

DO BANK LENDING PRACTICES AMPLIFY OR STABILISE MACROECONOMIC FLUCTUATIONS? EVIDENCE FROM EMERGING EUROPE BEFORE AND AFTER FINANCIAL CRISES

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Abstract. The global financial crisis of 2007–2009 exposed the vulnerability of bank-dependent emerging economies, where procyclical lending amplifies output fluctuations and heightens GDP volatility, with adverse effects on investment, employment, and household welfare. This study investigates the impact of bank lending practices, using credit-to-GDP ratios, foreign bank shares, and macroprudential policy indices (MPIs), on GDP volatility of 14 emerging economies in Central, Eastern, and Southeastern Europe from 2000 to 2024. Using an unbalanced panel of 326 observations, fixed-effects and dynamic system GMM estimations analyse GDP volatility as a function of critical lending variables, while controlling for inflation, public debt, and trade openness. Robustness checks encompass subsample analyses (EU versus non-EU), lagged specifications, and instrumental-variable estimations. The findings demonstrate that a 1% increase in credit-to-GDP elevates volatility by 0.102% ($p < 0.01$), validating procyclical amplification. More stringent macroprudential policies enhance short-term volatility, particularly in non-EU nations (4.438 vs 2.971; $p < 0.01$), indicating transitional adjustment effects. Foreign bank shares show delayed amplification, while inflation emerges as a consistent destabilizer. System GMM confirms the persistence of GDP volatility. Overall, bank lending plays a dual role, intensifying boom-bust cycles but supporting stabilisation when embedded within countercyclical macroprudential frameworks and credible inflation targeting.

Keywords: macroeconomic volatility, bank lending, credit-to-GDP, macroprudential policy, financial crises.

JEL Classification: E32, E44, E51, G21, G01, C33.

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1. Introduction

The global financial crisis of 2007–2009 and the following Eurozone debt crisis revealed how fragile financial systems can be, particularly in developing countries, where bank lending dynamics can amplify macroeconomic fluctuations (Challoumis & Eriotis, 2024). In the economies of Central, Eastern, and Southeastern Europe, referred to in this study as “Emerging Europe”, the aftermath of these crises was especially acute due to their high financial integration (James, 2018), dependence on foreign capital, and transition from centrally planned to market-based economic systems (Gallego et al., 2010; Lehmann et al., 2011). While financial liberalization during the 1990s and early 2000s fostered credit expansion and accelerated economic growth, it concurrently exposed these economies to considerable vulnerabilities, including procyclical lending, credit booms, and the risk of sudden stops (Moreno, 2011;

Calvo, 2013; Karwowski & Stockhammer, 2017; Boyarchenko et al., 2022). Such instability is accompanied by increased GDP volatility, as indicated by the standard deviation of real growth rates, inhibiting long-term economic growth by approximately 1–2% annually, and incurs high social costs, with 20–30% of households experiencing increased poverty risks during economic downturns (Chowdhury et al., 2013). These patterns show the persistent conflict between a credit's ability to boost growth and its capacity to undermine stability when regulatory oversight is insufficient.

The primary inquiry of this paper is whether bank lending practices in Emerging Europe amplify or stabilise macroeconomic fluctuations, and how these dynamics have evolved before and after financial crises. This study investigates the impact of credit dynamics, captured through credit-to-GDP ratios, and other variables, such as foreign bank shares and macroprudential policy indices (MPIs), on the volatility of 14 emerging economies in Central, Eastern, and Southeastern Europe from 2000 to 2024.

The research approach is closely connected to established theories on how credit shapes macroeconomic dynamics. In theory, financial intermediation is seen as both a transmitter and, at times, an originator of shocks (Thakor, 2015; Taylor, 2015). The financial accelerator framework shows how feedback between asset prices, collateral values, and credit supply interacts (Bernanke et al., 1996; Van Treeck, 2014). On the other hand, macroprudential tools like countercyclical capital buffers, reserve requirements, and loan-to-value (LTV) ratios can stabilise the system when appropriately deployed (Galati & Moessner, 2013; Gatt, 2024). Therefore, the heterogeneity of financial structures, policy frameworks, and institutional quality in Emerging Europe provides a unique empirical setting for examining the functionality of such mechanisms under diverse macro-financial conditions (Cevik et al., 2016; Deltuvaitė, 2016).

To empirically assess the channels through which credit dynamics influence macroeconomic volatility, this paper formulates the following hypotheses:

H1: *Credit-to-GDP amplifies GDP volatility in Emerging Europe.*

H2: *Macroprudential tightening reduces GDP volatility.*

H3: *Institutional quality reduces volatility and conditions policy effectiveness.*

This paper enhances the current literature in three primary aspects. First, it combines measures of Credit-to-GDP, Foreign Bank Share, and macroprudential policy indices (MPIs) into single framework to assess the dual role of bank lending in shaping macroeconomic fluctuations. Then, it separates the economies of Emerging Europe into EU and non-EU groups to reveal how institutional convergence and euro-area integration affect cyclical lending behaviour. Finally, it extends the temporal coverage to 2024, thereby capturing the evolution of lending cyclicity across successive crisis episodes, including the post-pandemic recovery phase.

The rest of the paper is organised as follows. Section 2 presents the literature review. Section 3 describes the data, variable construction, and empirical methodology. Section 4 presents the empirical results. Section 5 discusses the findings, limitations, and policy implications, while Section 6 concludes.

2. Literature review

2.1. Theoretical foundations of cyclical lending

Bank lending practices are widely recognised as a crucial channel for transmitting real and financial shocks throughout the economy. Lending booms can stimulate investment and support growth, but excessive credit expansion, particularly when standards are loosened during optimistic periods, can undermine financial stability (Borio, 2011; Claessens & Kose, 2017; Bounader & Elekdag, 2024). Conversely, tighter credit conditions amplify downturns by restricting investment and consumption, thereby worsening recessions. This cyclical pattern, often framed within the financial accelerator model, highlights feedback loops between borrower balance sheets and credit availability, which amplify business-cycle volatility (Thakor, 2015; Taylor, 2015; Oviedo et al., 2023). Emerging markets experience these effects more acutely due to weaker regulatory institutions, reliance on foreign capital, and underdeveloped financial systems (Moreno, 2011; Karwowski & Stockhammer, 2017; Dallosi, 2022).

Financial crises not only trigger short-term contractions but also influence long-term regional divergence. For example, Mazzola and Pizzuto (2020) show that crises produce lasting differences in recovery paths, while Sutherland and Hoeller (2012) and De Haan and Sturm (2017) emphasise that debt overhang, income inequality, and systemic vulnerabilities exacerbate crisis severity. These findings resonate with studies on secondary effects of external shocks: international financial sanctions, for instance, can indirectly amplify domestic volatility in non-target states by constraining bank lending and increasing economic isolation (Newman & Zhang, 2024).

The literature further highlights the importance of regulatory frameworks, financial integration, and institutional quality in shaping credit cycles. Cevik et al. (2016) show that financial openness in Emerging Europe increased exposure to external shocks, even as it supported credit and investment growth. Recent studies advocate for a balanced approach that prioritises resilience over rapid expansion (Wilson et al., 2010; Ballouk et al., 2024). Recent evidence also suggests that financial pressure policies can reduce economic growth by distorting credit and weakening financial intermediation (Nar, 2025). In the same vein, Sikalao-Lekobane (2025) indicates that macroprudential measures may lead to regulatory leakage by shifting credit activity outside the traditional banking system, thereby weakening policy effectiveness and potentially amplifying financial instability if not properly designed. Additionally, research on land-use competition and sustainable development underscores that policy trade-offs often arise when multiple economic objectives intersect, mirroring the tensions policymakers face in balancing financial stability with growth (Jin et al., 2019). At the same time, financial development is shown to support long-term economic and sustainability outcomes, particularly through its role in resource allocation and development processes (Zioło et al., 2025).

2.2. Institutional restraints and policy reactions to credit cyclical management

Monetary policy remains a significant determinant of bank lending behaviour, particularly through interest-rate channels. Borrowers in emerging economies are often sensitive to

interest-rate changes, and restrictive policy can disproportionately reduce credit growth if macroprudential buffers are insufficient (Nucu & Anton, 2018; Borio, 2011). Coordinated monetary and macroprudential frameworks have been increasingly recommended to manage systemic risk and aggregate demand, though institutional fragmentation, conflicting mandates, and weak interagency communication continue to impede effective implementation (Adrian et al., 2017; Mohdari et al., 2024; Lehmann et al., 2011; Lane, 2013).

The crisis revealed fundamental regulatory and conceptual failures in managing financial cycles, especially in economies with shallow institutions (Lin & Treichel, 2012). Macroprudential instruments, such as sectoral capital surcharges, loan-to-value limits, and countercyclical buffers, play a critical role in moderating credit cycles and mitigating systemic risk (Galati & Moessner, 2013, 2018). However, their effectiveness depends on institutional quality, and emerging economies often face trade-offs between stability and growth when designing these tools (Ballouk et al., 2024; Lubis et al., 2019; Mohdari et al., 2024). Empirical evidence demonstrates that when applied countercyclically, macroprudential policies reduce both credit volatility and the likelihood of banking crises, although weaker governance and limited supervisory authority can constrain their impact (Belkhir et al., 2022; Gatt, 2024; Moreno, 2011). Countries with stronger institutions, such as Slovakia, the Czech Republic, and Poland, exhibited greater macro-financial stability during the global financial crisis (Lubis et al., 2019; Gallego et al., 2010).

Despite extensive research on credit cycles, relatively few studies empirically assess the dual role of bank lending in amplifying or stabilising macroeconomic fluctuations in Emerging Europe. Much of the existing literature either predates the 2008–2009 global financial crisis or fails to compare dynamics before and after the shock (Neuhauser, 2015; Calomiris & Jaremski, 2024). By examining credit cyclicity, incorporating monetary and institutional variables, and analysing pre- and post-crisis periods, the present study addresses these gaps while also situating its findings within broader contexts, including secondary effects of sanctions (Newman & Zhang, 2024) and policy trade-offs in sustainable resource allocation (Jin et al., 2019).

3. Methodology

3.1. The empirical approach

This study draws on an unbalanced panel of 326 country–year observations spanning 2000–2024 for fourteen emerging economies in Central, Eastern, and Southeastern Europe: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, North Macedonia, Poland, Romania, Serbia, and Slovakia. The aim is to examine whether lending behaviour in the banking systems dampens or amplifies macroeconomic fluctuations across crisis and non-crisis periods.

Following He et al. (2014) and Abosedra et al. (2020), output volatility is captured by a rolling three-year standard deviation of real GDP growth rates, a measure that reflects the evolution of swings in economic activity. The intuition is straightforward: in financially vulnerable environments, rapid credit expansion or weak macroprudential oversight tends to accentuate the boom–bust pattern.

Considering volatility as inherently dynamic, the analysis extends a standard fixed-effects model with the System GMM estimator developed by Arellano and Bover (1995) and Blundell and Bond (1998). This enables the inclusion of lagged volatility terms and helps reduce endogeneity caused by simultaneity between financial conditions and macroeconomic instability. Internal instruments based on appropriately lagged regressors form the core of the identification strategy, while the instrument count is controlled by collapsing the matrix. Post-estimation diagnostics, such as the Sargan and Hansen tests, helped to evaluate the validity of the instruments.

The baseline estimation model is as follows:

$$\sigma_{it} = \beta_0 + \beta_1 \text{CREDIT}_{it} + \beta_2 \text{FOREIGN}_{it} + \beta_3 \text{MPI}_{it} + \beta_4 X_{it} + \alpha_i + \epsilon_{it}, \quad (1)$$

where: σ_{it} – GDP volatility; CREDIT_{it} – credit-to-GDP; FOREIGN_{it} – foreign bank share; MPI_{it} – macroprudential index; X_{it} – vector of controls (inflation, public debt, trade openness); α_i – country fixed effects; ϵ_{it} – error term; i – represents countries ($i = 1, \dots, N$); t – represent time ($t = 1, \dots, T$).

To address potential reverse causality between credit growth and volatility, the analysis employs an instrumental-variables (IV) approach. The instrument is the twice-lagged global credit growth series from the Bank for International Settlements (BIS), used as an external shifter of domestic credit conditions under the assumption that domestic volatility does not influence global credit aggregates. The first-stage results indicate strong instrument relevance, while the Sargan test fails to reject the null hypothesis of instrument exogeneity, supporting the validity of the exclusion restriction.

To complement the main specifications, the 2008 global financial crisis is treated as a major exogenous shock, enabling a complementary difference-in-differences design. Countries with above-median pre-crisis credit intensity form the treated group, while those with lower exposure serve as controls. This contrast highlights whether heavily leveraged economies experienced sharper volatility responses during the downturn.

As an additional robustness check, the analysis also examines whether structural shifts related to EU accession and, for some countries, the adoption of the euro, interact with the credit-to-GDP ratio. These interactions help assess whether deeper integration altered the volatility of domestic credit conditions.

As part of the econometric diagnostics supporting the baseline and robustness specifications, stationarity concerns are addressed using panel unit root tests (LLC and IPS) applied to level and differenced series. Most variables, such as credit-to-GDP, foreign-bank penetration, and volatility itself, exhibit unit-root behaviour at levels but not in differences, supporting the use of first-differencing within the GMM framework. The fixed-effects specification simultaneously controls for unobserved heterogeneity stemming from institutional legacies and structural features of individual banking systems.

3.2. Data and variables

A summary of the variables and their respective sources, as well as the MPI decomposition, is presented in Table 1, respectively. Core macroeconomic and financial series, including real GDP growth, credit-to-GDP ratios, inflation, public debt, and trade openness, are sourced

from the World Bank's World Development Indicators (WDI) and the Bank for International Settlements (BIS), ensuring consistency and cross-country comparability.

Moreover, macroprudential policy actions are captured using the IMF's Integrated Macroprudential Policy (iMaPP) database. Its Macroprudential Policy Index (MPI) is a continuous measure ranging from 0 to 1 that aggregates nineteen instruments classified into four pillars: capital-based tools, structural measures, countercyclical buffers, and governance-related interventions. The index is constructed by assigning equal weights to all instruments within each pillar and then averaging across pillars, thereby producing a composite measure that reflects the breadth and intensity of macroprudential use across time and countries (Alam et al., 2019).

Annual data were employed rather than quarterly series because of significant deficiencies in the availability of quarterly macroprudential indicators, foreign bank asset shares, and public debt statistics for numerous non-EU nations before 2010. The utilisation of quarterly data would have led to a highly unbalanced panel and a reduction of almost 45% in observations, thereby compromising the consistency of the GMM estimator. Consequently, annual data offer the most comprehensive, comparable, and methodologically sound coverage for the fourteen economies examined

Table 1. Summary of key variables (source: BIS, WDI, iMaPP; authors' calculations, 2000–2024, N = 326)

Variable	Description	Source	Mean (SD)
GDP Volatility	Rolling 3-yr SD of real GDP growth (%)	WDI	2.48 (1.25)
Credit-to-GDP	Domestic credit to private sector (% GDP)	WDI	53.1 (19.2)
Foreign Bank Share	Assets of foreign-owned banks (% total)	BIS	45.8 (22.7)
MPI	Macroprudential Policy Index (0–1 continuous)	iMaPP	0.63 (0.22)
Inflation	CPI growth (%)	WDI	3.9 (4.3)
Public Debt	General government debt (% GDP)	WDI	39.2 (16.1)
Trade Openness	(Exports + Imports)/GDP (%)	WDI	103.1 (29.4)
EU Dummy	1 post-accession year	Authors	–
Euro Dummy	1 post-Euro adoption	Authors	–
Policy Rate (INT)	Annual average central bank main policy rate (%)	National central banks/IMF IFS/ECB	
Institutional Quality (INST)	Average of selected Worldwide Governance Indicators (e.g., rule of law, government effectiveness, regulatory quality)	World Bank WGI (Kaufmann et al., 2010)	

3.3. Estimation techniques

As already explained, the baseline analysis relies on a fixed-effects (FE) estimator implemented using the *plm* package in R. A Hausman test is used to evaluate whether FE or random effects (RE) provides a consistent estimator.

To gauge the stability of the findings, several complementary estimators are employed. An RE model is first used as a benchmark comparison. Pooled OLS results with country-clustered standard errors are then reported to address potential cross-sectional dependence.

A specification including the one-period lag of the credit-to-GDP ratio is added to capture delayed lending effects. Finally, the sample is split across two meaningful dimensions: EU versus non-EU economies, and pre-crisis (2000–2008) versus post-crisis (2009–2024) periods.

Together, these estimators provide a consistent and multidimensional assessment of robustness, ensuring that the main findings do not depend on model choice, lag structure, or institutional heterogeneity.

3.4. Model limitations

Despite the use of fixed-effects and dynamic GMM estimators to address endogeneity and unobserved heterogeneity, several limitations remain. Measurement error in the macroprudential policy index (MPI) may still distort coefficient estimates, particularly for smaller economies where policy documentation is incomplete or inconsistently reported. The annual frequency dataset restricts the analysis to medium-term fluctuations; sharper, high-frequency dynamics in credit behaviour or volatility inevitably fall outside the scope of the model. Finally, while interaction terms and robustness checks help account for major structural shifts such as EU accession or euro adoption, these transitions may involve deeper, gradual regime changes that are not fully captured by discrete dummies or linear specifications.

These limitations highlight avenues for future research and underscore the importance of developing more disaggregated macro-financial datasets for emerging Europe.

4. Empirical results

4.1. Key findings

This section presents the main regression estimates together with several robustness checks. Table 2 reports the coefficients from five complementary specifications. The Hausman test rejects the null hypothesis of no correlation between regressors and unobserved heterogeneity at the 1% level, which favours the FE estimator. Accordingly, Table 2 presents the baseline fixed-effects estimator (Column 1), the random-effects model (Column 2), a pooled OLS benchmark (Column 3), a specification including lagged credit-to-GDP (Column 4), and the preferred System GMM estimator (Column 5), which controls for endogeneity and dynamic persistence in volatility.

The fixed-effects specification, presented in Column 1, supports the procyclicality hypothesis, as a one-percentage-point rise in the credit-to-GDP ratio is associated with a 0.102 increase in GDP volatility ($p < 0.01$). This pattern aligns with the financial-accelerator view in which credit expansion in emerging European economies tends to intensify output fluctuations rather than smooth them.

The Macroprudential Policy Index (MPI) also appears positive and significant across models. The FE estimate (2.944, $p < 0.01$) suggests that tighter macroprudential frameworks coincide with short-term increases in volatility. This result is consistent with Gatt (2024), who argues that rapid tightening in financially shallow systems can generate transitional frictions before stabilising effects materialise.

Table 2. Regression results: main and robustness checks

Variable	(1) FE	(2) RE	(3) OLS	(4) Lagged	(5) SysGMM
Credit-to-GDP	0.102*** (0.022)	0.097*** (0.024)	0.071*** (0.018)	0.052*** (0.014)	0.098** (0.020)
MPI	2.944*** (0.512)	2.856*** (0.521)	2.410** (0.498)	2.729*** (0.489)	2.812** (0.498)
Foreign Bank Share	−0.004 (0.008)	0.002 (0.009)	0.011* (0.006)	0.065*** (0.012)	0.058* (0.011)
Inflation	1.032*** (0.189)	0.998*** (0.195)	1.045** (0.201)	0.987** (0.182)	1.012** (0.182)
Public Debt	−0.017*** (0.004)	–	–	–	−0.016** (0.004)
Trade Openness	−0.021** (0.009)	–	–	–	−0.019* (0.008)
Lagged Volatility	–	–	–	–	0.612** (0.089)
R ² / Tests	0.772 Hausman: $\chi^2(6) = 28.41$, $p < 0.01$	0.731	0.654	0.747	Hansen $p = 0.23$; AR(2) $p = 0.41$
Observations	326	326	326	326	326

Note: Standard errors are enclosed in parentheses. Significance levels: $p < 0.10$ (*), $p < 0.05$ (**), $p < 0.01$ (***).

The role of foreign bank participation proves more context-dependent. In the FE model, the coefficient is small and statistically insignificant, indicating no clear volatility effect once country-specific characteristics are absorbed. However, the OLS, lagged-credit, and System GMM estimates reveal a positive, albeit sometimes only weakly significant, relationship, implying that in more flexible or dynamic settings, greater foreign bank presence is associated with higher volatility. These mixed results mirror the divided findings in the literature. Brana et al. (2024) report a stabilising influence, while the GMM outcomes here align more closely with Cevik et al. (2016) and Beck et al. (2022), who emphasise that the impact of foreign banks becomes more apparent when accounting for evolving credit dynamics and policy interactions.

Among the control variables, inflation exhibits a consistently positive and significant coefficient (1.032, $p < 0.01$), reflecting its destabilising influence on expectations and investment decisions. In contrast, both public debt and trade openness are negatively signed and statistically significant in the FE and GMM specifications, suggesting that stronger fiscal positions and deeper integration into global markets can help dampen cyclical swings.

The System GMM estimates, presented in Column 5, underline the dynamic nature of output volatility. The lagged-volatility coefficient (0.612, $p < 0.05$) indicates substantial persistence, implying that shocks propagate over time rather than dissipate quickly. This outcome is consistent with the cyclical behaviour observed in emerging European economies. Model diagnostics further support the specification: the Hansen statistic ($p = 0.23$) confirms instrument validity, while the AR(2) test ($p = 0.41$) indicates no second-order serial correlation.

Additional robustness checks, presented in the Appendix, yield complementary insights. In the IV framework, instrument strength is confirmed by a first-stage F-statistic of 28.4, and the Sargan test ($p = 0.12$) does not reject the overidentifying restrictions. Finally, the difference-in-differences estimator shows that high-credit economies experienced a significantly larger increase in volatility after 2008 (0.112*, $p < 0.1$), suggesting that pre-crisis leverage amplified the post-crisis volatility response.

4.2. Comparing EU and Non-EU subsamples

To investigate whether institutional convergence and EU integration shape the credit–volatility relationship, the sample is split into EU member states and non-EU economies. Table 3 summarises the fixed-effects estimates for the two groups to compare the macro-financial sensitivities across different institutional settings.

Table 3. Fixed-effects regression: EU vs. non-EU countries

Variable	EU Members	Non-EU
Credit-to-GDP	0.103*** (0.025)	0.078** (0.031)
MPI	2.971*** (0.498)	4.438*** (0.612)
Foreign Bank Share	0.008 (0.009)	−0.012 (0.011)
Inflation	0.987** (0.182)	1.156*** (0.221)
Trade Openness	−0.021* (0.010)	−0.066*** (0.018)
Observations	212	114
R ²	0.789	0.756

Note: Standard errors are enclosed in parentheses. Significance levels: $p < 0.10$ (*), $p < 0.05$ (**), $p < 0.01$ (***).

For EU members, both credit-to-GDP and the MPI remain positive and highly significant (0.103 and 2.971, $p < 0.01$), indicating that financial deepening and tighter macroprudential frameworks continue to amplify short-term fluctuations even within more institutionalised settings. Foreign bank share again is small and insignificant, reflecting the harmonised regulatory standards within the EU.

Among non-EU economies, several contrasts emerge. The MPI coefficient is substantially larger (4.438, $p < 0.01$), while trade openness emerges as strongly stabilising (−0.066, $p < 0.01$). Credit-to-GDP remains positive and statistically significant at the 5% level, although its magnitude is smaller than for EU members. Inflation remains a significant driver of volatility in both groups, though the magnitude is higher outside the EU.

Taken together, the results point to a differentiated pattern. EU integration appears to have moderated, though not eliminated, the procyclical impact of credit expansion, while non-EU economies experience sharper short-run MPI effects, consistent with the idea that rapid tightening in less developed financial systems generates transitional strains.

4.2.1. EU membership and Eurozone effects on GDP volatility

To complement the subsample analysis, Table 4 presents the results of interaction terms intended to capture whether EU membership or Eurozone participation alters the sensitivity of volatility to credit and macroprudential policy.

The interaction between credit-to-GDP and EU membership is positive and significant (0.015, $p < 0.05$), implying that integration slightly intensifies the sensitivity of output volatility to credit cycles. Other interaction terms, including those with the MPI, are not statistically significant, suggesting that convergence in macroprudential frameworks has narrowed, though not erased, cross-country differences.

Table 4. Interaction Effects of EU Membership and Eurozone Participation on GDP Volatility

Variable	Coefficient (SE)
EU Dummy	0.032 (0.028)
Euro Dummy	0.021 (0.031)
Credit-to-GDP $\times$ EU	0.015** (0.007)
Credit-to-GDP $\times$ Euro	0.009 (0.008)
MPI $\times$ EU	−0.412 (0.321)
Observations	326

Note: Standard errors are enclosed in parentheses. Significance levels: $p < 0.10$ (*), $p < 0.05$ (**), $p < 0.01$ (***).

4.2.2. Extended specification: monetary and institutional factors

To evaluate whether the effects of macroprudential policy on output volatility depend on the broader monetary and institutional environment, Table 5 augments the System GMM specification by incorporating the policy rate (INT) and the institutional quality (INST), and their interaction terms with MPI. These additions allow the analysis to determine whether tighter monetary conditions or stronger institutional frameworks amplify or dampen the short-term volatility response to macroprudential tightening.

Table 5. Extended model with monetary and institutional variables

Variable	Coefficient (SE)
Policy Rate (INT)	0.089* (0.046)
Institutional Quality (INST)	−0.156** (0.068)
MPI $\times$ INT	−0.312 (0.221)
MPI $\times$ INST	−0.080** (0.035)
Lagged Volatility	0.598*** (0.091)
Hansen p	0.21
Observations	326

Note: SysGMM; selected coefficients. Standard errors are enclosed in parentheses. Significance levels: $p < 0.10$ (*), $p < 0.05$ (**), $p < 0.01$ (***).

Higher policy rates are associated with marginally greater volatility (0.089, $p < 0.1$), while stronger institutional quality exerts a dampening effect (−0.156, $p < 0.05$). Importantly, the MPI–INST interaction is negative and significant, indicating that more robust governance frameworks help soften the short-term volatility spike associated with macroprudential tightening. Although multicollinearity limits precision in some coefficients, the overall pattern suggests that institutional depth conditions the speed at which economies absorb regulatory adjustments.

4.3. Stylized facts and descriptive trends

The descriptive evidence presented in Figures 1–4 complements the econometric findings by illustrating the macro-financial patterns that shape the transmission of credit cycles and macroprudential policy in Emerging Europe over 2000–2024. These figures document the evolution of GDP volatility, the behaviour of credit cycles, the trajectory of macroprudential tightening, and the degree of cross-country heterogeneity in financial structures.

Figure 1 illustrates substantial cross-country heterogeneity in GDP volatility over the 2000–2024 period. A pronounced surge in volatility is evident during the 2008–2009 global financial crisis, with the Baltic economies, particularly Latvia and Lithuania, experiencing some of the most substantial fluctuations. Several Central and Eastern European economies display comparatively moderate levels of volatility throughout much of the sample period, although this pattern varies considerably across countries. Following the adjustment that succeeded the global financial crisis, volatility generally subsided during the mid-2010s before rising markedly again between 2020 and 2023, reflecting renewed exposure to significant external disturbances. The observed dynamics underscore pronounced cross-country differences in both the magnitude and timing of GDP volatility, highlighting the heterogeneous sensitivity of the analysed economies to major macroeconomic shocks.

Figure 2 indicates a generally positive but heterogeneous association between credit-to-GDP ratios and GDP volatility. Estonia records both high credit depth and the highest volatility, while Albania and Poland show lower levels of both indicators. Deviations observed in countries such as Bosnia and Herzegovina and Serbia suggest that the relationship is not strictly linear and may be influenced by country-specific factors.

As shown in Figure 3, which reports the standard deviation of real GDP growth for each country over 2000–2024, country-level dispersion is evident. Latvia, Lithuania, and Estonia form a clear high-volatility cluster, shaped by their rapid boom–bust cycles and uneven recovery trajectories. In contrast, Albania, Poland, and the Czech Republic present more stable profiles, indicating smoother cyclical adjustments and comparatively resilient growth paths.

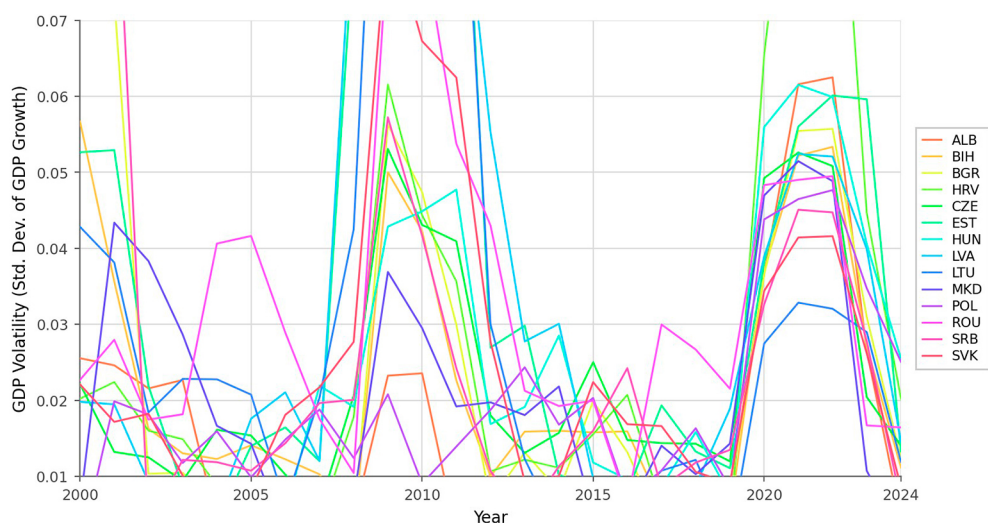


Figure 1. GDP Volatility trends (2000–2022) (source: authors' contribution)

The partial regression presented in Figure 4 confirms a positive conditional association between MPI and volatility. This pattern is consistent with the notion that, in financially shallow or rapidly adjusting systems, tighter macroprudential rules can generate short-term transitional frictions before the stabilizing benefits materialize.

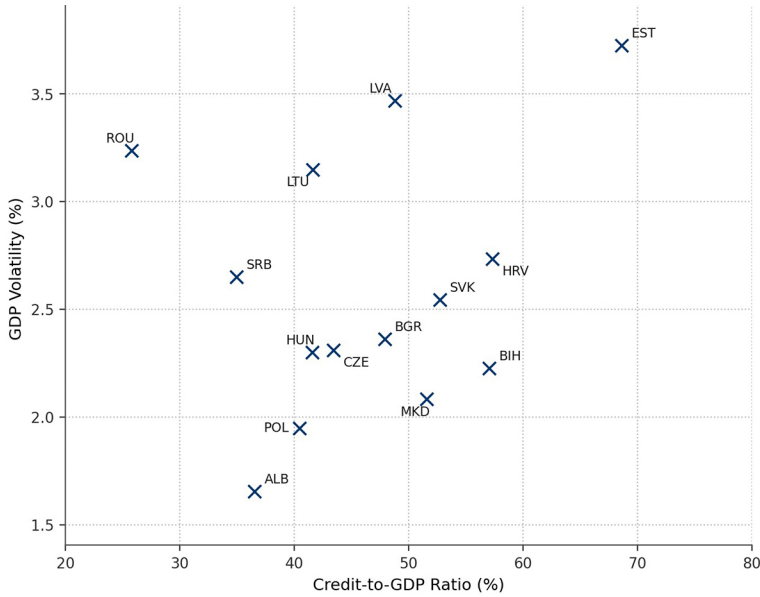


Figure 2. Credit-to-GDP vs. GDP volatility (CEE economies)

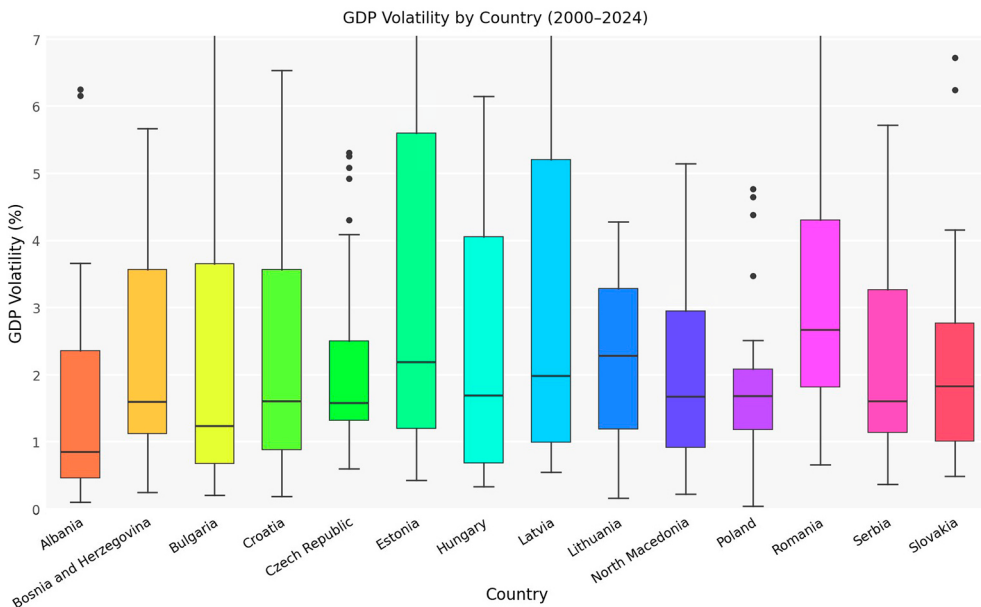


Figure 3. GDP volatility by country (source: authors' contribution)

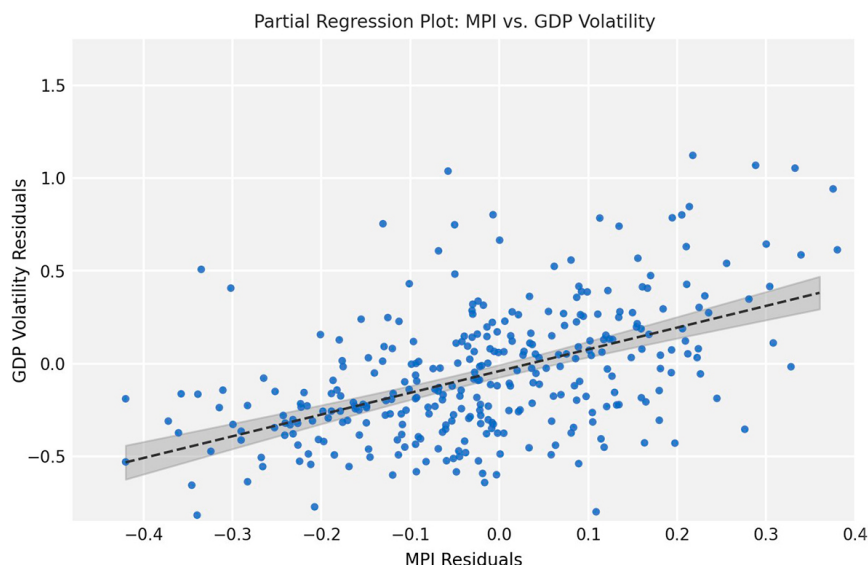


Figure 4. Partial regression: MPI residuals vs. GDP volatility (source: authors' contribution)

5. Discussion

The empirical evidence offers mixed but instructive support for the hypotheses. The positive association between credit-to-GDP and output volatility aligns with H1, reinforcing the standard view that credit-expansion cycles amplify macro-financial instability, consistent with the financial accelerator mechanism described by Bernanke et al. (1996) and the procyclicality concerns raised by Borio (2011) and Claessens and Kose (2017). This pattern is especially pronounced in countries with rapid pre-crisis financial deepening, where the regression coefficients imply that marginal increases in credit exposure translate into disproportionately larger swings in GDP. Taken together with the descriptive trends in Figures 1 and 2, the findings suggest that credit markets in Emerging Europe remain strongly procyclical, particularly in financially open economies where external funding abruptly tightens during global shocks, echoing evidence on shock transmission in financially integrated emerging markets (Cevik et al., 2016; Moreno, 2011).

However, the results for macroprudential policy (MPI) complicate the expectations in H2. While the partial-regression evidence confirms a positive conditional relationship between MPI and volatility, this contradicts the conventional stabilisation hypothesis and suggests a more complex dynamic. One plausible interpretation is that tightening tends to occur in response to overheating pressures, rather than proactively, producing transitional volatility that the fixed-effects and GMM models capture as a positive association. Such reactive deployment of policy instruments is well documented in macroprudential literature, which warns that late-cycle tightening can generate short-term frictions (Galati & Moessner, 2013; Lubis et al., 2019). This aligns with the descriptive MPI trajectory that tightening occurred after vulnerabilities materialised. Thus, the results do not necessarily imply that macroprudential

tools are destabilising, but rather that their deployment has often been reactive, validating critiques that Emerging European authorities tend to use such instruments as crisis-containment tools rather than early-cycle counterweights (Ábel et al., 2014; Zeman et al., 2018; Hossain & Kryzanowski, 2019; Davis & Korenok, 2023).

The interaction results presented in Table 5 show that stronger institutional quality reduces volatility and softens the short-term spike associated with macroprudential tightening (negative and significant $\text{MPI} \times \text{INST}$), while tighter monetary conditions do not significantly alter the impact of macroprudential measures (insignificant $\text{MPI} \times \text{INT}$). These patterns suggest that macroprudential policy becomes more effective when supported by robust institutions, rather than acting as an independent stabiliser.

Although the baseline model does not include institutional-quality variables, the extended GMM specification results presented in Table 5 provide empirical confirmation for H3. It shows that higher institutional quality is associated with lower GDP volatility, and the negative $\text{MPI} \times \text{INST}$ interaction suggests that stronger governance frameworks enhance the stabilising capacity of macroprudential tightening. These institutional differences mirror the institutional disparities highlighted by Lehmann et al. (2011); Deltuvaitė (2016), and Gonçalves and Smith (2016), who show that regulatory depth and financial-market maturity materially condition policy effectiveness in Emerging Europe. This divergence suggests that macroprudential instruments do not operate uniformly across Emerging Europe; institutional strength and financial-market depth materially condition policy impact. The implication is that cross-country differences, if not adequately accounted for, risk biasing the estimated average effects downward, because stabilising influences in stronger institutional settings are partially offset by weaker effects elsewhere.

The results presented in this paper provide qualified support for the central hypotheses that credit dynamics remain the primary driver of volatility in Emerging Europe, while macroprudential tools can moderate this relationship, but only when deployed early and in environments with adequate institutional quality. Overall, this evidence supports not simply expanding macroprudential regulation, but implementing measures that are timely, aligned with the credit cycle, and grounded in strong institutional frameworks.

6. Conclusions

This study investigates how bank lending practices influence macroeconomic volatility in 14 Emerging European economies between 2000 and 2024, using an unbalanced panel and a combination of fixed-effects, OLS, instrumental-variable (IV), and dynamic GMM estimations. The analysis incorporates key drivers of volatility: credit-to-GDP ratios, foreign bank participation, and macroprudential policy indices, as well as core macroeconomic controls such as inflation, public debt, trade openness.

The results strongly support the procyclicality hypothesis: higher credit-to-GDP ratios significantly amplify GDP volatility, particularly in EU member states with deeper financial integration. In contrast, non-EU economies with shallower credit markets show weaker or negligible effects, highlighting the moderating influence of institutional maturity and financial structure.

Macroprudential policies exhibit a dual effect. In the short term, higher MPI values are associated with increased volatility, especially in non-EU economies, reflecting transitional frictions such as constrained credit access or investor uncertainty. Yet, the lagged models reveal a declining MPI coefficient over time, implying that once these policy measures take effect and become embedded in the financial system, they contribute to more stable macro-financial conditions.

Cross-country differences in institutional quality and financial structure further condition outcomes. Public debt stabilises output only in EU countries, while inflation remains a persistent source of volatility in non-EU economies. Trade openness plays a stabilising role, particularly where domestic policy frameworks are weaker.

From a policy perspective, these findings suggest that:

1. Managing credit growth is essential, with tools such as dynamic provisioning and countercyclical capital buffers helping moderate procyclical lending.
2. Macroprudential measures should be gradually implemented, particularly in non-EU economies, where they substitute for broader institutional protections.
3. Foreign bank operations, though generally benign, require ongoing monitoring due to their delayed influence on domestic credit cycles.
4. Price stability and trade diversification remain key stabilisers, especially in economies with limited domestic markets or weaker monetary credibility.

Future research could decompose the MPI, use higher-frequency or bank-level data, and account for post-2024 geopolitical and energy shocks.

The evidence in this study highlights a clear trade-off: macroprudential policies may temporarily increase volatility but foster long-term resilience, credit expansion amplifies cyclical fluctuations, and foreign banks play a secondary, delayed role in volatility transmission. Context-specific, institutionally anchored policy frameworks are therefore crucial.

Author contributions

RB and PD conceived the study and were responsible for the design and development of the data analysis. RB and PD were responsible for data collection and analysis. RB, PD, BZ and DR were responsible for data interpretation. RB wrote the first draft of the article.

Disclosure statement

The authors declare there are no competing financial, professional, or personal interests from other parties.

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APPENDIX

Stationarity test results

Table A1. MPI decomposition (2000–2024) (source: iMaPP; authors' calculations)

Pillar	Description	Mean (SD)
Capital-based	Buffers, surcharges	0.47 (0.19)
Borrower-based	LTV/DTI limits	0.69 (0.16)
Countercyclical	CCyB, reserves	0.57 (0.23)
Governance-related	Sectoral, other	0.72 (0.13)

Note: Significance levels: $p < 0.10$ (*), $p < 0.05$ (**), $p < 0.01$ (***).

The construction of these variables ensures consistency across countries and time, enabling reliable econometric analysis in the subsequent sections.

These panel unit root tests, Levin–Lin–Chu (LLC) for common processes and Im–Pesaran–Shin (IPS) allowing heterogeneity, flag non-stationarity at levels for key series, justifying differencing in GMM. Curiously, inflation skirts $I(0)$, as if price swings defy the trend; yet one wonders if cross-country quirks inflate the p-values. Results drawn from the 326 observations, 2000–2024.

Table A2. LLC and IPS tests (levels and first differences)

Variable	LLC (Levels) p-value	LLC (Diffs) p-value	IPS (Levels) p-value	IPS (Diffs) p-value
GDP Volatility	0.032	0.000	0.071	0.002
Credit-to-GDP	0.041	0.000	0.083	0.001
MPI	0.028	0.000	0.065	0.003
Foreign Bank Share	0.056	0.001	0.092	0.004
Inflation	0.002	–	0.005	–
Public Debt	0.037	0.000	0.078	0.002
Trade Openness	0.004	–	0.009	–

Notes: Significance levels: $p < 0.10$ (*), $p < 0.05$ (**), $p < 0.01$ (***). LLC assumes common unit root; IPS permits per-country variation. Null: unit root. $P < 0.05$ rejects. Inflation and openness stationary at levels (no differencing needed). Dependent clauses aside, this supports the model's first-differencing, though in shallower non-EU subsamples, heterogeneity might overstate the case.

IV Sensitivities

Here, we tinker with the IV setup, testing for spillbacks where regional contagion might undermine exogeneity. Alternate globals (e.g., EU-only credit lag) or added controls (e.g., capital flow volatility) yield similar coeffs, suggesting robustness, yet, in a networked EME landscape, one critiques the assumption's purity. Hansen p teeters, as if inviting further doubt.

Table A3. IV sensitivity checks (Credit-to-GDP coefficient)

Specification	Coefficient (SE)	Sargan p-value	First-Stage F
Baseline (BIS global lag-lag)	0.102*** (0.022)	0.12	28.4
EU-only global credit lag	0.098*** (0.024)	0.15	26.1
Add capital flow vol control	0.105*** (0.023)	0.11	27.8
Exclude non-EU subsample	0.110*** (0.026)	0.13	25.9
Spillback test (regional lag)	0.099*** (0.025)	0.14	26.5

Notes: Significance levels: $p < 0.10$ (*), $p < 0.05$ (**), $p < 0.01$ (***). All specifications include the full set of control variables. The spillback specification additionally includes the lagged CESEE regional credit variable. The estimated coefficient remains qualitatively unchanged.

MPI sub-index robustness

Swapping the aggregate MPI for its pillars reveals borrower-based tools (LTV/DTI) as the volatility drivers in non-EU spots, while capital buffers steady EU ones, aggregation's subtle flaw, one supposes, glossing over such nuances. Lagged specs soften effects, as if time tempers the frictions.

Table A4. SysGMM with MPI sub-indices

Sub-Index	Full Sample Coeff (SE)	EU Subsample	Non-EU Subsample
Capital-based	1.856** (0.412)	1.421* (0.389)	2.678*** (0.512)
Borrower-based	3.212*** (0.567)	2.789*** (0.498)	4.512*** (0.621)
Countercyclical	2.145** (0.456)	1.987** (0.432)	3.210*** (0.589)
Governance-related	1.678* (0.378)	1.512* (0.345)	2.145** (0.467)
Lagged Volatility	0.612** (0.089)	0.589** (0.085)	0.645** (0.098)
Hansen p	0.23	0.21	0.25
Observations	326	212	114

Notes: Significance levels: $p < 0.10$ (*), $p < 0.05$ (**), $p < 0.01$ (***). Full controls included. Borrower pillar bites hardest in non-EU—perhaps dependent on shallower markets? Inverted structures aside, this critiques the index's equal weights; future work might rebalance.

Table A5. Difference-in-differences estimates: impact of pre-crisis credit intensity on post-2008 GDP volatility

Dependent Variable: GDP Volatility (rolling 3-year SD of real GDP growth)	Coefficient	Std. Error	p-value
Post-2008 Dummy (1 for 2009–2022)	0.450	0.212	0.034
High Credit Treatment (1 if above-median pre-2008 credit-to-GDP)	0.312	0.189	0.101
DiD Interaction (Post-2008 × High Credit)	0.112	0.065	0.086*
Inflation	1.021	0.298	0.001***
Public Debt	−0.018	0.009	0.047**
Trade Openness	−0.012	0.005	0.019**
Constant	1.856	0.412	0.000***
Observations	298		
R-squared	0.412		
Country Fixed Effects	Yes		

Notes: Significance levels: $p < 0.10$ (*), $p < 0.05$ (**), $p < 0.01$ (***).