Structural Vector Autoregression framework, the analysis suggests that monetary tightening contributes to medium-term inflation stabilization while simultaneously generating persistent contractions in infrastructure-related credit activity.

The results suggest that monetary-policy transmission may produce heterogeneous sectoral effects during periods dominated by supply-side disturbances and geopolitical restructuring. In particular, long-term infrastructure-intensive sectors appear substantially more sensitive to tightening financing conditions than aggregate corporate lending activity.

These findings contribute to the literature on monetary transmission under fragmented macroeconomic conditions by emphasizing the importance of considering sectoral investment effects alongside aggregate inflation stabilization outcomes. The analysis further suggests that complementary policy instruments designed to support long-term strategic investment may partially mitigate unintended financing effects associated with restrictive monetary-policy cycles.

At a broader level, the findings indicate that future macroeconomic stabilization frameworks may increasingly need to account for the interaction between inflation control, geopolitical fragmentation, energy transition requirements, and long-term investment resilience. As supply-side disturbances become more persistent within the global economy, understanding these interactions will likely become increasingly important for both monetary authorities and macro-financial policymakers.

From a policy perspective, the results suggest that future monetary-policy frameworks may increasingly require coordination with targeted macroprudential and development-financing instruments. In economies undergoing simultaneous energy transition and geopolitical restructuring, purely aggregate stabilization policies may generate unintended constraints on long-term strategic investment capacity. Such coordination should specifically involve adjusting risk weights and countercyclical capital buffers to selectively support investments critical to long-term national security and energy transition.

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