

FINANCIAL CONTAGION AND FOREIGN BANKS: DOES THE VIENNA INITIATIVE NEED A REEVALUATION? EVIDENCE FROM THE TRANSITION REGION²

This study explores the impact of financial contagion on lending to the broader economy in the Transition region, specifically through the internal capital markets of global banks. Utilizing financial data from 100 Western European and Transition region parent banks and 212 subsidiaries, we find that after joint negative tail events in financial markets, foreign-owned banks in the Transition region reduce their lending to the real economy by more than domestic banks. Focusing on the Vienna Initiative of 2009, we find that banks that subsequently signed commitments to stop the payouts to their foreign parents reduced their lending growth the most. However, we do not find any evidence that these banks changed their lending behavior by increasing lending after signing the commitments. Therefore, even if the Vienna Initiative may have been effective in combating capital outflow, it could not induce an increase of lending to the real economy – one of its main goals. Overall, this study provides valuable insights for policymakers in effectively managing financial contagion and crisis transmission in the Transition region.

Keywords: Financial Contagion; Financial Crisis; Vienna Initiative; Global Banks; Internal Capital Markets; Contagion

JEL: C16; C61; G01; G21

1. Introduction

The economies of the Transition region³ have undergone significant growth in recent decades, largely attributed to financial globalization and the integration of their financial

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³ We define the Transition region as countries encompassed by European Bank For Reconstruction and Development's Transition Report that are financially integrated with Western markets and have sufficiently developed stock markets to facilitate the estimation of our financial contagion measures. The Transition region in this study encompasses Emerging Europe and Turkey (see, e.g., EBRD, 2010; and EBRD, 2024 for updated definitions of the Transition region).

systems with Western Europe (Friedrich, Schnabel, & Zettelmeyer 2013). This integration, while initially beneficial, revealed vulnerabilities during the 2008 financial crisis, exposing these markets to contagion from both proximate and distant sources (Dietz, Homonnay, & Shvakman, 2012). As bank lending is crucial for economic growth, understanding the mechanisms of financial shock transmission between Western Europe and the Transition Region is imperative for effective preventive measures and crisis-mitigation efforts.

Foreign bank subsidiaries in the Transition region have generally benefited local economies through enhanced stability, corporate governance, and financial intermediation. However, they face challenges during financial crises, requiring effective risk management (De Haas and Naaborg 2005; Badulescu & Morutan 2019). This study utilizes the corporate ownership structure of global commercial banks from Western Europe and the Transition region to analyze the lending of their subsidiaries in the Transition region.⁴

In particular, we undertake an in-depth analysis of the transmission of financial shocks between Western European and Transition region financial markets during the global financial crisis. We pay particular attention to how these shocks influence the real economy through the lending activities of global banks, given the substantial foreign ownership of banks operating in the Transition region (Ongena et al. 2015). Our primary goal is to examine how financial interconnectedness facilitated risk transmission during crisis periods, primarily through the internal capital markets of global banks.

The internal capital market within banking conglomerates is a critical concept in cross-border activities, allowing funds allocation for projects without ceding control to creditors and preventing strategic information leakage. Radev (2022b) introduces a novel contagion channel from Western Europe to the Transition economies, exploring the comovement of financial markets and how it transmits via the internal capital markets of global banks. Using a switching-copula approach, similar to Rodriguez (2007) and Radev (2021b), financial contagion is identified through an increase in tail dependence, measuring the probability of jointly positive or negative returns.

We apply this approach to test hypotheses of cross-border contagion during an exogenous crisis event for the Transition region: the Lehman Brothers' bankruptcy. Leveraging these shocks, we overcome endogeneity concerns and establish a robust causal relationship between financial contagion and bank lending, employing a difference-in-differences estimation.

In the empirical results section, we find that during crises, the occurrence of joint negative extreme tail events between Western and Transition region markets leads to a reduction in lending growth of Transition region banks. The reduction is exclusively driven by foreign-owned banks. Focusing on the Vienna Initiative of 2009, we find that foreign banks, which signed commitments to stop the payouts to their foreign parents, reduced their lending growth the most. However, we could not find any evidence that these banks changed their lending behaviour after signing the commitments. Therefore, even if the Vienna Initiative may have been effective in combating capital outflow, it could not prevent the reduction of lending to

⁴ We define global banks as banks with headquarters in Western Europe and the Transition region with multiple foreign subsidiaries in the former region.

the real economy. These results emphasize the need for more comprehensive analyses to capture the complexities of crisis transmission mechanisms.

Our paper contributes to various strands of literature, particularly addressing the cross-border transmission of shocks through the internal capital markets of global banks, as explored by scholars such as Peek and Rosengren (1997), De Haas and Naaborg (2005), Barth and Radev (2022), Radev (2021a, 2022a,b), and others. Existing research typically indicates positive effects of foreign subsidiaries of global banks on transition economies, including enhanced financial stability, corporate governance practices, risk management, profitability, and efficient allocation of financial resources. However, the flexibility of global banks in transferring funds within the group is acknowledged as a potential factor contributing to the spread of financial crises (see, e.g., De Haas and Naaborg 2005; Badulescu & Morutan 2019).

Empirical evidence underscores the role of the internal capital market of global banks in driving financial interconnectedness and serving as a channel for crisis transmission (see, e.g., Pelletier 2018; Radev 2021a; and Radev 2022a,b). Using Markov-Switching copulas, Radev (2021b) identifies increased dependence, particularly in lower tail dependence, between Western Europe and Transition region equity markets during the global financial crisis. Our study delves deeper into this question, utilizing the Lehman Brothers bankruptcy as an identification tool to establish causal links between financial crises in Western markets and the supply of bank lending in the Transition region.

Our contributions to the existing literature include furthering the research agenda on identifying and measuring financial contagion across markets, enhancing regulators' tools to analyze the effects of foreign shocks on the real economy through the banking systems in the Transition region, and contributing to the ongoing debate on the role of foreign-owned banks in host economies during times of crises.

The paper is organized as follows. Section 2 presents an overview of the dynamic switching copula methodology used to identify financial market contagion, as well as our empirical model and data. Section 3 presents our empirical results. Section 4 concludes.

2. Institutional Environment in Global Banking

2.1. Global Banks and Internal Capital Markets

When expanding internationally, banks must decide between using subsidiaries or branches, considering their distinct characteristics. Subsidiaries are legally independent entities within the host country, whereas branches are integral parts of the parent bank without legal independence (Cerutti et al., 2007). Branches tend to have lower operational costs and can assist in managing liquidity and risks, sharing the parent bank's losses during crises. However, they may still face restrictions on cash flow movements and differing taxation and regulatory environments (Cerutti et al., 2007).

De Haas and Naaborg (2005) conceptualize the internal capital market as a mechanism within banking groups for fund allocation among various entities. This system offers several advantages, such as enabling banks to independently finance projects, which helps retain

control over decision-making and minimizes information leakage about strategic plans. Additionally, centralized decision-making processes streamline the approval and rejection of funding requests, thereby enhancing overall operational flexibility. Gertner et al. (1994) emphasize the benefits of internal capital allocation, particularly regarding enhanced control rights at headquarters and improved asset transfer, which lead to more effective utilization of bank capital.

However, the internal capital market is not devoid of risks. Lamont (1997), Shin and Stulz (1998), and De Haas et al. (2005) warn that the interconnectedness among banking units, even across different locations, can introduce hidden risks. Shocks affecting one unit may reverberate throughout the entire group, potentially impacting overall performance. Shin and Stulz (1998) further explore the efficiency of internal capital markets, suggesting that affiliates with superior investment opportunities can yield higher profits, thereby enhancing the group's overall wealth. They advocate for capital allocation based on subsidiary-specific investment prospects, emphasizing the subsidiary's cash flow as a primary determinant of investment size, in alignment with Lamont's (1997) findings regarding the impact of cash flow on investment decisions. Consequently, subsidiary liquidity and other balance sheet characteristics are integrated into empirical models for a more comprehensive analysis.

Investigating the role of foreign subsidiaries within the parent bank's internal capital market presents additional research avenues. De Haas and Naaborg (2005) suggest that the parent bank's performance influences both the internal capital market and the loan supply of foreign subsidiaries. The performance and deposits on the parent bank's balance sheet determine the availability of funds for lending. Holod (2012) posits that various metrics, including asset, capital, deposit, and employment measures, may impact loan growth. Gambacorta (2008) highlights liquidity, capitalization, and relationship lending as determinants of short-term interest rates, noting that bank behaviour in price-setting influences loan supply. Ben-David et al. (2017) demonstrate the internal capital market's significance in affecting deposit rates, decoupling them from external market conditions, and underscore the interconnectedness of regions within the banking group's internal market, which influences the transmission of shocks.

2.2. The Vienna Initiative

The Vienna Initiative, formally known as the European Bank Coordination "Vienna" Initiative, was launched in January 2009 in response to the global financial crisis of 2008-2009 (see EBCI 2024). The primary goal was to ensure the stability of the financial systems in Central, Eastern, and Southeastern Europe (CESEE) by fostering cooperation among key stakeholders, including international financial institutions, national authorities, and major cross-border banking groups. The initiative aimed to prevent a banking crisis in CESEE by coordinating the actions of international banks, host country authorities, and international financial institutions. The objective was to ensure that banks would not withdraw en masse from these regions, which could have exacerbated financial instability. One of the main goals was to maintain the flow of credit to the real economy in CESEE countries, ensuring that businesses and households continued to have access to necessary financing. Additionally, the

initiative sought to support the banking systems in these countries by encouraging parent banks to recapitalize and maintain their exposure to their subsidiaries in the region.

Key stakeholders included international financial institutions like the European Bank for Reconstruction and Development (EBRD), the International Monetary Fund (IMF), the World Bank, and the European Investment Bank (EIB). National authorities, particularly central banks and financial regulators from both home and host countries were involved to ensure coherent regulatory responses. Large European banking groups with significant operations in the CESEE region were crucial participants, committing to maintain their exposures and support their subsidiaries. National authorities in host countries committed to providing the necessary regulatory and policy support to maintain financial stability, while home countries ensured that parent banks had the necessary backing. Regular monitoring and reporting mechanisms were established to track the commitments and actions of the participating banks and authorities, ensuring transparency and accountability.

The Vienna Initiative has fostered a long-term cooperative framework that continues to influence policy responses and banking practices in the CESEE region. Overall, the Vienna Initiative is seen as a successful example of international coordination and cooperation in response to a financial crisis, highlighting the importance of collective action in maintaining financial stability. Our study performs a re-evaluation of the Initiative based on newer and more comprehensive data and better causal identification techniques.

3. Methodology, Theoretical Prediction, Empirical Model and Data

3.1. Tail Dependence and Financial Contagion

The increasing international interconnectedness between financial markets poses significant challenges for policymakers and researchers, particularly concerning the potential negative consequences of financial contagion. This issue gained prominence after the Mexican and Russian crises in the 1990s, sparking a debate on how financial disruptions in one country can spread globally. Longin and Solnik (2001) observed that market dependence intensifies during downturns but not during upswings. Forbes and Rigobon (2002) introduced the term ‘financial contagion’ to describe a significant increase in market comovement following a negative event in a single market or region. Early studies on stock market comovement, such as those by Bertero and Mayer (1990) and King and Wadhwani (1999), found that correlations between markets tend to rise during financial crises. However, subsequent research by Boyer et al. (1999) and Forbes and Rigobon (2002) challenged the notion of systematic shifts in correlation when accounting for conditional heteroskedasticity.

In this context, we argue that tail dependence is a valuable tool for measuring dependencies between extreme negative stock returns or other adverse events in financial markets. Tail dependence refers to the increased likelihood of simultaneous extreme market movements, especially during severe downturns. This concept captures the joint behaviour of returns in the tails of their distribution, providing insights that traditional correlation measures may miss.

Tail dependence can be categorized into two types: *upper tail dependence* and *lower tail dependence*. Upper tail dependence measures the probability that extreme positive returns in one market will coincide with extreme positive returns in another market. In contrast, lower tail dependence assesses the likelihood that extreme negative returns in one market will align with extreme negative returns in another market. These measures are crucial for understanding financial contagion as they highlight the risk of simultaneous extreme gains or losses across different markets, which can be particularly impactful during financial stress.

While traditional correlation measures offer some insight into market relationships, they often fail to capture the dynamics of extreme market conditions. Tail dependence provides a more comprehensive tool for understanding and managing the risks associated with financial contagion, particularly during periods of severe market stress.

The Global Financial Crisis of 2008-2009 exemplified the importance of measuring *lower tail dependence*, as simultaneous extreme downturns in various markets underscored the need for such analysis. Therefore, in our subsequent analysis, we pay particular attention to the effect of lower tail dependence on bank lending in the Transition region.

3.2. Methodology for Identifying Financial Contagion: A Switching Copula Approach

To address the research question in this paper – whether financial contagion between stock markets influences the transmission of shocks by foreign-owned banks, we draw on Rodriguez (2007), Radev (2021b), and Radev (2022b), who employ a switching copula approach to capture shifts in dependence between Western European and Transition region markets during volatile periods. Radev (2021b) and Radev (2022b) advocate for the Symmetrized Joe-Clayton Copula, chosen to model pairwise dependence structures between Western Europe's financial market and those of individual transition countries from 2006 to 2015. This copula offers consistent estimates of lower and upper tail dependence, crucial for understanding joint negative and positive return probabilities.

While Rodriguez (2007) and Radev (2021b) calculate static measures of tail dependence over full sample periods, capturing consistent estimates but lacking temporal changes, Radev (2022b) advances this by computing dynamic tail dependence using a rolling 250-day window, aligning with our approach to use panel banking and macroeconomic data. Section 3.5. presents data descriptions and figures illustrating tail dependence dynamics in selected markets. For detailed definitions and descriptions of the switching copula approach, readers are referred to Radev (2022b).

3.3. Hypothesis and Empirical Model

In this paper, we aim to answer the question of whether foreign-owned banks reduced lending asymmetrically more than domestic banks through their more direct connection to Western markets, and thus contributing to the transmission of the crisis from Western Europe to the Transition region. To this end, we test the following main hypothesis:

Hypothesis 1: *The drop in lending during crises is larger for foreign-owned banks the higher the comovement between domestic and Western stock markets.*

Next, we would like to evaluate the impact of the Vienna Initiative of 2009 on our sample of subsidiary banks. We expect that banks that signed commitment letters performed worse than other foreign banks and hence were the most susceptible to capital flight. Therefore, our next hypothesis reads.

Hypothesis 2: *The drop in lending during crises is larger for subsidiaries of parents identified by the Vienna Initiative.*

In the final step of our evaluation, we would like to test whether the banks that took part in the Vienna Initiative increased their lending after joining the Initiative:

Hypothesis 3: *Subsidiaries of parents taking part in the Vienna Initiative increase their lending after joining the Vienna Initiative.*

To test these hypotheses, we use different variations of the following general difference-in-difference-in-differences (DiDiD) model:

$$\begin{aligned}
 \text{growth}(\text{Loans})_{i,j,k,t} = & +\alpha_1 \cdot \text{Foreign}_i \\
 & +\alpha_2 \cdot \text{Lehman}_t \\
 & +\alpha_3 \cdot \text{Measure}_{k,t} \\
 & +\alpha_4 \cdot \text{Lehman}_t \cdot \text{Foreign}_i \\
 & +\alpha_5 \cdot \text{Measure}_{k,t} \cdot \text{Foreign}_i \\
 & +\alpha_6 \cdot \text{Measure}_{k,t} \cdot \text{Lehman}_t \\
 & +\alpha_7 \cdot \text{Measure}_{k,t} \cdot \text{Lehman}_t \cdot \text{Foreign}_i \\
 & +\alpha_8 \cdot \text{SubsidiaryControls}_{i,j,k,t-1} \\
 & +\alpha_9 \cdot \text{ParentVariables}_{i,j,k,t} \\
 & +\alpha_{10} \cdot \text{MacroVariables}_{j,t} \\
 & +\epsilon_{i,j,k,t},
 \end{aligned} \tag{1}$$

where $\text{growth}(\text{Loans})_{i,j,k,t}$ is the loan growth of subsidiary i in country k of parent j at time t ; Lehman_t takes the value of 1 for the period after the announcement of Lehman Brother's bankruptcy on September 15, 2008, and 0 otherwise; Foreign_i takes the value of 1 if subsidiary bank i is foreign and 0 otherwise; $\text{Measure}_{j,t}$ takes the value of 1 if a tail dependence measure between the Western stock market and the stock market of country j is above its median for the sample of Transition countries and 0 otherwise; $\text{Measure}_{j,t} \cdot \text{Lehman}_t \cdot \text{Foreign}_i$ is an interaction variable between the Lehman dummy, the foreign bank indicator, and a determinant of political contagion. $\text{SubsidiaryControls}_{i,j,k,t-1}$ is a vector of individual bank-related variables for subsidiary i in country k of parent j at time $t-1$; $\text{ParentVariables}_{i,j,k,t-1}$ is a vector of individual bank-related variables for parent j of subsidiary i in country k at time $t-1$; $\text{MacroVariables}_{j,t}$ is a vector of macroeconomic variables for the economic strength and institutional environment of country k at time t .

Further, we winsorize our variables at the 1st and the 99th percentile values of each variable to avoid extreme outliers that may affect our results. All standard errors are clustered at the parent bank level.

3.4. Variables

In our empirical investigation, we follow the methodology of Peek and Rosengren (1997), Radev (2022b), and Barth and Radev (2022), who examine the determinants of loan growth. Our model integrates lagged variables from both parent and subsidiary banks, along with macroeconomic factors. For a detailed understanding of the variables employed, please refer to Table A1 in the Appendix. Drawing on empirical literature, we incorporate micro and macro factors recognized as pivotal drivers of credit growth during regular periods. Definitions and descriptive statistics for all variables are available in Tables A1, A4a, A4b and A4c in the Appendix.

3.5. Data Descriptives

The dataset in this study is a composite from various sources. Bank-level data spanning March 2006 to March 2015 are sourced from Bankscope. For tail dependence calculations, daily and monthly historical data for 13 international stock markets are collected from Datastream. Macroeconomic data is sourced from Eurostat, EBRD's Banking Survey, the World Bank's World Development Indicators, and the International Monetary Fund's World Economic Outlook.

This dataset encompasses information about international commercial banks in Western Europe and the Transition region, along with their subsidiaries in specific countries. The data spans subsidiaries in Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia, and Turkey. The data collection effort provides insights into 100 parent banks, of which 62 are from Western Europe and 38 from the Transition region. Overall, the dataset includes 212 subsidiaries, with 157 affiliated with Western European banks and 55 with Transition region banks. Refer to Tables A2 and A3 in the Appendix for a summary of the final sample of parent banks.⁵

We apply a number of adjustments to reconcile the different frequencies of the data in our analysis. Daily tail dependence data are aggregated to the monthly level, preserving the majority of variation. The annual frequency of our balance sheet data is increased to the monthly level through linear interpolation, following Barth and Schnabel (2013). This results in 8625 monthly observations for regression. To ensure comparability, all level data are converted to U.S. dollars from the original country currencies, as U.S. dollars are the common exchange rate in Bankscope. Daily exchange rate data are obtained from Datastream.

We consider the Global Financial Crisis as a significant event for regime shifts in our data and apply the following timeline for the pre-, mid- and post-crisis periods:

- The pre-Lehman Brothers Crisis from March 2006 to August 2008;
- The Lehman Brothers Crisis from September 2008 to April 2009;
- For the evaluation of the effect of the Vienna Initiative, we consider the period from May 2009 to April 2010.

⁵ Note that our regression analysis is at the subsidiary level. Due to journal article size restrictions, we do not present the full list of subsidiaries. The list of subsidiary banks that are subject of the regression analysis is available upon request.

We base the pivotal moments in our timeline based on official announcements. In September 2008, Lehman Brothers, the fourth-largest US bank, filed for bankruptcy amid the subprime crisis, triggering the most significant financial crisis in recent history. This crisis persisted in Western Europe until early to mid-2009. The cutoff date for the evaluation of the effect of the Vienna Initiative was chosen to avoid interferences from the subsequent Sovereign Debt Crisis in the euro area that commenced in May 2010 with riots in Greece against the First Bailout Package by the Troika (European Central Bank, International Monetary Fund and the European Commission) (Beck et al. 2020).

Tail Dependence Descriptives

Tail dependence reflects the extreme-value dependence between the movements of the WE stock market and each stock market of the following countries: Bulgaria, the Czech Republic, Estonia, Croatia, Lithuania, Latvia, Poland, Romania, Slovenia, Slovakia and Turkey. The Western Europe stock market is represented by the Stoxx600 index.

Table 1 summarizes the averaged results of the switching copula estimation of tail-dependence coefficients for each country. The superscripts low and high indicate values for periods of high volatility and low volatility, respectively. The periods of high volatility are estimated using a bivariate Switching ARCH model as in Radev (2022a,b).

Poland has the highest *average* value of UTD (Low Vol) and LTD (Low Vol) equal to 0.3458 and 0.4580 respectively. The highest UTD (High Vol) and the highest LTD (High Vol) belong to Latvia (0.9089 and 0.8633 respectively).

Table 1. Tail dependence results, switching SJC copula model: individual markets

Markets	Bulgaria	Croatia	Czech	Estonia	Hungary	Latvia
τ^U (Low Vol)	0.0004*** (0.000)	0.1525*** (0.021)	0.2783*** (0.034)	0.0580** (0.024)		0.2954*** (0.016) 0.0125 (0.810)
τ^U (High Vol)	0.0000*** (0.000)	0.0006*** (0.000)	0.4791*** (0.000)	0.0549 (0.032)		0.3223*** (0.025) 0.9089 (2.770)
τ^L (Low Vol)	0.1129 (0.080)	0.2510*** (0.003)	0.4119*** (0.046)	0.1687*** (0.024)		0.3467*** (0.044) 0.0773 (0.403)
τ^L (High Vol)	0.1109 (0.068)	0.2761*** (0.021)	0.5249*** (0.000)	0.2103*** (0.004)		0.4911*** (0.022) 0.8633 (2.839)
Markets	Lithuania	Poland	Romania	Slovakia	Slovenia	Turkey
τ^U (Low Vol)	0.0378 (0.022)	0.3458*** (0.013)	0.2203*** (0.015)	0.0000 (1.020)	0.0244*** (0.000)	0.2718*** (0.025)
τ^U (High Vol)	0.0000 (0.398)	0.4308*** (0.061)	0.0314 (0.072)	0.0001 (0.776)	0.0001*** (0.000)	0.2916*** (0.057)
τ^L (Low Vol)	0.1760*** (0.015)	0.4580*** (0.014)	0.2067*** (0.027)	0.0000 (0.922)	0.0554*** (0.000)	0.3873*** (0.040)
τ^L (High Vol)	0.2665 (10.224)	0.5720*** (0.015)	0.3248*** (0.061)	0.0010 (3.429)	0.1699*** (0.000)	0.3714*** (0.018)

This table presents the tail dependence estimates of a switching symmetrized Joe-Clayton (SJC) copula between Western Europe (WE) and the individual market in the Transition region. Time period: 01.01.2005 to 30.04.2009.

Countries: as shown in the table. Standard errors for the individual tail dependence coefficients in parentheses.

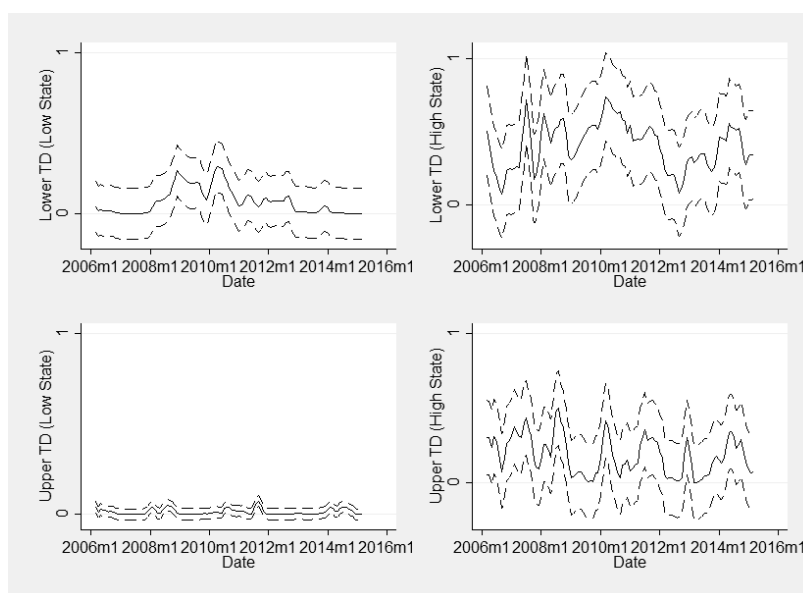
*Statistical significance at the 1, 5 and 10 per cent levels is denoted by ***, **, and *, respectively.*

Figures 1 and 2 depict the tail dependence relationships between the Stoxx600 index and selected Transition region stock markets, specifically Bulgaria and Poland. Both countries exhibit different behaviour of lower tail dependence across volatility states. Poland consistently displays statistically and economically significant lower tail dependence throughout the sample period, indicating a substantial probability of simultaneous negative returns with Western European (WE) markets, reaching approximately 45%, even in periods of relative calm. Bulgaria displays a markedly different behaviour, showing no statistically significant comovement of negative returns with Western markets when the latter is in a high volatility state. During high-volatility states, lower tail dependence becomes statistically significant in both countries and consistently surpasses LTD in low-volatility states, with the largest spikes in 2008 and the first half of 2010, aligning with the collapses of Bear Stearns, Lehman Brothers, and the initial Greek bailout. Dispersion of coefficients is higher during high-volatility states, indicating a less stable relationship with WE markets.

Regarding upper tail dependence (joint positive returns), the presented countries show lower and less stable values during low-volatility states, typically lacking statistical significance at the 5 per cent level. However, in high-volatility states, upper tail dependence typically becomes highly significant for both markets, suggesting increased propagation of positive news across markets during crisis periods.

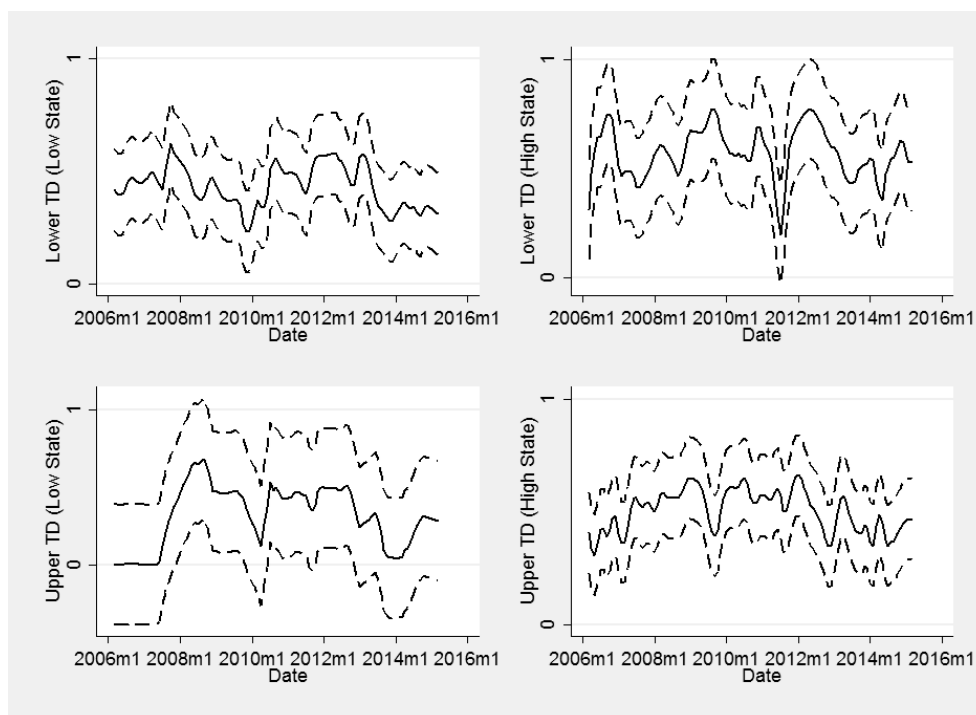
Overall, there is a noticeable rise in lower tail dependence across the region during high-volatility states, indicating an amplified occurrence of joint negative returns during turmoil. Notably, the Global Financial Crisis significantly elevates dependence levels across the region.

Figure 1. Tail Dependence. Markets: Stoxx600 – Bulgaria



Dashed lines – 95th Percent error band. Sample period: March 2006 to March 2015. Source: Radev (2022b) and own calculations.

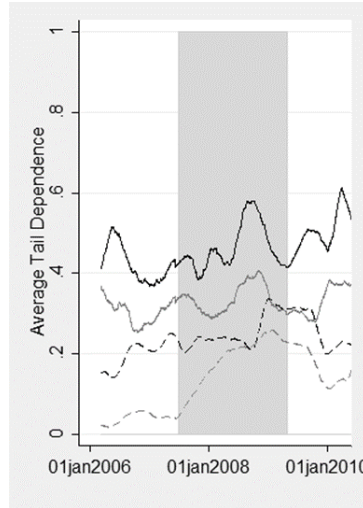
Figure 2. Tail Dependence. Markets: Stoxx600 – Poland



Dashed lines – 95th Percent error band. Sample period: March 2006 to March 2015. Source: Radev (2022b) and own calculations.

Figure 3 depicts the dynamics of averaged values for our four measures of tail dependence, captured at the daily frequency. The solid black line represents average lower tail dependence (LTD) during high-volatility states, the solid grey line corresponds to average upper tail dependence (UTD) during high-volatility states, the dashed black line represents average LTD during low-volatility states, and the dashed grey line depicts average UTD during low-volatility states. Grey shading indicates the crisis period. Lower tail dependence consistently surpasses upper tail dependence within their respective volatility states, with both measures amplified during high-volatility periods.

Figure 3. Average Tail Dependence (Daily). Markets: Stoxx600 – Transition Economies



Solid black line – average LTD (high volatility state). Solid grey line – average UTD (high volatility state).
Dashed black line – average LTD (low volatility state). Dashed grey line – average UTD (low volatility state).
Grey areas – crisis periods. Sample period: March 2006 to April 2010.
Source: Radev (2022b) and own calculations.

Country Characteristics and Balance Sheet Data

Tables A4a, A4b, and A4c in the Appendix provide descriptive statistics for the variables in our regression analysis. Table A4a shows that foreign subsidiaries generally have lower capitalization, higher risk, and lower liquidity than their parent banks. Host countries display positive GDP growth, with varied inflation rates and trade levels. The rule of law index averages 0.39, and foreign ownership in the matched panel sample ranges from 27.4% to 93%. In Table A4b, we see that domestic subsidiaries tend to have more favourable characteristics than their parent banks, including profitability, liquidity and capitalization. Table A4c shows that foreign subsidiaries of Vienna Initiative banks have much worse characteristics not only compared to their parents but also to the average foreign subsidiary in the sample (see Table A4c).

4. Empirical Results

4.1. Baseline Results

In Table 2, we present our baseline regression results for the period around the Global Financial Crisis. The interpretation of the results is as follows. Each column represents results for each version of tail dependence (lower and higher tail dependence) for each volatility state in financial markets (high and low volatility). Lower tail dependence is the probability of simultaneous occurrence of a negative return in the national stock market (represented by

its respective stock index) with a negative return in the Western stock market represented by Stoxx600. Upper tail dependence is the probability of simultaneous occurrence of a positive return in the national stock market with a positive return in the Western stock market.

Table 2. Baseline regressions: Lehman Brothers Crisis

Measure	Lehman Brothers Crisis			
	τ^L (high)	τ^L (low)	τ^U (high)	τ^U (low)
	(1)	(2)	(3)	(4)
Lehman	-0.0924 (0.141)	-0.1190 (0.128)	-0.0628 (0.402)	-0.0966 (0.262)
Measure t-1	-0.1539** (0.014)	0.0964* (0.098)	0.0470 (0.352)	0.0161 (0.832)
Measure t-1 * Lehman	0.0958 (0.160)	0.0413 (0.714)	-0.0218 (0.795)	0.1108 (0.159)
SubsidiarySize t-1	-0.0264 (0.238)	-0.0274 (0.217)	-0.0251 (0.262)	-0.0252 (0.259)
SubsidiaryProfit t-1	0.2646 (0.774)	0.1878 (0.838)	0.2855 (0.760)	0.2547 (0.786)
SubsidiaryCap t-1	0.5854 (0.317)	0.5789 (0.326)	0.6016 (0.311)	0.6213 (0.298)
SubsidiaryLiq t-1	0.1166 (0.550)	0.1193 (0.545)	0.1056 (0.589)	0.0973 (0.618)
Subs.IntGenFunds t-1	-0.1901 (0.206)	-0.1891 (0.215)	-0.1881 (0.219)	-0.1885 (0.218)
ParentSize t-1	0.0000 (1.000)	-0.0006 (0.978)	-0.0003 (0.987)	0.0004 (0.984)
ParentProfit t-1	0.5772 (0.402)	0.4747 (0.469)	0.5751 (0.405)	0.5833 (0.405)
ParentRisk t-1	-1.1240 (0.514)	-1.3764 (0.413)	-1.2881 (0.468)	-1.3326 (0.454)
ParentCap t-1	-0.0916 (0.774)	-0.1117 (0.724)	-0.0976 (0.763)	-0.0913 (0.779)
ParentLiq t-1	-0.2939 (0.168)	-0.2902 (0.171)	-0.3047 (0.158)	-0.3016 (0.160)
Par.IntGenFunds t-1	-0.0041 (0.925)	-0.0052 (0.906)	-0.0062 (0.888)	-0.0079 (0.857)
GDPGrowth t-1	0.0432*** (0.000)	0.0553*** (0.000)	0.0465*** (0.000)	0.0488*** (0.000)
Inflation t-1	0.0015 (0.870)	0.0073 (0.394)	0.0043 (0.611)	0.0048 (0.575)
TradeOpen t-1	-0.0008 (0.594)	0.0002 (0.879)	-0.0003 (0.818)	-0.0002 (0.916)
ForBankOwn t-1	0.1154 (0.556)	0.0516 (0.792)	0.0894 (0.650)	0.0624 (0.759)
FinDev	0.0013 (0.618)	0.0038 (0.169)	0.0018 (0.528)	0.0018 (0.532)
RuleofLaw t-1	-0.0021 (0.981)	-0.1550* (0.053)	-0.0630 (0.443)	-0.0672 (0.464)
Observations	5467	5467	5467	5467
R ²	0.1359	0.1410	0.1302	0.1303
Adjusted R ²	0.1327	0.1378	0.1270	0.1271

*The dependent variable is the Loan growth rate. The numbers in parentheses are p-values. Standard errors are clustered at the parent level. Statistical significance at the 1%, 5% and 10% levels is denoted by ***, **, and *, respectively. Sample period: March 2006 to April 2009.*

The regression results reveal that, before Lehman, banks in countries with a higher probability of joint *negative* returns with Western Europe (i.e., above-median lower tail dependence) had lower lending growth in periods of high volatility in financial markets and positive relative loan growth in periods with low market volatility (second row of coefficients Columns (1) vs (2)). The effect of a higher likelihood of positive joint returns (i.e., upper tail dependence) is insignificant in both low and high-volatility periods. After Lehman, we do not observe a systematic difference in loan growth in relation to tail dependence.

To analyse the economic significance of the results, we can use the unconditional means below and above the median of the respective measure. For instance, the below-median mean of lower tail dependence in high volatility state is 0.42 (i.e., 42 per cent probability of joint occurrence). The respective above-median mean is 0.61, yielding a difference of approximately 0.20 (or 20 percentage points). The respective differential for lower tail dependence in a low-volatility state is 0.30. The numbers for the differentials for upper tail dependence are 0.30 for high-volatility states and 0.35 for low-volatility states. Therefore, the result in Column (1) of Table 2 means that before Lehman, a realistic increase of 0.20 (or 20 percentage points) of lower tail dependence in high volatility periods leads to a drop in lending by 3.8 percentage points. Column (2) shows that in low-volatility periods, there is an increase in lending of about 2.7 percentage points (if we use the differential of 0.30 between the means above and below the median of that indicator).

The overall results show that there seems to be a link between the joint fluctuation of transition region markets with Western markets and the lending of Transition region banks. However, this difference is statistically significant only before the default of Lehman Brothers.

4.2. Do Foreign Banks Import Crises to Transition Economies?

In this section of our study, we aim to address the question of whether foreign subsidiaries were a conduit for the transmission of shocks in Transition economies due to financial contagion. The high foreign ownership of banks in the region has often been suspected of importing crises and exacerbating their impact.

4.2.1. Foreign Banks: Triple Differences Estimation

To explore this, we refer to Table 3, where we employ triple interactions involving whether the subsidiary is owned by a foreign parent or not. We observe that before the Global Financial Crisis, domestic banks had higher levels of lending growth than foreign banks when there was a higher probability of joint negative returns with Western markets and the volatility on the markets was low (the coefficients on Row 2 versus these on Row 6 in Column (2)). This also occurs when there is a higher probability of joint positive events and high market volatility (Columns (3)). Overall, that means that before the Global Financial Crisis, domestic banks were less responsive to foreign stock market fluctuations and managed to cushion the real economy from the drop in lending of foreign-owned banks in volatile periods.

Table 3. Lehman Brothers Crisis and Foreign Banks

Measure	Lehman Brothers Crisis			
	τ^L (high)	τ^L (low)	τ^U (high)	τ^U (low)
	(1)	(2)	(3)	(4)
Lehman	-0.0884 (0.441)	-0.0686 (0.581)	-0.0266 (0.806)	-0.1577 (0.295)
Measure t-1	-0.1750 (0.299)	0.2645** (0.014)	0.2049** (0.034)	0.2256 (0.268)
Foreign	-0.0860 (0.538)	0.0601 (0.646)	0.0007 (0.995)	-0.0521 (0.670)
Measure t-1 *Lehman	0.1331 (0.444)	0.0370 (0.749)	-0.1303 (0.408)	-0.0534 (0.845)
Lehman*Foreign	-0.0144 (0.906)	-0.0650 (0.627)	-0.0544 (0.670)	0.0578 (0.724)
Measure t-1 *Foreign	0.0320 (0.857)	-0.2473* (0.053)	-0.2368** (0.035)	-0.2809 (0.199)
Measure t-1 *Lehman*Foreign	-0.0555 (0.757)	0.0980 (0.475)	0.1618 (0.369)	0.1430 (0.626)
SubsidiarySize t-1	-0.0260 (0.248)	-0.0281 (0.206)	-0.0244 (0.275)	-0.0254 (0.253)
SubsidiaryProfit t-1	0.2010 (0.822)	0.0708 (0.935)	0.1967 (0.824)	0.1994 (0.822)
SubsidiaryCap t-1	0.5884 (0.323)	0.6019 (0.309)	0.6080 (0.305)	0.6197 (0.300)
SubsidiaryLiq t-1	0.1063 (0.591)	0.1021 (0.612)	0.0999 (0.613)	0.0876 (0.658)
Subs.IntGenFunds t-1	-0.1866 (0.211)	-0.1851 (0.220)	-0.1842 (0.222)	-0.1847 (0.222)
ParentSize t-1	0.0119 (0.612)	0.0062 (0.792)	0.0094 (0.695)	0.0110 (0.640)
ParentProfit t-1	0.5138 (0.409)	0.5349 (0.386)	0.5662 (0.365)	0.5274 (0.413)
ParentRisk t-1	-1.6008 (0.388)	-1.9387 (0.291)	-1.7719 (0.347)	-1.8063 (0.346)
ParentCap t-1	-0.0277 (0.933)	-0.1162 (0.722)	-0.0662 (0.842)	-0.0416 (0.901)
ParentLiq t-1	-0.2900 (0.166)	-0.2489 (0.246)	-0.2817 (0.184)	-0.2807 (0.190)
Par.IntGenFunds t-1	-0.0011 (0.979)	-0.0031 (0.942)	-0.0018 (0.968)	-0.0040 (0.926)
GDPGrowth t-1	0.0436*** (0.000)	0.0544*** (0.000)	0.0465*** (0.000)	0.0493*** (0.000)
Inflation t-1	0.0009 (0.919)	0.0066 (0.441)	0.0029 (0.740)	0.0035 (0.681)
TradeOpen t-1	-0.0007 (0.662)	0.0004 (0.805)	-0.0003 (0.853)	0.0001 (0.961)
ForBankOwn t-1	0.1432 (0.484)	0.0692 (0.728)	0.1172 (0.564)	0.0788 (0.707)
FinDev	0.0020 (0.482)	0.0037 (0.173)	0.0022 (0.428)	0.0022 (0.439)
RuleofLaw t-1	-0.0253 (0.775)	-0.1496* (0.056)	-0.0757 (0.348)	-0.0892 (0.322)
Observations	5467	5467	5467	5467
R ²	0.1392	0.1483	0.1366	0.1370
Adjusted R ²	0.1354	0.1446	0.1328	0.1332

*The dependent variable is the Loan growth rate. The numbers in parentheses are p-values. Standard errors are clustered at the parent level. Statistical significance at the 1%, 5% and 10% levels is denoted by ***, **, and *, respectively. Sample period: March 2006 to April 2009.*

After the Lehman Brothers shock, we do not observe a statistically significant change in lending policy by either group. This also means that foreign banks did not contribute to an additional drop in lending during the Global Financial Crisis.

One possible explanation for the slower growth of foreign-owned banks before the crisis is that they are typically the largest banks in the respective country, and therefore – more mature organizations with a larger market share (Cull et al., 2017). However, we control for bank size in our regressions, so our results are robust to this alternative explanation.

4.2.2. Vienna Initiative: Countries

We proceed with a deeper exploration of the differential impact of domestic and foreign banks on lending by evaluating the effect of the Vienna Initiative (VI), championed by the European Bank for Reconstruction and Development in 2009 (EBCI, 2023). This initiative aimed to convince foreign banks to maintain their investments in the region and avoid withdrawing funds. The positive impact of this initiative could have contributed to foreign banks being able to continue their lending activities at a faster pace during the Global Financial Crisis, effectively supporting the real economy.

Hence, we expect that among foreign-owned banks in the Transition region, the ones that are part of VI have decreased their lending by less (or increased their lending by more) than non-VI foreign-owned banks.

For completeness, we start by evaluating the impact of foreign banks in countries in our sample that did not participate in VI (i.e., Bulgaria, Croatia, Czech Republic, Estonia, Lithuania, Poland, Slovakia, Slovenia and Turkey) in Table 4 and compare it to these that participated in the Vienna Initiative (i.e., Romania, Hungary and Latvia) in Table 5.

The results for non-VI countries in Table 4 mimic these from Table 3: Before Lehman, any increase in growth by domestic banks was countered by a slower growth in lending by foreign-owned banks.

Table 5 paints a very different picture for VI countries. Foreign banks in Vienna Initiative countries drop their lending growth by 15 percentage points after Lehman in periods of negative comovement with Western markets (Row (7), Column (2) in Table 5). Furthermore, the explanatory power of the regressions almost triples and a number of control variables gain in significance. At the bank level, these are the lagged liquidity levels of subsidiaries and parents. At the macro level, the Rule of Law prominently becomes significant across all specifications, indicating either a maturity of markets with high institutional standards or an easier withdrawal of funds across borders due to better protection of property rights (see, e.g., Ojah et al. 2010).

Table 4. Lehman Brothers Crisis and Foreign Banks in Non-Vienna Initiative Countries

Measure	Lehman Brothers Crisis			
	τ^L (high)	τ^L (low)	τ^U (high)	τ^U (low)
	(1)	(2)	(3)	(4)
Lehman	-0.0500 (0.689)	-0.0611 (0.663)	-0.2027 (0.138)	-0.2402 (0.159)
Measure t-1	-0.0411 (0.847)	0.2803** (0.024)	0.1570* (0.098)	0.1794 (0.373)
Foreign	-0.0780 (0.605)	0.0619 (0.696)	-0.0313 (0.823)	-0.0805 (0.582)
Measure t-1 *Lehman	0.0147 (0.949)	0.0191 (0.881)	0.1169 (0.527)	0.1071 (0.713)
Lehman*Foreign	-0.0653 (0.622)	-0.1465 (0.344)	0.0248 (0.867)	0.0471 (0.791)
Measure t-1 *Foreign	-0.0879 (0.698)	-0.3023** (0.040)	-0.2184* (0.057)	-0.2513 (0.261)
Measure t-1 *Lehman*Foreign	0.0713 (0.763)	0.2121 (0.156)	0.0524 (0.795)	0.1099 (0.715)
Subsidiary Controls	Yes	Yes	Yes	Yes
Parent Controls	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes
Observations	4280	4280	4280	4280
R ²	0.1392	0.1483	0.1366	0.1370
Adjusted R ²	0.1354	0.1446	0.1328	0.1332

The dependent variable is the Loan growth rate. The numbers in parentheses are p-values. Standard errors are clustered at the parent level. Statistical significance at the 1%, 5% and 10% levels is denoted by ***, **, and *, respectively. Sample period: March 2006 to April 2009.

Table 5. Lehman Brothers Crisis and Foreign Banks in Vienna Initiative Countries

Measure	Lehman Brothers Crisis			
	τ^L (high)	τ^L (low)	τ^U (high)	τ^U (low)
	(1)	(2)	(3)	(4)
Lehman	0.0356 (0.727)	0.0012 (0.988)	0.0531 (0.636)	0.0440 (0.747)
Measure t-1	0.0108 (0.885)	0.1576 (0.187)	0.0793 (0.195)	0.0286 (0.876)
Foreign	0.1696 (0.311)	0.1533 (0.357)	0.1060 (0.463)	0.1176 (0.416)
Measure t-1 *Lehman	0.1507 (0.165)	0.1176 (0.515)	-0.1749* (0.084)	0.0000 (.)
Lehman*Foreign	-0.1610 (0.231)	0.0146 (0.881)	-0.1948 (0.166)	0.0114 (0.954)
Measure t-1 *Foreign	-0.0868 (0.431)	-0.0712 (0.653)	0.0028 (0.973)	-0.2970 (0.268)
Measure t-1 *Lehman*Foreign	-0.1712 (0.198)	-0.4329* (0.063)	-0.1053 (0.322)	0.0000 (.)
Subsidiary Controls	Yes	Yes	Yes	Yes
Parent Controls	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes
Observations	1187	1187	1187	1187
R ²	0.3635	0.3853	0.3667	0.3664
Adjusted R ²	0.3503	0.3726	0.3536	0.3545

The dependent variable is the Loan growth rate. The numbers in parentheses are p-values. Standard errors are clustered at the parent level. Statistical significance at the 1%, 5% and 10% levels is denoted by ***, **, and *, respectively. Sample period: March 2006 to April 2009.

4.2.3. Vienna Initiative: Banks

Next, we dive deeper into the lending behaviour of banks in Vienna Initiative countries. These countries were identified by the European Bank for Reconstruction and Development as having the highest probability of foreign capital flight.

To this end, we will examine the behaviour of both domestic (Table 7) and foreign-owned banks. The latter group will be additionally split into VI foreign banks (e.g. banks that have signed commitment letters not to withdraw capital from their subsidiary in the respective country; Table 8) and non-VI foreign banks (Table 9).

Table 6 presents the banks in our sample whose parents signed commitment letters as part of the Vienna Initiative.

Table 6. Foreign VI Banks in Vienna Initiative Countries in Current Bank Sample

Name	Country
K&H Bank Zrt	HUNGARY
MKB Bank Zrt	HUNGARY
Raiffeisen Bank Zrt	HUNGARY
UniCredit Bank Hung..	HUNGARY
CIB Bank Ltd-CIB Ba..	HUNGARY
Erste Bank Hungary ..	HUNGARY
AS DNB Banka	LATVIA
SEB banka AS	LATVIA
Swedbank AS	LATVIA
BCR Banca Pentru Lo..	ROMANIA
UniCredit Bank SA	ROMANIA
Alpha Bank Romania	ROMANIA
Banca Romaneasca S.A.	ROMANIA
Piraeus Bank Romania	ROMANIA
Raiffeisen Bank SA	ROMANIA
Banca Comerciala Ro..	ROMANIA
BRD-Groupe Societe ..	ROMANIA

Table 7 presents Difference-in-Differences results for domestic banks in VI countries. Although there was an overall drop in lending growth before Lehman Brothers' collapse (see all point estimates on Row (1)), domestic banks in VI countries were not influenced by stock market comovement with Western markets during the Crisis. This may be due to their relatively small size and little connection with these markets (see, e.g., Schnabl, 2012 for a case study about emerging economies in Latin America). The results for the interaction in Column (4) drop out, because all countries are either below or above the median of the respective tail dependence measure.

In Table 8, we present the results for non-VI foreign-owned banks. After the Lehman Brothers shock, we observe a drop in lending growth by 6 percentage points for extreme negative returns comovement (Column (2)). The effect of positive returns comovement on lending of non-VI foreign banks does not change after the shock.

Table 9 zooms in on the most interesting case in our sample: VI foreign banks. We again observe a negative effect on lending growth of joint negative returns with Western markets during the Crisis (Column (2)), but now we also find that extreme joint positive returns lead,

on average, to a drop in lending by almost 10 percentage points. Our interpretation is that any extreme comovement with Western markets may lead to a drop in lending for the identified VI banks due to the increase in uncertainty it represents.

The results in all three tables are with extremely high explanatory power, with Adjusted R squared ranging from 0.69 to 0.96. Furthermore, an unreported large number of control variables for fundamental banking and macroeconomic characteristics gain statistical and economic significance.⁶

Table 6. Lehman Brothers Crisis and Domestic Banks in Vienna Initiative Countries

Measure	Lehman Brothers Crisis			
	τ^L (high)	τ^L (low)	τ^U (high)	τ^U (low)
	(1)	(2)	(3)	(4)
Lehman	-0.0746 (0.134)	-0.0496** (0.045)	-0.0577 (0.163)	-0.0454 (0.158)
Measure t-1	-0.0015 (0.871)	0.0142 (0.695)	0.0011 (0.917)	-0.0221 (0.420)
Measure t-1 *Lehman	0.0361* (0.073)	-0.0184 (0.744)	0.0213 (0.448)	0.0000 (.)
Subsidiary Controls	Yes	Yes	Yes	Yes
Parent Controls	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes
Observations	238	238	238	238
R ²	0.9608	0.9602	0.9602	0.9602
Adjusted R ²	0.9572	0.9565	0.9566	0.9567

*The dependent variable is the Loan growth rate. The numbers in parentheses are p-values. Standard errors are clustered at the parent level. Statistical significance at the 1%, 5% and 10% levels is denoted by ***, **, and *, respectively. Sample period: March 2006 to April 2009.*

Table 7. Lehman Brothers Crisis and Foreign Non-VI Banks in Vienna Initiative Countries

Measure	Lehman Brothers Crisis			
	τ^L (high)	τ^L (low)	τ^U (high)	τ^U (low)
	(1)	(2)	(3)	(4)
Lehman	-0.1107 (0.258)	-0.0076 (0.901)	-0.1246 (0.104)	-0.0468 (0.436)
Measure t-1	0.0133 (0.731)	0.0961 (0.111)	0.0101 (0.729)	-0.1196** (0.011)
Measure t-1 *Lehman	-0.0548 (0.294)	-0.2049** (0.033)	0.0406 (0.327)	0.0000 (.)
Subsidiary Controls	Yes	Yes	Yes	Yes
Parent Controls	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes
Observations	434	434	434	434
R ²	0.7079	0.7142	0.7072	0.7081
Adjusted R ²	0.6938	0.7003	0.6931	0.6947

*The dependent variable is the Loan growth rate. The numbers in parentheses are p-values. Standard errors are clustered at the parent level. Statistical significance at the 1%, 5% and 10% levels is denoted by ***, **, and *, respectively. Sample period: March 2006 to April 2009.*

⁶ The estimates for the control variables are omitted due to space constraints. The full tables are available upon request.

Table 8. Lehman Brothers Crisis and Foreign VI Banks in Vienna Initiative Countries

Measure	Lehman Brothers Crisis			
	τ^L (high)	τ^L (low)	τ^U (high)	τ^U (low)
	(1)	(2)	(3)	(4)
Lehman	-0.0066 (0.942)	0.0471 (0.567)	-0.0306 (0.693)	-0.0146 (0.839)
Measure t-1	-0.0171 (0.737)	0.1131*** (0.000)	0.1053** (0.016)	0.0060 (0.954)
Measure t-1 *Lehman	-0.0204 (0.711)	-0.2047*** (0.000)	-0.3162*** (0.009)	0.0000 (.)
Subsidiary Controls	Yes	Yes	Yes	Yes
Parent Controls	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes
Observations	515	515	515	515
R ²	0.7895	0.7929	0.8029	0.7888
Adjusted R ²	0.7810	0.7846	0.7949	0.7807

*The dependent variable is the Loan growth rate. The numbers in parentheses are p-values. Standard errors are clustered at the parent level. Statistical significance at the 1%, 5% and 10% levels is denoted by ***, **, and *, respectively. Sample period: March 2006 to April 2009.*

Overall, we observe financial contagion of the type of Forbes and Rigobon (2002) transmitted to the real economy in the Transition region via foreign banks and it is even higher for foreign banks that eventually took part in the Vienna Initiative.

4.2.4. Vienna Initiative: Did VI banks lend more after signing commitments?

In the previous section, we found that during the crisis VI banks reduced lending faster than other foreign-owned banks. However, the commitments and the subsequent capital injections were not in force before the spring of 2009. It may very well be that VI banks started lending at a higher pace after the commitments were signed. Therefore, in this section, we compare the lending behaviour of VI banks between September 2008 and April 2009 to their lending growth from May 2009 and April 2010.

Table 9 presents the results. Overall, we do not document any statistically significant difference in the lending behaviour of VI banks during the period of the Global Financial Crisis. Hence, we cannot find evidence that the Vienna Initiative was effective in preventing foreign capital market shocks to transmit to the real economies in the Transition region.

Table 9. Post Lehman Brothers Crisis and Foreign VI Banks in Vienna Initiative Countries

Measure	Post Lehman Brothers Crisis			
	τ^L (high)	τ^L (low)	τ^U (high)	τ^U (low)
	(1)	(2)	(3)	(4)
Lehman	0.0064 (0.922)	0.0303 (0.675)	0.0218 (0.693)	-0.0219 (0.829)
Measure t-1	-0.0142 (0.115)	0.0446 (0.294)	0.0263 (0.539)	0.0583 (0.335)
Measure t-1 *Lehman	-0.0102 (0.716)	-0.0388 (0.532)	-0.0323 (0.563)	0.0000 (.)
Subsidiary Controls	Yes	Yes	Yes	Yes
Parent Controls	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes
Observations	472	472	472	472
R ²	0.8435	0.8436	0.8435	0.8440
Adjusted R ²	0.8366	0.8367	0.8366	0.8371

*The dependent variable is the Loan growth rate. The numbers in parentheses are p-values. Standard errors are clustered at the parent level. Statistical significance at the 1%, 5% and 10% levels is denoted by ***, **, and *, respectively. Sample period: May 2006 to April 2010.*

4. Summary and Conclusion

This study offers insights into the impact of financial contagion on Transition economies during the Global Financial Crisis. Our findings provide a new evaluation of the efficacy of international initiatives to combat the fallout from the bankruptcy of Lehman Brothers and the subsequent Global Financial Crisis.

Our results reveal that during financial crises, the simultaneous occurrence of extreme negative tail events between Western and Transition region markets results in a decline in lending growth among banks in the Transition region. This decline is predominantly attributed to foreign-owned banks. Examining the 2009 Vienna Initiative, we observe that foreign banks that pledged to halt payouts to their parent companies exhibited the most significant reductions in lending growth. Nevertheless, we did not find any evidence indicating that these banks altered their lending behaviour following the signing of these commitments.

The Vienna Initiative was designed to prevent capital flight and some previous studies have found that it has managed to achieve this goal (e.g., De Haas et al. 2015). However, it had no instruments to coerce foreign banks to maintain lending to the real economy. While VI banks did not shift capital abroad, we find that they did not lend against these amassed capital buffers either.

Our findings should not discourage international and national authorities from seeking innovative tools to combat economic crises. Overall, proactive and coordinated measures are essential to mitigate crisis effects on lending and the real economy, facilitating the development of targeted policies for sustained financial stability in the region and beyond.

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Appendix: Tables

Regression Analysis

Table A1: Panel Regression Variables. This table presents a description of the variables and data sources for the panel regressions. All relevant balance sheet variables are converted to U.S. dollars for an easier interpretation of the results.

Variable	Description	Data Source
<i>Panel A: Bank Variables</i>		
<i>Subsidiary Variables</i>		
Subsidiary Loan Growth Rate	Growth of total subsidiary USD-denominated loans	Bankscope
Subsidiary Size	Natural logarithm of total subsidiary USD- denominated assets	Bankscope
Subsidiary Profitability	Ratio of subsidiary profits to total earning assets	Bankscope
Subsidiary Riskiness	Ratio of subsidiary loan-loss provisions to total loans	Bankscope
Subsidiary Capitalization	Ratio of subsidiary equity to total assets	Bankscope
Subsidiary Liquidity	Ratio of subsidiary liquid assets to total assets	Bankscope
Subsidiary Internally generated funds	Ratio of subsidiary net income at period t to loans at period (t-1)	Bankscope
<i>Parent Variables</i>		
Parent Size	Natural logarithm of total parent USD- denominated assets	Bankscope
Parent Profitability	Ratio of parent profits to total earning assets	Bankscope
Parent Riskiness	Ratio of parent loan-loss provisions to total loans	Bankscope
Parent Capitalization	Ratio of parent equity to total assets	Bankscope
Parent Liquidity	Ratio of parent liquid assets to total assets	Bankscope
Parent Internally generated funds	Ratio of parent net income at period t to loans at period (t-1)	Bankscope
<i>Panel B: Country Characteristics</i>		
GDP p.c. growth	Growth of Gross Domestic Product per capita	Eurostat
Inflation	Consumer Price Index	Eurostat
Trade Openness	Trade as percentage of GDP	World Bank's World Development Indicators
Foreign Bank Ownership	Foreign ownership share in percentages. Foreign ownership is defined as banks with assets of foreign ownership > 50%	EBRD's Banking Survey
Domestic Credit/GDP	Domestic credit to the private sector to GDP	International Monetary Fund's World Economic Outlook
Rule of Law	Rule of Law captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5.	World Bank's World Development Indicators

Bank Sample

Table A2: Parents and Subsidiaries. This table presents the 100 parent banks of our sample and the overall number of subsidiaries of a bank. The list of subsidiaries is available upon request.

#	Parent Name	Parent Country	# of Subsidiaries
Foreign Parents			
1	Bausparkasse der Oesterreichischen Sparkassen AG	AUSTRIA	1
2	Erste Bank der Oesterreichischen Sparkassen AG	AUSTRIA	1
3	Sberbank Europe AG	AUSTRIA	4
4	Raiffeisenlandesbank Oberoesterreich AG	AUSTRIA	2
5	Raiffeisen Landesbanken Holding GmbH	AUSTRIA	1
6	Raiffeisen Bank International AG	AUSTRIA	4
7	Bausparkasse Wuestenrot	AUSTRIA	3
8	Steiermaerkische Bank und Sparkassen AG-Bank Styria	AUSTRIA	2
9	Raiffeisen Zentralbank Oesterreich AG - RZB	AUSTRIA	5
10	Immigon Portfolioabbau AG	AUSTRIA	1
11	BKS Bank AG	AUSTRIA	1
12	Erste Group Bank AG	AUSTRIA	14
13	UniCredit Bank Austria AG-Bank Austria	AUSTRIA	3
14	Porsche Bank AG	AUSTRIA	2
15	DenizBank AG	AUSTRIA	1
16	Commonwealth Bank of Australia	AUSTRALIA	1
17	KBC Groep NV/ KBC Groupe SA-KBC Group	BELGIUM	2
18	KBC Bank NV	BELGIUM	3
19	Commerzbank AG	GERMANY	1
20	Deutsche Bank AG	GERMANY	5
21	Volkswagen Financial Services AG	GERMANY	2
22	Union Asset Management Holding AG	GERMANY	1
23	DZ Bank AG-Deutsche Zentral-Genossenschaftsbank	GERMANY	2
24	VR-Leasing AG	GERMANY	1
25	Deutsche Sparkassen Leasing AG & Co KG	GERMANY	1
26	ProCredit Holding AG & Co. KGaA	GERMANY	2
27	Toyota Kreditbank GmbH	GERMANY	1
28	Danske Bank A/S	DENMARK	3
29	Banco Santander SA	SPAIN	2
30	RCI Banque SA	FRANCE	3
31	Banque PSA Finance SA	FRANCE	1
32	BNP Paribas Personal Finance SA	FRANCE	2
33	Societe Generale SA	FRANCE	5
34	BNP Paribas	FRANCE	3
35	Crédit Agricole S.A.	FRANCE	3
36	HSBC Bank plc	UNITED KINGDOM	1
37	HSBC Holdings Plc	UNITED KINGDOM	1
38	Investec Plc	UNITED KINGDOM	1
39	National Bank of Greece SA	GREECE	3
40	Alpha Bank AE	GREECE	2
41	Eurobank Ergasias SA	GREECE	1
42	Piraeus Bank SA	GREECE	2
43	Cassa di Risparmio di Firenze SpA-Banca CR Firenze SpA	ITALY	1
44	UniCredit SpA	ITALY	10
45	Intesa Sanpaolo	ITALY	4
46	FCA Bank SPA	ITALY	1
47	Veneto Banca scpa	ITALY	1
48	Banca di Cividale SpA	ITALY	1

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#	Parent Name	Parent Country	# of Subsidiaries
49	Banca Popolare di Vicenza Societa cooperativa per azioni	ITALY	1
50	Royal Bank of Scotland NV (The)-RBS NV	NETHERLANDS	1
51	ING Bank NV	NETHERLANDS	1
52	DNB Bank ASA	NORWAY	3
53	Banco Banif Mais SA	PORTUGAL	1
54	Banco Comercial Portugues, SA-Millennium bcp	PORTUGAL	1
55	Swedbank AB	SWEDEN	6
56	Skandinaviska Enskilda Banken AB	SWEDEN	7
57	Nordea Bank AB	SWEDEN	6
58	State Street Corporation	UNITED STATES OF AMERICA	5
59	JPMorgan Chase & Co	UNITED STATES OF AMERICA	2
60	Goldman Sachs Group, Inc	UNITED STATES OF AMERICA	1
61	Northern Trust Corporation	UNITED STATES OF AMERICA	2
62	Morgan Stanley	UNITED STATES OF AMERICA	3
Domestically Incorporated Parents			
63	Corporate Commercial Bank AD	BULGARIA	1
64	Ceska Sporitelna a.s.	CZECH REPUBLIC	1
65	Komerční Banka	CZECH REPUBLIC	1
66	Privredna Banka Zagreb d.d-Privredna Banka Zagreb Group	CROATIA	1
67	Banka Splitsko-Dalmatinska dd Split	CROATIA	1
68	VABA dd Banka	CROATIA	1
69	Zagrebacka Banka dd	CROATIA	2
70	National Bank of Hungary ZRT-Magyar Nemzeti Bank	HUNGARY	1
71	OTP Bank Plc	HUNGARY	1
72	MFB Hungarian Development Bank Private Limited Company	HUNGARY	1
73	FHB Mortgage Bank Plc	HUNGARY	1
74	mBank SA	POLAND	3
75	Powszechna Kasa Oszczednosci Bank Polski SA - PKO BP SA	POLAND	3
76	Getin Noble Bank SA	POLAND	1
77	Getin Holding SA	POLAND	2
78	Patria Bank	ROMANIA	1
79	Transilvania Bank-Banca Transilvania SA	ROMANIA	1
80	NLB dd-Nova Ljubljanska Banka d.d.	SLOVENIA	3
81	Nova Kreditna Banka Maribor d.d.	SLOVENIA	1
82	Slovenska sporitel'na as-Slovak Savings Bank	SLOVAKIA	1
83	Ceskoslovenska obchodna banka CSOB	SLOVAKIA	1
84	Koç Financial Services-KOC Finansal Hizmetler AS	TURKEY	2
85	C Faktoring A.S.	TURKEY	1
86	GSD Holding Anonim Sirketi	TURKEY	1
87	Fiba Holding AS	TURKEY	3
88	Turkiye is Bankasi A.S. - ISBANK	TURKEY	3
89	T.C. Ziraat Bankasi A.S.	TURKEY	2
90	Akbank T.A.S.	TURKEY	1
91	Yapi Ve Kredi Bankasi A.S.	TURKEY	1
92	Turkiye Garanti Bankasi A.S.	TURKEY	1
93	Arab Turkish Bank-Arap Turk Bankasi	TURKEY	1
94	Turkiye Ihracat Kredi Bankasi - Turk Eximbank-Export Credit Bank of Turkey	TURKEY	2

#	Parent Name	Parent Country	# of Subsidiaries
95	Sekerbank T.A.S.	TURKEY	1
96	Turkiye Sinai Kalkinma Bankasi A.S.-Industrial Development Bank of Turkey	TURKEY	2
97	Finansbank A.S.	TURKEY	1
98	Turkish Bank A.S.	TURKEY	1
99	Alternatifbank A.S.	TURKEY	1
100	Turkiye Vakiflar Bankasi TAO	TURKEY	1
Total:			212
Total (foreign parents):			158
Total (domestic parents):			54

Table A3: List of ownership by parent bank country. This table presents the parent bank's countries and the number of subsidiaries.

#	Parent Country	Number of Subsidiaries
Western Country		
1	AUSTRALIA	1
2	AUSTRIA	43
3	BELGIUM	5
4	DENMARK	3
5	FRANCE	16
6	GERMANY	16
7	GREECE	8
8	ITALY	17
9	THE NETHERLANDS	2
10	NORWAY	3
11	PORTUGAL	2
12	SPAIN	1
13	SWEDEN	19
14	THE UNITED KINGDOM	3
15	THE UNITED STATES OF AMERICA	13
CEE Country		
16	BULGARIA	2
17	CROATIA	6
18	THE CZECH REPUBLIC	4
19	HUNGARY	7
20	POLAND	11
21	ROMANIA	2
22	SLOVAKIA	2
23	SLOVENIA	4
24	TURKEY	25
Total		212

Table A4a: Descriptive statistics of variables (Foreign-owned subsidiary bank sample). This table presents the descriptive statistics of variables used in our regression analysis. Time period: March 2006 to April 2010.

Variable	Mean	Min	Max	Std.Dev.	Number
Loan Growth Rate	0,343	-1,705	5,801	0,582	6199
τ^L (High Vol)	0,508	0,072	0,835	0,153	6197
τ^L (Low Vol)	0,312	0,000	0,622	0,168	6197
τ^U (High Vol)	0,393	0,008	0,813	0,167	6197
τ^U (Low Vol)	0,206	0,000	0,683	0,186	6197
Subsidiary Size	7,728	-2,224	11,313	1,716	6302
Subsidiary Profitability	0,019	-0,149	0,312	0,040	6292
Subsidiary Riskiness	0,016	-0,111	0,257	0,028	6292
Subsidiary Capitalization	0,117	-0,033	0,731	0,091	6302
Subsidiary Liquidity	0,201	-0,042	0,980	0,163	6272
Subsidiary Internally Generated Funds	0,039	-0,417	1,501	0,133	6198
Parent Size	11,305	6,113	14,969	1,886	6302
Parent Profitability	0,022	-0,042	0,437	0,060	6302
Parent Risk	0,006	-0,017	0,136	0,012	5619
Parent Capitalization	0,142	-0,008	1,280	0,191	6302
Parent Liquidity	0,275	-0,011	0,723	0,172	6251
Parent Internally Generated Funds	0,169	-0,287	13,091	0,979	5755
GDP Growth	2,926	-18,080	12,536	5,222	6302
Inflation	5,082	-4,129	20,604	3,734	6302
Trade Openness	101,918	46,540	169,287	34,882	6302
Foreign Bank Ownership	0,653	0,274	0,930	0,187	6302
Domestic Credit/GDP	51,061	19,880	105,486	16,996	6302
Rule of Law	0,444	-0,192	1,165	0,399	6302

Table A4b: Descriptive statistics of variables (Domestic subsidiary bank sample). This table presents the descriptive statistics of variables used in our regression analysis. Time period: March 2006 to April 2010.

Variable	Mean	Min	Max	Std.Dev.	Number
Loan Growth Rate	0,460	-7,890	5,507	0,802	2176
τ^L (High Vol)	0,504	0,072	0,835	0,158	2293
τ^L (Low Vol)	0,364	0,000	0,622	0,156	2293
τ^U (High Vol)	0,443	0,008	0,813	0,143	2293
τ^U (Low Vol)	0,225	0,000	0,683	0,178	2293
Subsidiary Size	6,661	3,344	11,557	1,552	2323
Subsidiary Profitability	0,034	-0,037	0,289	0,052	2323
Subsidiary Riskiness	0,016	-0,117	0,176	0,031	2323
Subsidiary Capitalization	0,167	0,003	0,858	0,149	2323
Subsidiary Liquidity	0,211	-0,093	1,009	0,220	2323
Subsidiary Internally Generated Funds	-0,034	-7,471	2,301	0,846	2176
Parent Size	8,989	3,232	11,437	1,802	2323
Parent Profitability	0,019	-0,175	0,100	0,027	2323
Parent Risk	0,017	-0,019	0,117	0,021	2289
Parent Capitalization	0,137	0,009	0,695	0,121	2323
Parent Liquidity	0,208	-0,011	0,723	0,128	2323
Parent Internally Generated Funds	0,097	-2,700	10,487	0,993	2272
GDP Growth	2,887	-7,797	12,536	4,614	2323
Inflation	5,859	-2,450	15,726	3,605	2323
Trade Openness	89,108	46,540	169,287	40,313	2323
Foreign Bank Ownership	0,585	0,274	0,930	0,213	2323
Domestic Credit/GDP	44,683	19,880	92,324	16,090	2323
Rule of Law	0,356	-0,192	1,059	0,375	2323

Table A4c: Descriptive statistics of variables (Vienna Initiative foreign subsidiary bank sample). This table presents the descriptive statistics of variables used in our regression analysis. Time period: March 2006 to April 2010.

Variable	Mean	Min	Max	Std.Dev.	Number
Loan Growth Rate	0,344	-0,167	2,775	0,483	746
τ^L (High Vol)	0,483	0,105	0,835	0,144	746
τ^L (Low Vol)	0,242	0,000	0,528	0,155	746
τ^U (High Vol)	0,342	0,011	0,645	0,143	746
τ^U (Low Vol)	0,152	0,000	0,458	0,139	746
Subsidiary Size	8,865	3,117	10,106	0,783	746
Subsidiary Profitability	0,015	-0,092	0,058	0,021	746
Subsidiary Riskiness	0,016	-0,117	0,176	0,031	746
Subsidiary Capitalization	0,087	0,047	0,516	0,028	746
Subsidiary Liquidity	0,232	0,030	0,911	0,111	746
Subsidiary Internally Generated Funds	0,024	-0,074	0,917	0,041	746
Parent Size	11,831	7,203	13,351	1,013	746
Parent Profitability	0,012	-0,029	0,242	0,032	746
Parent Risk	0,005	-0,004	0,032	0,007	704
Parent Capitalization	0,100	-0,008	0,734	0,119	746
Parent Liquidity	0,311	0,033	0,668	0,155	746
Parent Internally Generated Funds	0,030	-0,043	0,270	0,051	704
GDP Growth	2,462	-18,080	12,536	7,320	746
Inflation	8,235	-4,129	20,604	5,321	746
Trade Openness	106,443	67,244	160,783	35,676	746
Foreign Bank Ownership	0,810	0,454	0,930	0,114	746
Domestic Credit/GDP	56,911	19,880	105,486	22,521	746
Rule of Law	0,426	-0,140	1,003	0,453	746