Faculty of Economics and Business Administration
ICADE

Policy constraints: the role of Domestic Uncertainty vs International Geopolitics

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POLICY CONSTRAINTS: THE ROLE OF DOMESTIC UNCERTAINTY VS INTERNATIONAL GEOPOLITICS

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ABSTRACT

In recent decades, geopolitical tension and uncertainty have been on the rise. The balance of power is shifting from a US-centric global system to a more fragmented structure. This paper examines the traditional view that globalization promotes peace. While bilateral relationships may benefit from economic interdependence, the forces promoting peace diminish in a multilateral system as dependency becomes more distributed. Using the three-player game model for sovereign debt holdings and prospects of peace, this study explores the relationship between geopolitics and stability, employing CDS spreads as a proxy for sovereign risk. The findings suggest that the bonds of the three major economies—US, EU, and China—are treated as safe-haven assets during adverse geopolitical events. Additionally, evidence indicates that the US and the EU exhibit similar reactions to geopolitical tensions, while China reacts independently. This divergence highlights a coalition between the traditional allies, the US and the EU. The three-player model is also applied to the European debt crisis, illustrating the dynamics of coalition formation and exploring how alternative alliances could have altered the crisis's outcome. Lastly, the paper reviews four geopolitical indices: the widely used GPR, the BBVA Geopolitical Index, the International Political Relations (IPR) Index, and the Conflict Forecast Index. Each index is analyzed in terms of its methodology, strengths, and limitations.

- Keywords: geopolitics, war, sovereign debt, CDS
- JEL codes: F50, F51, H63, G15

Introduction

This thesis examines the shifting dynamics of the liberal international order, traditionally grounded in Montesquieu's (1748) and Kant's (1795) theories that economic interdependence fosters peace and prosperity. While this belief has shaped Western policies for decades, recent global developments challenge its validity. Nations like China have thrived within the liberal system economically while consolidating authoritarian control, and global fragmentation has led to emerging alliances such as China, Russia, and Iran. These shifts mirror pre-World War

I dynamics, where globalization and trade failed to prevent conflict. Economic integration, once a stabilizing force, is increasingly weaponized in geopolitical rivalries, raising important questions about whether it promotes stability or introduces vulnerabilities.

The literature historically highlights the link between trade and peace, particularly the significant role of bilateral trade in reducing conflict, while multilateral trade's effects are less definitive (Martin *et al.*, 2008). Beyond trade, factors such as foreign direct investment (Polachek *et al*., 2007) and diplomatic engagement (Fuchs & Kahn, 2013) have been shown to promote peace. Recent research has begun connecting sovereign debt markets to geopolitics, using tools like CDS spreads and indices such as the Geopolitical Risk Index (GPR) to analyze market responses to geopolitical tensions. Findings reveal divergent impacts: geopolitical risks reduce CDS spreads for Global Systemically Important Banks (G-SIBs), signifying a safe-haven effect, while increasing them for non-G-SIBs (Imtiaz *et al.*, 2023). Others argue that global financial cycles are more influenced by US monetary policy than by geopolitics, underscoring the interplay between macroeconomic policy and global financial stability (Hélène Rey, 2015, 2020, 2022).

This line of research has been bolstered by advancements in computational methods, including large language models, which have enabled more precise measurement of geopolitical risks. Recent studies demonstrate how geopolitical events influence key factors such as oil prices (Mignon & Saadaoui, 2023), sovereign risk of the 27 EU-member states (Afonso *et al.*, 2023), or economic forecast (Diakonova *et al.* 2022).

This study explores the intersection of financial markets, sovereign risk, and geopolitical tensions, with a specific focus on how debt markets perceive peace and respond to the escalation of geopolitical risks. By examining these dynamics, the thesis contributes to a deeper understanding of the financial implications of global political shifts.

Methodology

The thesis begins with a summary of the 3-player game model developed by Professor Claeys, as outlined in a working paper co-authored with the researcher. It proceeds with a comprehensive analysis to support the paper, incorporating both quantitative and qualitative methodologies. The thesis concludes with a literature review on geopolitical indices, aimed at facilitating future research in the field.

The quantitative analysis focuses on CDS spreads of China, the US, and the EU, using an OLS

regression to study these spreads and their bidirectional spillovers in conjunction with the Geopolitical Risk Index (GPR) and BBVA Geopolitical Index. A VAR analysis further explores the relationship between the BBVA Geopolitical Index and the CDS spreads, while a SUR analysis supports the CDS spillover findings. The qualitative analysis applies the 3-player game model to a use case scenario, examining the European debt crisis with Greece, Spain, and European institutions as players. The literature review compares the GPR, BBVA Geopolitical Index, International Political Relations Index (IPR), and Conflict Forecast Index, evaluating their methodologies (where available), strengths, and limitations.

Results

The quantitative results indicate that geopolitical indices reduce sovereign risk (CDS), contrary to initial expectations. This finding aligns with Imtiaz *et al.* (2023), who observed that adverse geopolitical events decrease CDS spreads for Global Systemically Important Banks (G-SIBs) while increasing them for non-G-SIBs. This result suggests that the bond markets of major economies are perceived as "fly-to-heaven" assets during times of geopolitical uncertainty. These findings highlight the need for further research, particularly by examining periods of heightened geopolitical tension, such as the onset of the Ukraine-Russia war, to determine whether market reactions differ between significant geopolitical events and more routine circumstances. Additionally, it would be valuable to explore whether more unstable economies behave similarly to non-G-SIBs, showing increased CDS spreads during geopolitical events. As discussed in the geopolitical index comparison section, incorporating new variables, particularly the Conflict Forecast Index, would further enrich the analysis and provide additional insights.

In the spillover analysis, the results reveal that Europe and America's bidirectional risk decreased, indicating a strong coalition between these traditional allies. However, spillovers from China increase, with the European Union receiving more risk from China, a portion of which is then transferred to the US This dynamic underscores Europe's critical role within the coalition, acting as both a recipient and a transmitter of geopolitical risk.

The qualitative analysis examines the political dynamics within the European Union during the debt crisis, exploring what could have occurred under the three-player game model if Spain and Greece had formed a coalition against European institutions. This scenario highlights the potential shifts in power and risk dynamics that could emerge from alternative coalition structures within a multilateral framework.

Index

List of tables

List of Figures

CHAPTER 1. INTRODUCTION

The liberal international order has dominated global politics for the past few decades, a theory that traces its roots to Montesquieu (1748) and Kant (1795). Montesquieu argued that "two nations who traffic with each other become reciprocally dependent…their union is founded on their mutual necessities." Liberalism underpinned the belief in the West that economic interdependence through trade and financial integration would lead to peace, economic prosperity, and even the spread of democracy to nations like China. However, this theory now seems to be reversing. While China has engaged with and benefited from the liberal order, the grip of the Communist Party over society has only strengthened. Similar dynamics can be observed in other regions, such as the Middle East, where economic integration has not led to liberalization.

The world is now fragmenting, with coalitions such as the BRICS seeking to challenge the American-led order, while the US appears to be retreating. In this evolving global landscape, new coalitions are emerging — China, Russia, Iran, and North Korea are increasingly aligned. This situation has historical echoes of the pre-World War I era, a period of intense globalization and trade that ended abruptly in conflict. As Clark (2012) describes, World War I resulted from key decisions to tie the future of great coalitions to smaller, volatile regional conflicts, such as those in the Balkans. A contemporary parallel might be China forming closer ties with Russia or Iran. However, these alliances have not yet reached the level of interdependence seen between Russia and France in 1914.

While economic integration has traditionally been viewed as a tool for peacekeeping, it is increasingly weaponized in geopolitical rivalries. Examples include the extensive sanctions against Russia following its actions in Ukraine and the so-called Trump tariffs, which even extended to its allied blocs. These developments raise critical questions about financial interconnectedness: is financial integration perceived as a stabilizing force or as a risk? Moreover, does this perception shift depending on the nature of the relationships between the nations involved? By examining the intersection of financial markets, sovereign risk, and geopolitical tensions, the study aims to shed light on how markets respond to the shifting global order and whether financial integration remains a force for stability or a source of vulnerability in the face of rising geopolitical competition.

- SDG alignment: 8 (decent work and economic growth), 10 (reduced inequalities) & 16 (peace, justice and strong institutions)
- Keywords: geopolitics, war, sovereign debt, CDS
- JEL codes: F50, F51, H63, G15

I. Motivation

The project began after I attended an international macroeconomics class taught by Professor Claeys. Intrigued by the subject, I wanted to gain experience in academic research before finishing my studies. As I was particularly interested in geopolitics and macroeconomics, I approached Professor Claeys with the idea of collaborating on research, expressing my interest in publishing a paper and learning more about the research process.

After discussing potential areas of focus, we decided to work at the intersection of geopolitics and financial markets. Professor Claeys had been working on a similar project within Europe, examining the spread of sovereign risk propagation using CDS spreads and spillovers. Building on this foundation, we began developing the paper, where, under his guidance, I focused on conducting quantitative research, much of which is presented in this thesis.

This thesis is, therefore, motivated by a personal interest in the subject matter and a genuine desire to gain hands-on experience in academic research. This journey culminated in an incredible opportunity to teach my first class, where I shared the work I had done for the paper and this thesis during a two-hour session at ICADE.

CHAPTER 2. SCOPE OF THE PROJECT

I. Objectives

The primary goal of this project is to build upon and support the research conducted by Professor Claeys, Professor Gómez-Bengoechea, and myself in the paper "Multilateral Financial Integration and Political Conflict: A 3-Player Game of Debt Negotiation." My contribution to the original research involved assisting Professor Claeys in developing a three-player game that examines how countries interact based on their level of economic integration. Specifically, I focused on conducting the empirical analysis, which I have expanded upon in greater depth in this thesis.

The primary aim of this thesis has been to provide further analysis and empirical support for the findings of the paper. Consequently, the specific objectives of this thesis include:

- Conducting an OLS analysis to strengthen the empirical foundation of the three-player game model, while also exploring complementary analytical approaches that may provide deeper insights into the dynamics of geopolitical risk and sovereign debt interactions.
- Comparing Matteo Iacoviello's Geopolitical Risk Index (GPRD) with BBVA's new geopolitical index, which employs Generalized Linear Models (GLMs), to evaluate their effectiveness in capturing both global and country-specific geopolitical risks. This comparison aims to identify the index that offers the most accurate and nuanced representation of geopolitical tensions and their financial implications.
- Applying the model qualitatively to a historical scenario to test its validity as a tool for understanding geopolitical conflicts. This application serves as a proxy for predicting future conflicts, allowing for a practical assessment of the model’s strengths and limitations in real-world contexts.
- Identifying and understanding the limitations of the research and the results obtained, with the aim of proposing actionable steps to guide future research efforts. This involves critically assessing the methodologies, datasets, and theoretical frameworks used, and suggesting refinements or alternative approaches that could address these limitations and enhance the robustness and applicability of the findings.

II. Methodology

The thesis begins with a comprehensive literature review, concluding with a summary of the three-player game model developed within this study. This foundation sets the stage for the core analysis presented in Chapter 5, which forms the bulk of the thesis. In particular, the first three subsections describe the variables used, conduct a descriptive analysis, and presenting the results and conclusions of the quantitative research. The chapter also includes a practical example demonstrating how the model can be applied qualitatively. The final chapter is dedicated to comparing the Geopolitical Risk Index (GPR) with the BBVA Geopolitical Index, the IPR and the Conflict Forecast, emphasizing their respective methodologies, strengths, and limitations. Accordingly, the methodology is structured into two parts: a theoretical study and an empirical study.

The empirical study combines quantitative and qualitative approaches to test the model and explore its applicability in real-world scenarios.

- Qualitative Analysis: The qualitative approach involves applying the model to historical cases, such as the eurozone debt crisis. This section contrasts the approaches taken during the Greek and Spanish crises to evaluate the model's ability to mirror real-world dynamics and outcomes.
- Quantitative Analysis: The quantitative component includes conducting four types of regressions: standard regressions, panel regressions, SUR (seemingly unrelated regression) analysis, and VAR (vector autoregression). These methods allow for a robust exploration of the dataset. Although the panel regressions were carried out (see Appendix B for the code used), they were ultimately excluded from the main analysis as the dataset structure did not align with the requirements of this methodology.

The theoretical study provides a literature review to contextualize and compare the geopolitical variables employed in the analysis, also including the IPR and the Conflict Forecasts. This section aims to illuminate the strengths and limitations of these variables within academic research, offering valuable insights for future studies. The findings are particularly relevant as the school intends to expand its academic contributions in this emerging field of study.

This structured approach—integrating theoretical exploration, quantitative rigor, and qualitative application—has been crucial in addressing evolving research needs since March,

which remains the primary objective of the thesis.

CHAPTER 3. LITERATURE REVIEW

Traditionally, there is extensive literature examining trade and its impact on global geopolitics. As early as the works of Montesquieu and Kant, it has been argued that trade reduces the likelihood of war. This idea remains widely accepted, with recent confirmation by Kimbrough *et al.* (2020). However, while the role of bilateral trade in fostering peace is well-studied, multilateral trade relationships have received less attention. Martin *et al.* (2008) argues that while bilateral trade significantly reduces the likelihood of war, this effect diminishes in the context of multilateral trade, as dependency on any single country decreases.

Beyond trade, researchers have explored various factors influencing peace. For instance, Fuchs and Kahn (2013) highlight the role of political visits in fostering diplomatic ties, while Polachek *et al.* (2007) emphasize the contribution of foreign direct investment to promoting peace. In our paper, we aim to extend this line of inquiry by studying the relationship between peace and sovereign debt. Our quantitative analysis employs CDS spreads and geopolitical indices to explore this connection.

In a related study, Imtiaz *et al.* (2023) takes a different approach, examining the relationship between geopolitics and CDS spreads on banks. Their findings reveal a divergence: geopolitical risk decreases CDS spreads for Global Systemically Important Banks (G-SIBs), implying their status as safe assets, while it increases CDS spreads for non-G-SIBs, reflecting their higher perceived vulnerability.

However, there is a perspective that geopolitics do not significantly influence financial markets, but rather that US monetary policy is the dominant factor. Hélène Rey (2015, 2020, 2022) argues that the global financial cycle — characterized by fluctuations in financial activity such as risk-taking, credit creation, asset prices, gross capital flows, spreads, and leverage — is heavily shaped by US monetary policy. She posits that risk premiums increase following financial crises but not after wars, despite wars often causing comparable declines in consumption. In the pre-crisis "risk build-up phase," marked by GDP growth, real exchange rate appreciation, and high leverage among intermediaries, risk premiums remain low, masking vulnerabilities. From this perspective, wars and conflicts do not significantly impact debt markets.

Furthermore, with the advancement of computational capabilities, new indices are emerging to

quantify and measure geopolitics more effectively. In the 1960s, the manually intensive Correlates of War database set a foundational example for systematically analyzing geopolitical events. Since then, various indices have been developed to capture the complex and abstract nature of geopolitics. Initially, these indices relied on text-scraping methods to analyze patterns in geopolitical discourse. More recently, advancements in large language models (LLMs) and machine learning techniques have enabled more sophisticated analyses, providing deeper insights into geopolitical dynamics. This thesis examines several of these indices, evaluating their methodologies and exploring their potential applications in academic research, by assessing their strengths and limitations.

The Geopolitical Risk Index (GPR) has been widely applied in research to study its impact on various economic and financial factors. For instance, Mignon & Saadaoui (2023) demonstrate that positive advancements in US-China relations, as measured by the GPR, positively influence oil prices. Aysan *et al.* (2019) reveals that geopolitical events captured by the GPR negatively affect Bitcoin returns while increasing its volatility. Similarly, Diakonova *et al.* (2022) incorporate the GPR and the Economic Policy Uncertainty Index (EPU), among others, to enhance economic forecasts in Mexico, Brazil, and Colombia. In the context of sovereign risk, Afonso *et al*. (2023) find that geopolitical risk influences the sovereign risk of the 27 EU member states, again using the GPR. Their study identifies significant links between traditional trading partners, such as South America, China, and Asia. Additionally, Middle Eastern geopolitical events negatively impact bond returns due to the region's importance as an energy supplier. Lastly, Silva-Bustonet *et al.* (2024) introduce the International Political Relationship Index (IPR), which they employ to predict debt default risk across various countries.

We continue to advance this line of research, focusing on the intersection of financial and economic indicators with geopolitics. Specifically, we aim to explore how debt markets perceive peace and the likelihood of geopolitical events escalating, using indices such as the GPR.

CHAPTER 4. THE 3-PLAYER MODEL

In this chapter, we provide an overview of the 3-player game introduced by Claeys, Aramburu, and Gomez in their paper, "Multilateral Financial Integration and Political Conflict: A 3-Player Game of Debt Negotiation." The empirical model presented in this thesis is designed to complement and reinforce this theoretical model.

The game developed by Claeys *et al*. (2024) shares certain similarities with Lockwood (2006). It is a 3-player game in which three equally sized countries have conflicting interests regarding consumption and its financing. The game assumes that defaulting on debt can trigger international conflict. The model is akin to Eaton and Gersovitz's (1981) model on sovereign debt wars, where governments finance their consumption through international debt markets but lack the commitment to repay. Additionally, the model incorporates coalitions and negotiations based on Elard (2020) and is resolved statically with complete information, without accounting for shocks, in line with Herbst *et al*. (2020).

Internal household preferences θ are uniform across the three countries, and these preferences are manifested through the consumption of goods c. Consumption is funded through income, but each country has the option to either issue debt β_i to bolster its consumption or lend money abroad to increase its income β_{-i}. Notably, the game does not involve the trade of goods, hence consumption is solely domestic. It also encompasses payments on outstanding debt.

Financial integration α represents the level to which a country is developed and integrated into financial markets. When α is 0, the country operates in autarky. Under this circumstance, debt is exclusively raised domestically, rendering international conflict impossible while also diminishing financial opportunities and decreasing overall welfare.

$$U_i = \theta_i c_i + \alpha_{ij}\beta_{-1} - \alpha_{ii}\beta_i - \alpha_{ij}\beta_i \qquad (1)$$

The international order can be examined from three perspectives. First, a scenario involving a fully centralized world government with complete information, where resources are distributed among the countries to maximize welfare for all. The second perspective involves a democratic multilateral governance system, where resources are allocated based on a voting mechanism following Lockwood's (2006) model. In this system, countries may form coalitions to vote against others, leading to resource distribution that may not necessarily maximize welfare.

Lastly, the paper focuses on the international anarchy framework, where countries independently distribute their resources and can unilaterally decide to default on their debt without an international organization to oversee communications. The cost associated with going to war is denoted as f. In the event of a war between two countries, the losing side loses its debt holdings with a probability of λ, while the winning country defaults on its debt.

For a country to default on its debt, the net gain obtained must exceed the cost of war (2). Conversely, a country will not declare war if the default is smaller than the cost of debt (3). This condition applies to all countries involved.

$$\alpha_{21}\beta_1 + \alpha_{31}\beta_1 > f \qquad (2)$$

$$\alpha_{21}\beta_1 - \alpha_{12}\beta_2 > f \qquad (3)$$

If country 2 engages in war with country 1, the cost for country 3 is the anticipated net loss resulting from being involved with both countries (4). Furthermore, if the expected loss exceeds the cost of war, country 3 will initiate a war against the victor of the initial conflict.

$$\lambda(\alpha_{32}\beta_2 - \alpha_{23}\beta_3) + (1-\lambda)(\alpha_{31}\beta_1 - \alpha_{13}\beta_3) \qquad (4)$$

Country 3 has a favorable position, which implies that countries 1 and 2 must be prepared to confront a second war in order to engage in war. Therefore, the credible threat and initiation of war hinge upon the following overall condition:

$$\alpha_{ij}\beta_j - \alpha_{ji}\beta_i > 2f \qquad (5)$$

In the context of international anarchy, the potential for war diminishes as the challenges of engaging in multiple conflicts increase. Therefore, a well-integrated financial market can serve as a deterrent to war, and only minor defaults that do not provoke armed conflict may be considered in such a scenario.

The model is then enriched with political negotiations based on Harstad (2008), leading to a significant change in the predicted outcome. In the event of a conflict, Country 2 may seek to form a coalition with Country 3 against Country 1. However, Country 1 can try to keep Country 3 neutral by offering compensation, ensuring that Country 3 will not default after the war. Any compensation offered by Country 1 or 2 must account for the potential financial losses that

Country 3 could incur. As per Harstad (2008), the compensation must be comprehensive, with Country 3 capturing any potential benefits that Country 1 or 2 might derive from defaulting or engaging in war. Consequently, compensatory agreements between countries can lead to coalitions, albeit at the expense of increasing the likelihood of default or war.

In equilibrium, countries transfer their gains from avoiding war or default to their coalition partners. This contributes to making default or war more probable, in contrast to the conventional Nash equilibrium model. Multilateral financial integration offers countries external opportunities, which can stoke conflict instead of fostering peace. This result is in line with Elard's (2020) model, which demonstrates that creditors can influence negotiation outcomes by inciting competition among debtor countries. It also corresponds with the findings of Martin *et al.* (2008), who established that in a multilateral system, additional trade opportunities increase the chances of war. The model under discussion challenges the war-as-bargaining theory, wherein war is averted due to perfect information; instead, conflict arises from a lack of commitment as opposed to informational asymmetries.

CHAPTER 5. EMPIRICAL TEST

This chapter begins by examining the data used to carry out the empirical tests, detailing its sources, the transformations applied, and a descriptive analysis of the variables to provide a deeper understanding of their characteristics. Following this, the empirical analysis is presented, which underpins the proposed three-player game model for debt negotiation. To further validate these findings, qualitative research is incorporated, showcasing real-world scenarios where the game can be effectively applied. The empirical analysis has been conducted on both daily and monthly frequencies, based on the assumption that certain geopolitical news events may have an immediate impact on financial markets but could diminish over the following weeks. However, it is important to note that some critical variables, such as the Economic Political Uncertainty Index (EPU), are not available with the same level of granularity, presenting a limitation in the analysis.

I. Data sources and transformations

In all databases, blank spaces have been eliminated, as data points were not available during weekends and festivities.

CDS

Credit default swaps (CDS) are widely utilized as indicators of sovereign and financial risk, as demonstrated in studies such Andretto (2024), Plăcintă *et al.* (2024) and Gamboa-Estrada & Romero (2024). For this model, the CDS spread for sovereign debt was obtained from Bloomberg, using the closing price for a five-year range for each country. To calculate the European CDS, a weighted average approach was employed, focusing on the four largest economies in the European Union—Germany, France, Italy, and Spain—based on their GDP. The GDP data, sourced from the World Bank, is reported annually, meaning the weighted average factors remain consistent throughout each year. This methodology ensures that the European CDS variable reflects an accurate representation of regional sovereign risk, accounting for the relative economic size of these key economies.

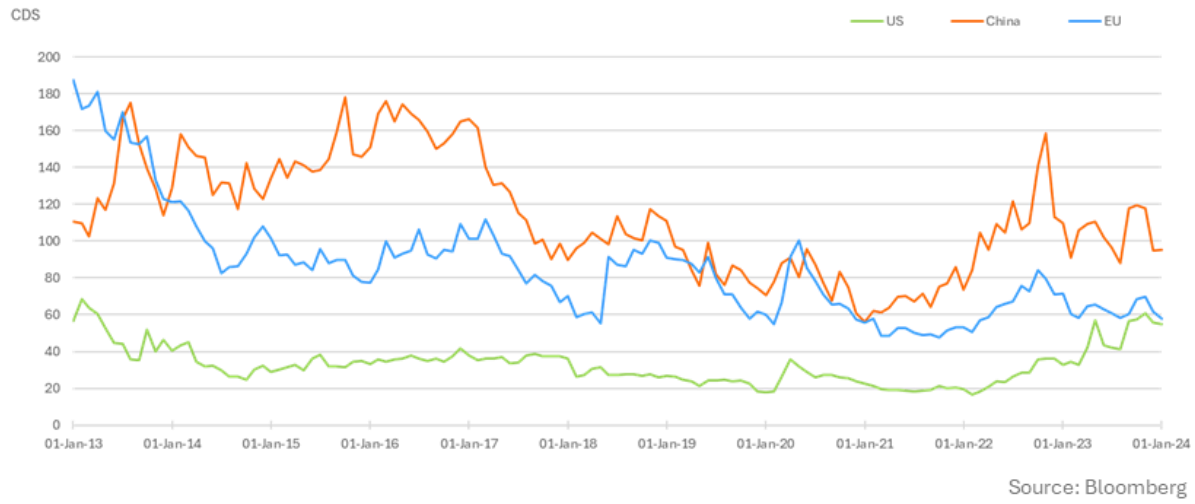

Figure 1. Monthly CDS spreads in US, China, and the EU

Spillovers

Financial markets are deeply interconnected, as variables from one market often influence economies in other regions. A prominent framework for understanding this interconnectedness is the global financial cycle theory proposed by Hélène Rey (2018), which posits that macroeconomic variables from major economies, particularly the United States, exert significant influence on other countries. Building on this foundation, this study examines how sovereign risk is shaped by geopolitical factors and how these risks are interconnected across major economies.

To analyze this interconnectedness, we employ the methodology developed by Diebold and Yilmaz (2014) to measure sovereign risk linkages between the Chinese, American, and European markets. This approach utilizes a dynamic connectedness index, which quantifies how shocks in one financial market propagate to others, based on forecast error variance decompositions derived from vector autoregressions (VARs). This method allows for the calculation of both total and directional spillovers, offering insights into the extent and direction of sovereign risk transmission between these economies. For a comprehensive explanation of this methodology, see Andrada-Félix *et al*. (2020). This analytical framework provides a robust tool to study the interconnected nature of sovereign risk in the context of geopolitical factors.

On Figure 2, we observe that American spillovers predominantly affect its own domestic market, with notable exceptions during events like the European debt crisis, where external

factors briefly influenced US financial dynamics. In contrast, both China and the European Union exhibit a greater degree of interconnectedness, with their sovereign risks being more significantly impacted by their counterparts. This highlights the broader influence of external factors on their economies. Additionally, the data reveals substantial month-to-month variation.

These findings suggest that the US economy remains relatively insulated, with its sovereign risk largely constrained by internal factors. On the other hand, the Chinese and European economies are more exposed to external shocks, demonstrating their greater susceptibility to fluctuations in the global economic environment.

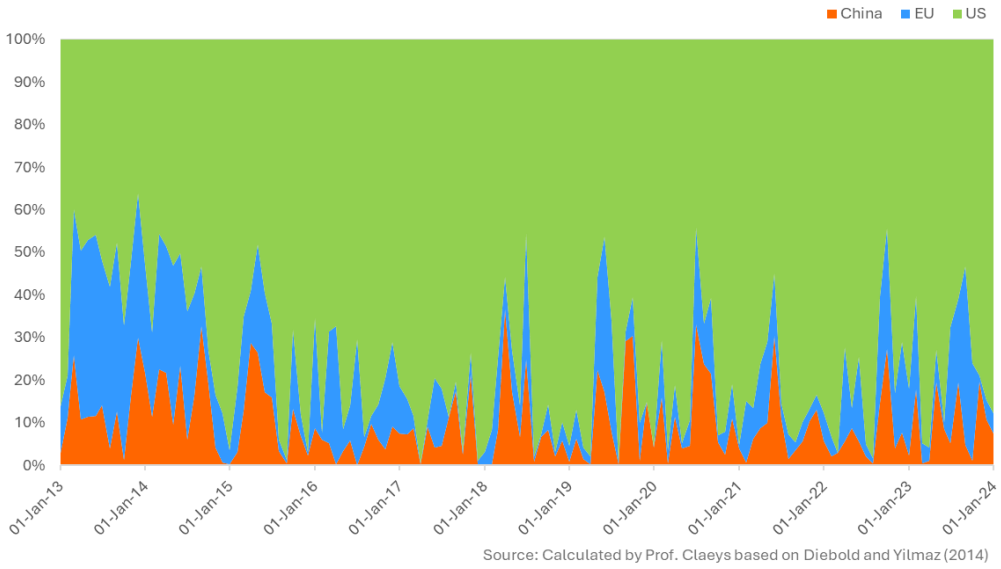

Figure 2. Bilateral spillover from the US

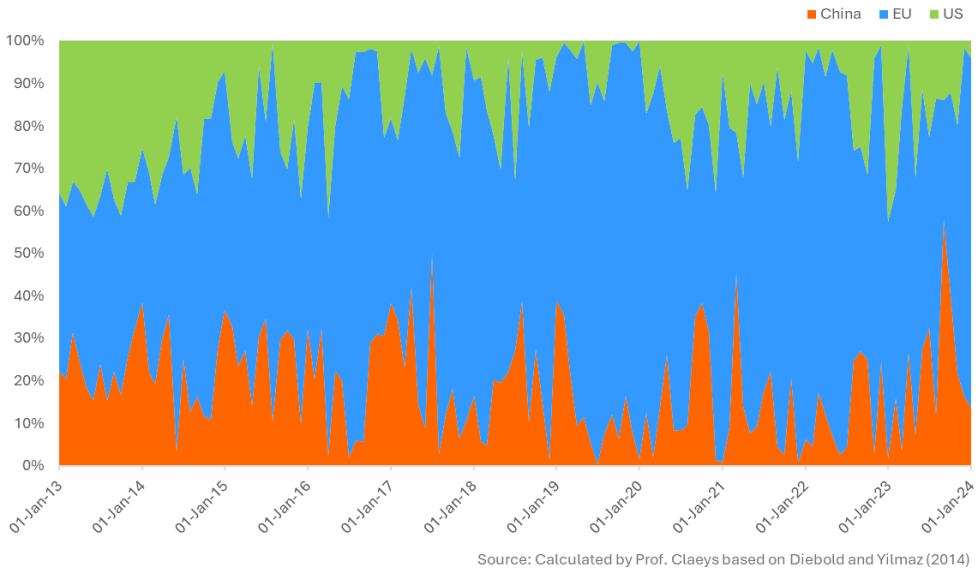

Figure 3. Bilateral spillover from the EU

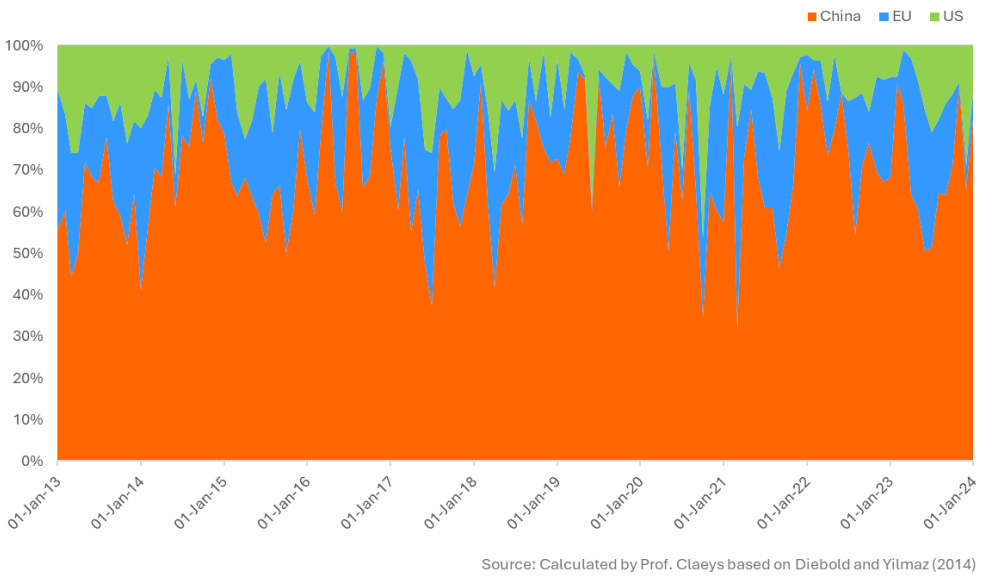

Figure 4. Bilateral spillover from China

Interest rates

When interest rates approach the zero lower bound (ZLB), their effectiveness in stimulating the economy diminishes, as they cannot be reduced further. In such scenarios, central banks resort to alternative methods to influence economic activity. To model this, the theoretical interest rate known as the shadow rate, as proposed by Wu and Xia (2016), is used. The shadow rate estimates where the nominal interest rate would be if it were not constrained by the ZLB,

providing a more accurate representation of monetary policy under these conditions.

For this analysis, shadow rates are used for the European and American economies when available in the monthly database. Specifically, the shadow rate is applied until August 2022 for the European economy and June 2023 for the American economy. Beyond these dates, and for the daily database, the nominal interest rate as reported by the central bank is used. For Europe, the Main Refinancing Operation rate from the European Central Bank is applied, while for the United States, the Federal Funds Effective Rate is utilized. In the case of the Chinese economy, interest rate data is sourced from the American Federal Reserve repository, specifically the Discount Rate for China. This approach ensures consistency and accuracy across all datasets while accounting for the specific dynamics of monetary policy in each region.

Volatility

To measure financial market volatility, this study utilizes two key indices: the VIX and the MOVE. The VIX, often referred to as the "fear gauge," measures the expected volatility of the S&P 500, offering insights into equity market uncertainty. On the other hand, the MOVE index captures the volatility of US Treasury yields, serving as an indicator of expectations and uncertainty in the bond market. These indices are critical for understanding the broader market's impact on sovereign risk, as measured by credit default swaps (CDS). Specifically, the MOVE is used as a proxy for global volatility in bond markets, while the VIX represents volatility in equity markets. The data for both indices was sourced from Yahoo Finance, ensuring reliable and accessible inputs for the analysis. This dual approach provides a comprehensive measure of market risk and its potential influence on sovereign risk.

Ccbbss5y

As a proxy for funding liquidity stress, we use the cross-currency basis swap spread at 5-year (CCBBSS5y). The CCBSS5y reflects the supply and demand dynamics for funding in different currencies over a five-year horizon. A widening spread might indicate increased demand for one currency relative to the other or heightened credit risk.

Geopolitics

To measure geopolitical conflict, this study employs two indices: the Geopolitical Risk Index (GPR) and the BBVA Geopolitical Index. Both indices serve as key tools for capturing geopolitical tensions, and their comparative strengths and limitations will be analyzed in detail in Chapter 6. The BBVA index, which provides data on a daily basis, is converted to monthly data by taking the first value of each month. Meanwhile, the GPR offers both daily and monthly data for global and country-specific indices, making it highly versatile for different analytical needs.

The GPR measures the frequency of specific words related to geopolitical conflict across 10 newspapers for the global index and additional newspapers for country-specific indices. It categorizes these words into eight distinct groups: War Threats, Peace Threats, Military Buildups, Nuclear Threats, Terror Threats, Beginning of War, Escalation of War, and Terror Acts. With data available since 1985, the GPR is widely used due to its extensive historical coverage and its ability to track geopolitical tensions over time.

In contrast, the BBVA Geopolitical Index leverages artificial intelligence to analyze unstructured data from 150 international and regional newspapers across 100 sources. Unlike the GPR, the BBVA index goes beyond simple word counting by providing both an index and a sentiment analysis of how geopolitical events are perceived globally or within specific countries. This AI-driven approach allows for a deeper understanding of the emotional and contextual impact of geopolitical events, offering a more nuanced perspective. Together, these indices provide complementary insights into the dynamics of geopolitical conflict.

On Figure 5, we observe the three country-specific indices for geopolitical risk: the United States, the European Union, and China. These indices exhibit broadly similar trends, suggesting a certain degree of alignment in how geopolitical risks are perceived across these regions. The correlations among the Geopolitical Risk Indices (GPR) further reflect this interdependence: the correlation between the US and China is 0.69, between the US and the EU is 0.81, and between the EU and China is 0.51. These values indicate a particularly strong relationship between the US and the EU, with a more moderate connection involving China.

In contrast, the BBVA Geopolitical Index reveals a lower degree of interdependence across the regions. The correlations are significantly weaker, with US/China at 0.43, US/EU at 0.41, and EU/China at 0.33. This disparity highlights the methodological differences between the two indices. While the GPR focuses on word frequency from specific news sources, the BBVA index uses AI and NLP techniques to derive sentiment and contextual understanding, capturing more nuanced regional variations. These differences underline the complementary nature of the two indices in assessing geopolitical risk across different global contexts, which will be explored further in Chapter 6.

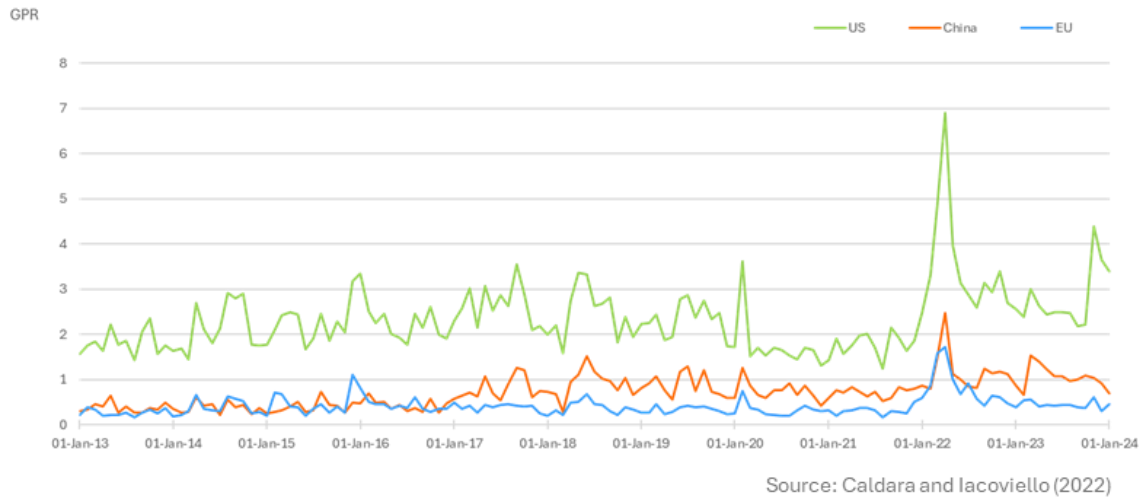

Figure 5. Country-specific GPR index (China, US, EU)

Economic uncertainty

The Economic Policy Uncertainty Index (EPU) is constructed in a manner similar to the Geopolitical Risk Index (GPR), relying on the frequency of specific keywords in news articles. This index calculates a monthly average by counting articles that mention terms related to uncertainty, regulation, or deficit, among others. Each newspaper's monthly data is standardized to a unit standard deviation based on a predefined date range, and the results are averaged across all newspapers. Finally, the index is normalized to a base value of 100, ensuring consistency and comparability across different time periods.

The EPU further tailors its keyword searches to the linguistic and contextual nuances of each country. For example, in Spain, the search includes terms such as "incert," "inestabl,"

"economia," or "Moncloa," reflecting localized concerns. The European EPU index is constructed using prominent newspapers from five major economies: Le Monde and Le Figaro for France, Handelsblatt and Frankfurter Allgemeine Zeitung for Germany, Corriere Della Sera and La Stampa for Italy, El Mundo and El País for Spain, and The Times of London and the Financial Times for the United Kingdom. In the United States, the index draws from a broader pool of publications, including USA Today, the Miami Herald, the Chicago Tribune, the Washington Post, the Los Angeles Times, the Boston Globe, the San Francisco Chronicle, the Dallas Morning News, the Houston Chronicle, and the Wall Street Journal. The Chinese index is based on two state-run newspapers: the Renmin Daily and the Guangming Daily.

By leveraging country-specific searches and a diverse range of newspapers, the EPU captures variations in economic uncertainty across different regions, providing a granular and localized measure of policy-related risks.

II. Descriptive analysis

Overall, we use three databases in our analysis: one for the monthly regression and two for the daily analysis. The daily databases differ based on the geopolitical risk index employed; one incorporates the BBVA Geopolitical Risk Index, while the other utilizes the GPR. Each database covers a specific time range, providing the necessary granularity and scope for the respective analyses. The details of these ranges are outlined below:

- Daily regression: from December 2012 to December 2023.
- Daily regression with the BBVA index: from March 2017 to December 2023.
- Daily regression: from December 2012 to December 2023.

Daily regression w/o BBVA index

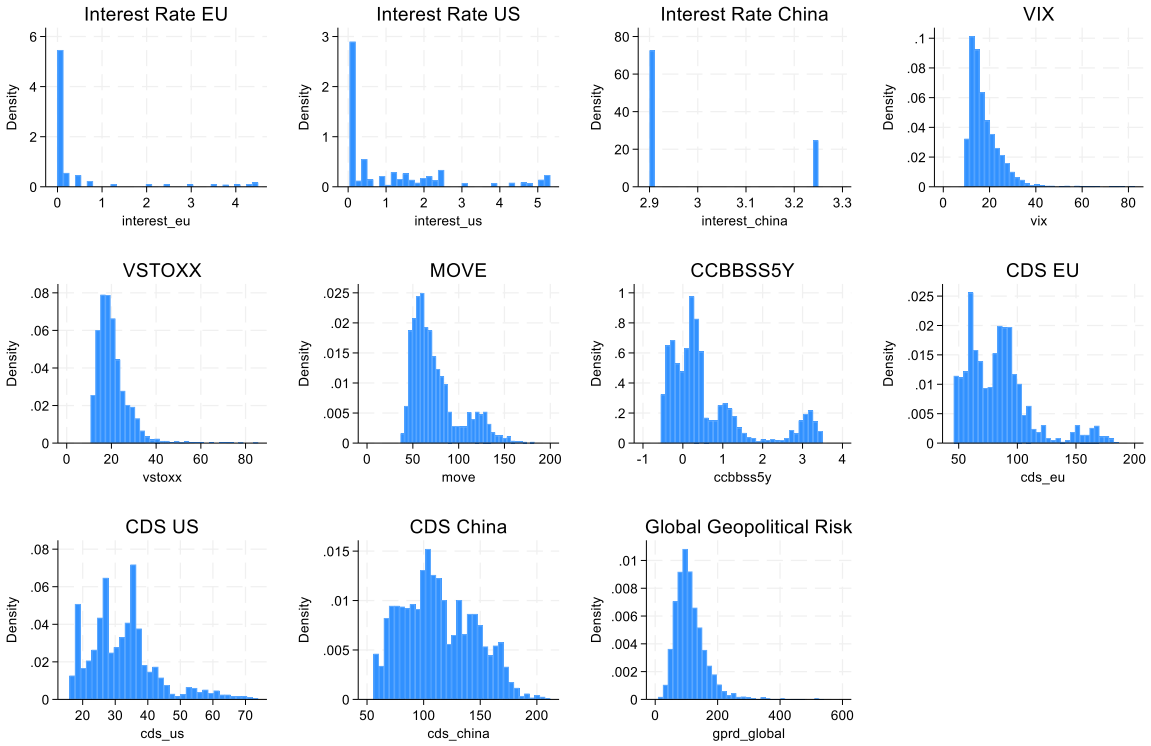

Figure 6. Histograms daily database: Dec. 2012 to Dec. 2023

- The distribution of EU interest rates shows a sharp peak at lower levels, indicating that most of the values are concentrated around near-zero interest rates.
- US interest rates also show a similar concentration near lower levels, with a slightly broader spread compared to the EU rates. This indicates a more diverse range of interest rates in the US over the analyzed period.
- The distribution of Chinese interest rates is narrow and concentrated within a specific range around 3.0–3.3. This suggests low volatility and consistent interest rate policies during the analyzed period.
- The VIX distribution indicates a strong skew towards lower levels, with most values concentrated below 20. This suggests relatively stable market conditions, with occasional spikes in volatility.
- The distribution of VSTOXX, a European volatility index, resembles VIX with values clustering at low levels, but with a slightly broader spread. This reflects periods of moderate market uncertainty in Europe.

- MOVE index displays a bell-shaped distribution with most values concentrated around 60–100. This highlights moderate fluctuations in bond market volatility.
- The CCBBSS5y graph shows a bimodal distribution, indicating that funding liquidity stress has fluctuated between two distinct ranges. Such behavior may reflect shifts in economic conditions or credit risks.
- The EU CDS spreads show a right-skewed distribution with most values concentrated below 100, indicating relatively stable credit risks for European entities with occasional extreme events.
- Similar to CDS EU, the US CDS spreads show a peak at lower levels, with a narrower spread. This suggests the US credit market experiences slightly less volatility than the EU.
- The distribution of Chinese CDS spreads is broader and slightly more uniform, indicating a higher degree of variability in credit risks for China over time.
- The GPR distribution is skewed to the left, with a concentration of values around 0–100, indicating relatively low geopolitical risk in most periods, with rare but significant spikes.

Table 1. Correlation table daily database: Dec. 2012 to Dec. 2023

	Interest rate EU	Interest rate US	Interest rate China	VIX	VSTOXX	MOVE	CCBBSS5y	CDS EU	CDS US	CDS China	GPR
Interest rate EU	1										
Interest rate US	0.8237	1									
Interest rate China	-0.102	-0.4117	1								
VIX	-0.0287	-0.0461	-0.2393	1							
VSTOXX	-0.1068	-0.2414	-0.0301	0.8661	1						
MOVE	0.6223	0.5355	-0.0678	0.3326	0.352	1					
CCBBSS5y	0.8666	0.7268	0.0723	-0.0076	-0.0545	0.757	1				
CDS EU	-0.1286	-0.3097	0.6401	-0.1896	0.018	-0.1235	0.032	1			
CDS US	0.5615	0.2869	0.3145	-0.2268	-0.0827	0.2548	0.5551	0.566	1		
CDS China	-0.0232	-0.1675	0.4209	-0.1747	0.1631	0.2116	0.1645	0.5321	0.4282	1	
GPR	0.1302	0.1534	-0.1337	0.0538	0.0854	0.27	0.2093	-0.1576	-0.0097	0.0519	1

Table 1 reveals strong linkages between monetary policies and credit conditions, particularly in the US and EU, with a high positive correlation between their interest rates (0.8237) and a strong relationship between credit spreads (CCBSS5Y) and both EU and US interest rates. Conversely, Interest Rate China shows weak or negative correlations with global variables, reflecting China's isolated monetary policy stance. Sovereign risk, as measured by CDS, exhibits interdependence between regions, with the strongest correlation between CDS EU and CDS US (0.5551), while CDS China remains less connected. Market volatilities (VIX,

VSTOXX, and MOVE) display moderate correlations with each other, but weak links to geopolitical risk (GPR), indicating that geopolitical turmoil has limited direct influence on short-term market volatility.

Daily regression w/ BBVA index

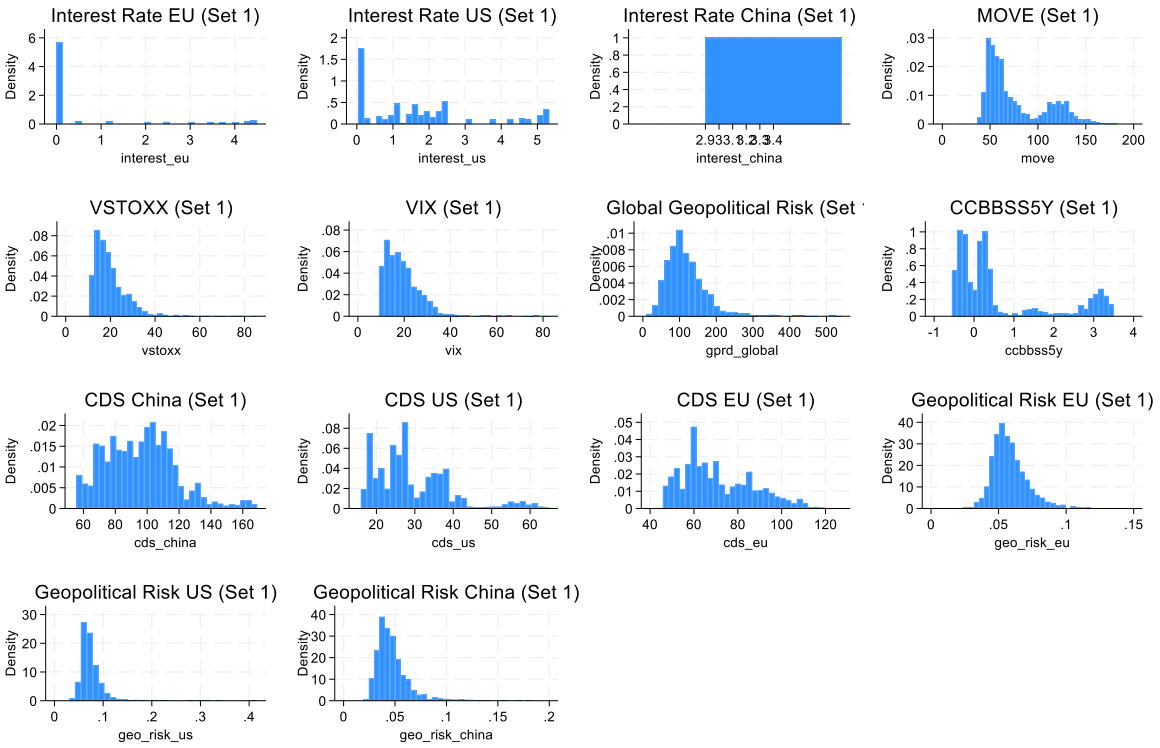

Figure 7. Histograms daily database: Mar. 2017 to Dec. 2023

- The EU interest rates still show a concentration at near-zero levels, indicating a continued policy of low or negative rates. This aligns with historical trends of accommodative monetary policies in Europe.
- The distribution remains broader for the US interest rate, with a higher frequency around the 1–2% range. This reflects the diverse monetary policy in the US compared to the EU during the adjusted timeframe.
- The distribution for China's interest rates constant at 2.9% over 6 years measured.
- The MOVE index distribution continues to center around 60–100, but there may be subtle changes in tail behavior, indicating slightly differing bond market volatility trends.
- European volatility (VSTOXX) shows a similar distribution to the prior graph, with low

values being dominant but a broader spread, suggesting there has been more volatility since 2017.

- The US volatility index (VIX) distribution remains skewed towards low levels, confirming market stability with occasional volatility peaks during the new period.
- The GPR distribution again highlights low average geopolitical risks but shows rare, sharp spikes. The tail appears slightly more extended, suggesting higher global uncertainty at certain moments.
- The bimodal distribution for the CCBBSS5y persists, indicating liquidity remained volatile with distinct phases of higher and lower credit risk during the revised timeframe.
- Chinese CDS is still broader, suggesting more instability for the Chinese bond market, peaking at higher values than its counterparts.
- The US CDS spreads maintain their lower concentration around 20–40, but the distribution appears slightly more peaked, indicating less variability in credit risks.
- European CDS spreads remain concentrated below 100, with a broader distribution, indicating ongoing concerns about credit risks in the region.
- The US geopolitical risk distribution is left-skewed, with most values near zero, indicating low average risk but with a few rare significant increases.
- Chinese geopolitical risk shows a sharper concentration near zero, with minimal outliers. This suggests fewer periods of elevated risk.
- The EU geopolitical risk distribution has a slightly longer tail, suggesting periods of greater uncertainty compared to the US and China.

Table 2. Correlation table daily database: Mar. 2017 to Dec. 2023

	Interest rate EU	Interest rate US	MOVE	VSTOXX	VIX	GPR	CCBBSS5y	CDS China	CDS US	CDS EU	Geo risk EU	Geo risk US	Geo risk China	Time
Interest rate EU	1													
Interest rate US	0.8699	1												
MOVE	0.658	0.5922	1											
VSTOXX	-0.0846	-0.2696	0.3469	1										
VIX	-0.0791	-0.2277	0.314	0.9461	1									
GPR	0.1387	0.1242	0.3177	0.1085	0.0202	1								
CCBBSS5y	0.8825	0.8443	0.8195	-0.0049	-0.0107	0.2616	1							
CDS China	0.2493	0.3665	0.424	-0.0542	-0.0524	0.2614	0.4746	1						
CDS US	0.778	0.7067	0.4416	-0.0964	-0.1457	0.1169	0.7094	0.5565	1					
CDS EU	-0.1824	0.0363	-0.1396	-0.0228	-0.0387	-0.0889	0.6031	0.2336	0.092	1				
Geo risk EU	0.0506	0.1361	-0.0457	-0.2115	-0.1982	0.0097	0.0233	0.041	0.0433	0.041	1			
Geo risk US	-0.0386	-0.1245	-0.055	-0.026	-0.0131	-0.092	-0.0955	-0.071	-0.0787	-0.071	0.4119	1		
Geo risk China	-0.0318	-0.0413	-0.0199	-0.0411	-0.0199	-0.0829	-0.1097	-0.112	-0.0912	0.3281	0.4265	0.3281	1	
Time	0.6587	0.42	0.7254	0.3129	0.3457	0.1635	0.647	-0.1584	0.1969	-0.5522	-0.0849	0.0297	0.0778	1

Table 2 continues to highlight strong positive relationships between Interest Rate EU and Interest Rate US (0.8699), as well as their close ties with CCBSS5Y (0.8832 and 0.8443,

respectively), emphasizing the interconnectedness of monetary policy and credit conditions in these regions. MOVE and VSTOXX show moderate correlations (0.5922 and 0.3469 with Interest Rate US), suggesting that bond and equity volatility are partially linked to US monetary policy. CDS China exhibits moderate correlations with MOVE (0.3665) and CCBSS5Y (0.4746), reflecting some sensitivity to global liquidity conditions. Geopolitical Risk EU shows weak to moderate negative correlations with most CDS variables, particularly CDS EU (-0.3281), indicating that geopolitical risks may reduce perceived sovereign risk in the EU.

Monthly regression

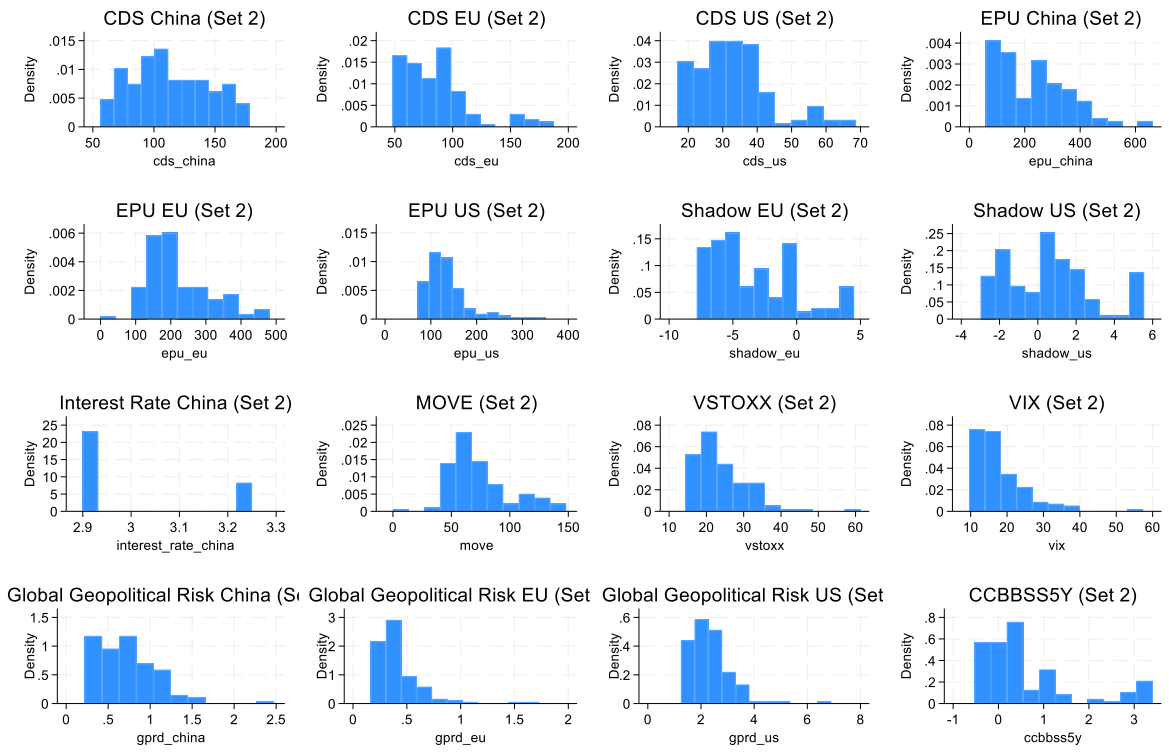

Figure 8. Histograms monthly database: Dec. 2012 to Dec. 2023

- The distribution of China's CDS spreads shows clustering around 100–150, a higher range than for the American and European CDS.
- The EU CDS spreads are concentrated below 100, but the distribution reveals a wider spread, suggesting variability in monthly credit risks for European entities.
- The US CDS spreads remain centered around 20–40, with a slight right skew. This indicates generally low credit risk with some occasional outliers.
- The Economic Policy Uncertainty index for China has a widespread, with values

peaking around 100–200. This highlights periodic uncertainty spikes in China's policy environment on a monthly basis.

- The European EPU distribution is broader and peaks between 100–200, showing moderate monthly policy uncertainty with occasional higher periods.
- The US EPU index has a similar distribution to the EU, but with slightly more observations in the lower ranges, suggesting relatively stable monthly policy uncertainty.
- The distribution of shadow rates in the EU is centered around -5 to 0, reflecting accommodative monetary policy with negative interest rates in many months.
- The US shadow rates cluster around 0 to -2, indicating the use of near-zero or slightly negative policy rates during certain periods to stimulate economic activity.
- The Chinese interest rate distribution remains highly concentrated around 3.0–3.2, reflecting consistency in monetary policy on a monthly basis.
- The MOVE index has a peak around 60–100, with lower occurrences beyond this range, indicating stable monthly bond market volatility with occasional spikes.
- The European volatility index shows a peak below 20–30, with a gradual tapering, reflecting lower market uncertainty in most months with periodic higher volatility.
- The US volatility index (VIX) is sharply concentrated around 10–20, with most months experiencing low volatility, suggesting steady market conditions on average.
- The geopolitical risk for China clusters below 1, with few months showing higher risks, suggesting overall low but stable geopolitical risk.
- The EU geopolitical risk distribution is similar to China's, with most values below 1, indicating overall low monthly geopolitical risk.
- The US geopolitical risk distribution is slightly broader but still centered below 1, indicating manageable monthly geopolitical tensions. It is noteworthy how the BBVA and GPR are inversely related, being the US which has the broader range with the GPR, and the narrower with the BBVA. This can be an effect of the GPR skewed towards American news and perspectives topics.
- The liquidity stress peaks around 0–1, with occasional higher spreads, indicating relatively stable credit markets with intermittent liquidity scarcity.

Table 3. Correlation table monthly database: Dec. 2012 to Dec. 2023

	CDS China	CDS EU	CDS US	EPU China	EPU EU	EPU US	Interest rate EU	Interest rate US	Interest rate China	MOVE	VSTOXX	VIX	GPR China	GPR EU	GPR US	CCBBSS5y	Time
CDS China	1																
CDS EU	0.5374	1															
CDS US	0.4153	0.5843	1														
EPU China	-0.6494	-0.4941	-0.3807	1													
EPU EU	-0.1292	-0.2548	0.0001	0.4406	1												
EPU US	-0.4525	-0.178	-0.1938	0.6031	0.5107	1											
Interest rate EU	0.4019	0.2459	0.6904	-0.3334	0.1682	-0.3233	1										
Interest rate US	-0.1988	-0.3759	0.1781	0.4733	0.4708	0.1509	0.2569	1									
Interest rate China	0.4511	0.6514	0.3311	-0.6205	-0.4246	-0.3373	0.3838	-0.6541	1								
MOVE	0.1936	-0.1209	0.1842	0.0268	0.663	0.0368	0.5727	0.4337	-0.0525	1							
VSTOXX	0.0899	-0.0973	-0.0985	-0.0642	0.2664	0.4856	-0.1169	0.144	0.1886	1							
VIX	-0.2377	-0.2137	-0.2255	0.43	0.5203	0.733	-0.1522	0.094	-0.2156	0.2076	0.5049	1					
GPR China	-0.3955	-0.4595	-0.178	0.5255	0.4752	0.2428	-0.0413	0.5988	-0.5681	0.3427	-0.1134	0.1984	1				
GPR EU	0.0688	-0.2616	-0.166	0.0285	0.3373	-0.0397	0.0863	0.1328	-0.1823	0.3573	0.1033	0.1417	0.5087	1			
GPR US	0.0532	-0.2534	-0.0285	0.0616	0.2915	-0.1279	0.1722	0.3518	-0.2523	0.343	-0.142	-0.0093	0.6817	0.8141	1		
CCBBSS5y	0.1643	0.0288	0.5565	-0.0199	0.406	-0.1406	0.8993	0.5727	0.0604	0.6934	-0.1635	-0.0153	0.2887	0.1788	0.3118	1	
Time	-0.6076	-0.772	-0.2823	0.6923	0.6253	0.4313	-0.0104	0.695	-0.7628	0.3909	-0.0298	0.3948	0.6626	0.2395	0.2956	0.3266	1

Table 3 highlights distinct relationships between sovereign risk, economic policy uncertainty, interest rates, and geopolitical risk. CDS China shows a moderate positive correlation with CDS EU (0.5374) and CDS US (0.4153), indicating some global linkages in sovereign risk on a monthly basis, though weaker compared to EU-US interdependencies. Economic Policy Uncertainty (EPU) displays regional differences, with EPU China negatively correlated with CDS China (-0.6494) and moderately with CDS EU and CDS US, reflecting a divergence in how uncertainty impacts these regions. The interest rates in the EU and US are highly correlated (0.5727), consistent with integrated monetary policy trends. Geopolitical risk (GPR) exhibits moderate correlations with CDS measures, particularly GPR EU with CDS EU (0.2387), suggesting a localized impact of geopolitical tensions.

III. Quantitative analysis

In this section, we apply quantitative research (OLS and VAR analysis) to support the model developed in Chapter 4. The research is focused on the current dynamics between the three major economic blocs: the United States, China, and the European Union. The model is employed to explore how each of these economies might respond to an increasingly unstable global environment.

First, we analyze sovereign debt holdings, as shown in Figure 9, Figure 10 and Figure 11 (Arslanalp & Tsuda, 2014). The data reveals that most sovereign debt is held domestically, with foreign debt comprising approximately 25% in the United States, around 40% in Europe, and a negligible amount for China. In the case of Europe, the relatively high level of foreign debt holdings can largely be attributed to intra-European ownership, reflecting the integrated nature of European financial markets. Moreover, as highlighted by Hodula and Libich (2023),

shadow banking has played an increasingly significant role in the sovereign debt markets of the US and Europe since 1999. A substantial proportion of debt in these regions is now held within the shadow banking system.

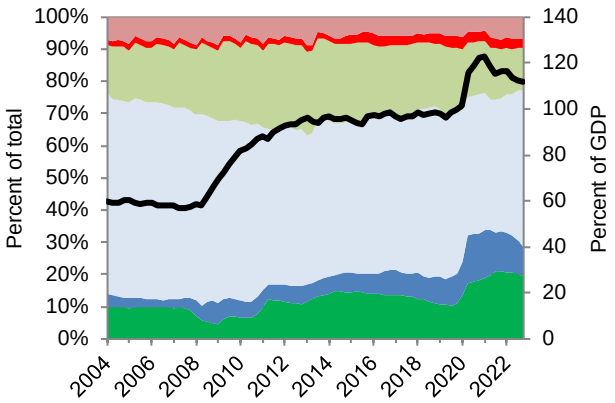

Figure 9. American sovereign debt holdings

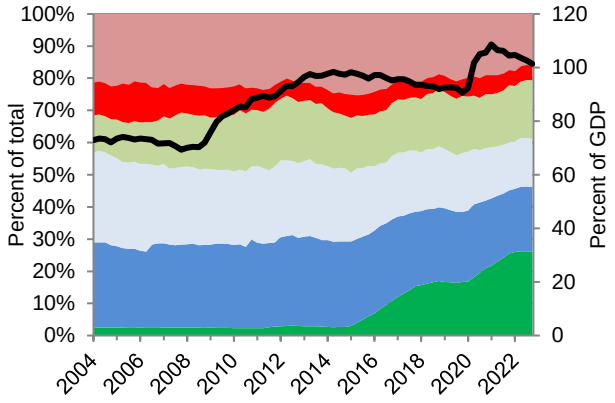

Figure 10. European sovereign debt holdings

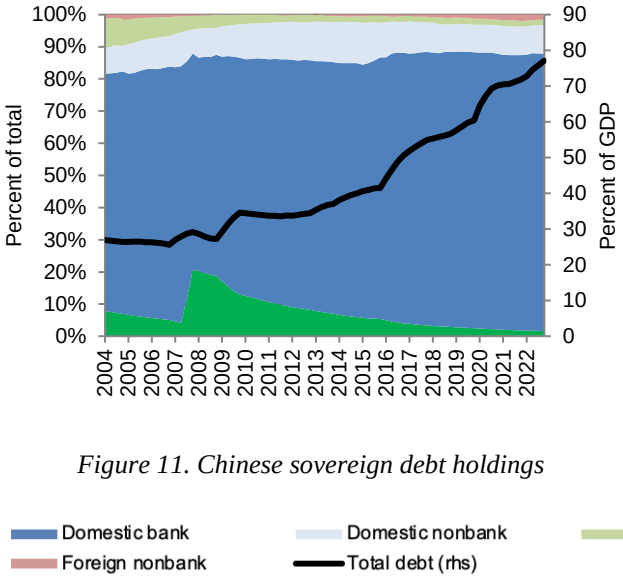

Figure 11. Chinese sovereign debt holdings

Notes: data constructed from the updated version of Arslanalp and Tsuda (2014).

To test the model, we examine whether geopolitical risk, as measured by the GPR or BBVA index, influences sovereign risk, represented by CDS spreads. The underlying hypothesis is that if a country engages in significant bilateral lending, heightened geopolitical tensions in the debtor nation should increase the lender's sovereign risk due to potential doubts about future debt repayment. Additionally, geopolitical tensions may prompt the lender to escalate the conflict as a means of ensuring repayment, further intertwining geopolitical and financial dynamics.

Moreover, if geopolitical risk impacts spillovers, it suggests that financial risks transferring from one country to another are also affected by geopolitical tensions. This amplifies the connection between geopolitical instability and sovereign risk, reinforcing the model's premise that geopolitical factors are integral to understanding sovereign debt dynamics and their cross-border implications.

Geopolitical effect on CDS

We examine various variables that may influence CDS spreads in the first model. The analysis primarily utilizes the daily dataset, based on the assumption that financial markets tend to process and incorporate information on a daily basis. This approach allows for capturing more immediate reactions to market developments. However, on the monthly dataset, distinguishing

the specific impact of geopolitical variables from the general market noise can be challenging unless there is a significant geopolitical shock.

Despite the advantages of daily data, some key variables, such as the Economic Policy Uncertainty Index (EPU) or the country-specific GPR, are only available monthly. As a result, using the daily dataset entails a trade-off, as some potentially valuable information is lost due to the lower granularity of these variables. Refer to Appendix A for the monthly results.

Table 4 reveals that the GPR has a significant impact on the sovereign risk of the European Union and the United States, whereas it does not appear to influence China. While it might initially seem intuitive to expect a positive relationship between the GPR and sovereign risk—indicating higher geopolitical risk leading to increased CDS spreads—this model uses the global GPR. As a result, during periods of global turmoil, the US and EU often act as safe havens, attracting capital and experiencing lower relative sovereign risk, as noted by Gourinchas and Rey (2022). In contrast, China seems insulated from global geopolitical risk, which can likely be attributed to its relatively closed financial system and limited integration with international capital markets. This insulation diminishes the impact of external geopolitical events on its sovereign risk.

Table 4. Reg. model: effect of the GPR on the CDS (daily)

	(a) China	**(b) EU**	**(c) US**
GPR	0.000	-0.044***	-0.009***
Interest rate EU	-7.109***	-6.379***	6.535***
Interest rate US	-6.553***	-1.932***	-2.869***
Interest China	44.121***	93.982***	9.495***
MOVE	0.565***	-0.207***	-0.079***
VIX	-1.336***	-0.021	-0.177***
CCBBSS5y	6.928***	12.177***	4.100***
Constant	-30.616*	-177.948***	11.888***
N	2,651	2,651	2,651
R2	0.337	0.446	0.515
R2 adj	0.335	0.444	0.513

note: .01 - ***; .05 - **; .1 - *;

Table 5 employs the BBVA Geopolitical Index, which offers a distinct perspective compared to the GPR. Unlike the GPR, which is often criticized for its Western-centric viewpoint, the BBVA index is designed to account for country-specific nuances, focusing more on domestic protests and tensions rather than international conflicts. This approach provides a more

localized understanding of geopolitical risk, capturing dynamics that might otherwise be overlooked in broader, globally oriented indices.

One adjustment in this analysis is the exclusion of the Chinese interest rate variable, as it remains constant throughout the sample period. Additionally, given the differing timeframes used for the GPR and BBVA indices, the results from this table should not be directly compared to those in Table 1. Instead, each set of findings should be interpreted independently, with an understanding of the unique methodologies and time horizons underpinning the respective analyses. This distinction ensures a clearer interpretation of how sovereign risk is influenced under different geopolitical risk measurements.

The European and American indices do not have any significant effect on the sovereign risk of any country. Meanwhile, the Chinese index has a significant effect on China and the US. On both cases, negative geopolitical events decrease the credit default risks of the countries. This could be explained as negative relations between both countries affecting equity markets, and investors transferring their assets to debt. Also, if investors do not see the risk of war, or that the geopolitical events pose a real danger to the country's capabilities to repay its debt, then the debt market might be seen as more secure during turmoil. The idea of investors turning to bond markets as a safe haven during times of geopolitical turmoil is further supported by Imtiaz *et al.* (2023). In their study on CDS spreads for banks, they observe that while the CDS spreads of non-Global Systemically Important Banks (non-G-SIBs) increase with adverse geopolitical events, the CDS spreads of G-SIBs decrease. This finding implies that the market perceives G-SIB bonds as safe assets during periods of heightened geopolitical risk. Similarly, in this analysis, the sovereign bonds of the three major economies exhibit behavior similar to that of G-SIB bonds, reinforcing the notion that state bonds are viewed as stable and reliable investments amidst uncertainty.

Table 5. Reg. model: effect of the BBVA Geopolitical Index on the CDS (daily)

	(a) China	(b) EU	(c) US
Geo risk EU	54.258	18.100	11.572
Geo risk US	13.372	4.742	-10.103
Geo risk China	-102.707***	-38.490	-22.980**
Interest rate EU	-14.584***	-12.096***	4.530***
Interest rate US	3.179***	8.960***	0.017
Interest rate China	(dropped)	(dropped)	(dropped)
MOVE	0.091***	-0.195***	-0.090***
VIX	-0.256***	0.544***	-0.000
CCBBSS5y	16.667***	4.499***	3.169***
Constant	87.091***	64.872***	32.705***
N	1,701	1,701	1,701
R2	0.381	0.247	0.639
R2 adj	0.379	0.243	0.637

note: .01 - ***; .05 - **; .1 - *;

Table 6,Table 7 and Table 8 present the results of the vector autoregression (VAR) model, conducted using the BBVA Geopolitical Index. This index was chosen because the GPR does not provide daily country-specific data, which is crucial for capturing the immediate effects of geopolitical events on financial markets. Given that financial markets incorporate information on a daily basis, it was deemed unnecessary to extend the analysis to a monthly timeframe to examine lagged effects, as doing so would likely introduce excessive noise into the results, making it difficult to identify significant impacts. This decision was further supported by model selection criteria. Using the Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), and Hannan-Quinn Information Criterion (HQIC), the analysis determined that a single lag was optimal for the monthly VAR model.

Across all cases, the most significant variable influencing the CDS is the lagged CDS, with one notable exception: the US geopolitical index demonstrates an effect on CDS with a three-period lag. Interestingly, this effect is negative, indicating that an increase in the geopolitical index leads to a reduction in the CDS. This aligns with earlier observations suggesting that geopolitical tensions may prompt investors to shift assets into sovereign debt, which is often perceived as a safer investment during times of uncertainty.

The impulse response functions (see Figure 12, Figure 13 and Figure 14) provide additional insights into this relationship. They show that an increase in a country's geopolitical index reduces its own CDS, but the confidence intervals are too wide for the results to be statistically

significant. This lack of significance can likely be attributed to the inherent noise in financial markets, which are influenced by a multitude of variables. Additionally, most geopolitical events are not substantial enough to have a discernible impact on financial markets. This supports the need for future research to focus on specific, highly significant geopolitical events that are likely to produce clearer and more measurable impacts.

Table 6. VAR model: effect of the BBVA European Geopolitical Index on the CDS (daily)

	(a) CDS	(b) GEO risk EU
CDS EU - L1	0.946***	-0.000
CDS EU - L2	0.065	0.000
CDS EU - L3	-0.022	-0.000
Geo risk EU - L1	-6.050	0.590***
Geo risk EU - L2	4.917	0.084
Geo risk EU - L3	-1.984	0.061
Constant	0.973*	0.014***
N	598	

note: .01 - ***; .05 - **; .1 - *;

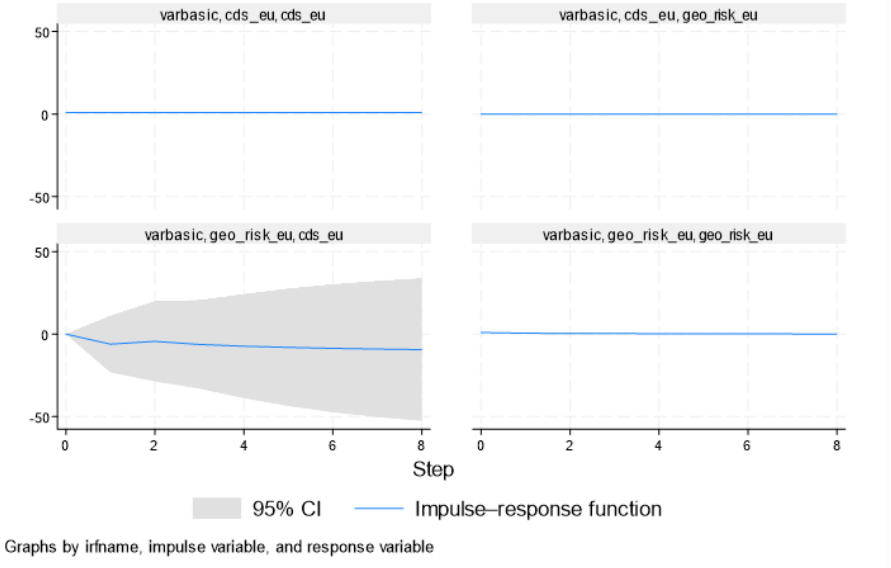

Figure 12. Impulse response graph - BBVA European Geopolitical Index on the CDS

Table 7. VAR model: effect of the BBVA American Geopolitical Index on the CDS (daily)

	(a) CDS	(b) GEO risk US
CDS US - L1	0.831***	-0.001
CDS US - L2	0.170**	-0.000
CDS US - L3	-0.001	0.001
Geo risk US - L1	1.135	0.735***
Geo risk US - L2	-4.610	0.022
Geo risk US - L3	4.743*	0.024
Constant	-0.048	0.019***
N	598	

note: .01 - ***; .05 - **; .1 - *;

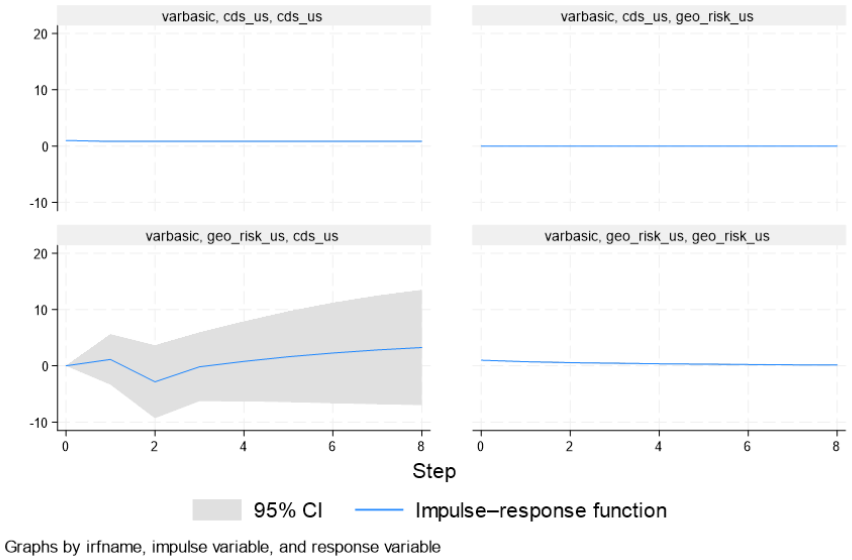

Figure 13. Impulse response graph - BBVA American Geopolitical Index on the CDS

Table 8. VAR model: effect of the BBVA Chinese Geopolitical Index on the CDS (daily)

	(a) CDS	(b) GEO risk China
CDS China - L1	0.997***	-0.000
CDS China - L2	-0.161***	0.000
CDS China - L3	0.153***	-0.000
Geo Risk China - L1	-7.590	0.569***
Geo Risk China - L2	6.605	0.048
Geo Risk China - L3	-9.298	0.128***
Constant	1.483*	0.011***
N	598	

note: .01 - ***; .05 - **; .1 - *;

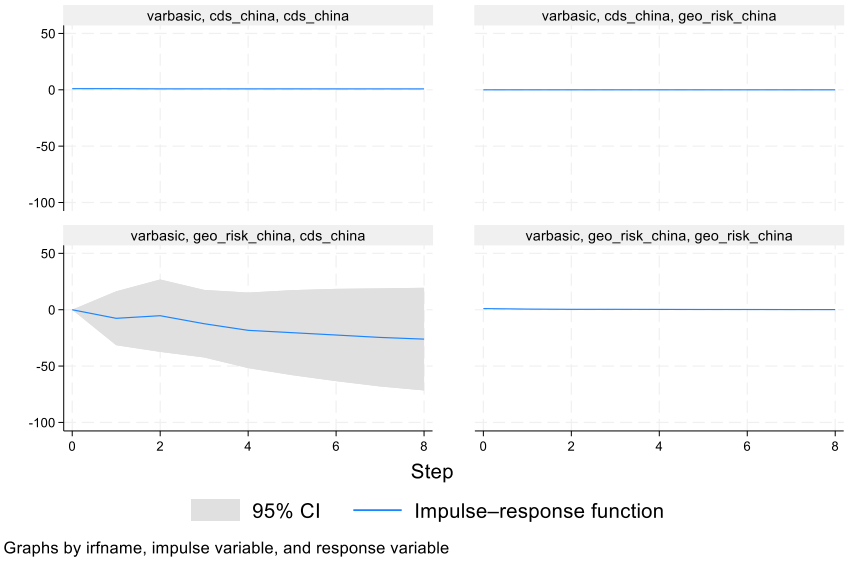

Figure 14. Impulse response graph - BBVA Chinese Geopolitical Index on the CDS

Geopolitical effect on CDS spillovers

In this section, we analyze how sovereign risk is transferred between nations, focusing on whether it is influenced by geopolitical factors. The goal is to understand if and how geopolitical effects alter the dynamics of risk transfer, depending on the level of financial interconnectedness and the degree of rivalry between economic blocs. To achieve this, we utilize the daily dataset, as it provides a more precise view of market responses. By capturing daily fluctuations, this approach minimizes the noise that accumulates in financial markets over the course of a month, offering a clearer and more immediate perspective on how geopolitical tensions influence the transmission of sovereign risk across nations.

Table 9 presents the results of the OLS model analyzing directional spillovers with the GPR. A notable finding is that the relationship between the EU and the US is unaffected by geopolitical events. This could be attributed to the two blocs responding similarly to global geopolitical dynamics, thereby mitigating any measurable impact on their financial interconnectedness. Interestingly, all significant geopolitical events reduce spillovers, suggesting that such events decrease the spread of financial risk between markets. This aligns with previous observations that geopolitical distortions can reduce CDS spreads, as investors shift assets into perceived safer investments like sovereign debt during times of uncertainty.

However, there is one exception: the spillover from the EU to China. In this case, global geopolitical events increase the spillover, possibly reflecting unique economic or financial linkages between the two regions that amplify risk transmission during periods of heightened geopolitical tension.

Table 9. Reg. model: effect of the GPR on the spillover (daily)[1]

	(a) China -> US	(b) China -> EU	(c) US -> China	(d) US -> EU	(e) EU -> China	(f) EU -> US
GPR	-0.013***	-0.012**	-0.007*	-0.002	0.027***	0.003
Interest rate EU	3.398***	2.835***	0.122	0.916*	4.138***	-1.996***
Interest rate US	-0.010	1.431***	1.778***	-2.116***	1.791***	0.417
Interest rate China	-0.710	31.121***	-5.034***	-22.099***	24.221***	5.663**
MOVE	0.094***	0.240***	-0.110***	-0.078***	0.158***	0.115***
VIX	-0.011	0.348***	0.157***	0.012	-0.183***	0.272***
CCBBSS5y	-5.866***	-9.517***	0.414	6.072***	-7.291***	0.996
Constant	10.322	-94.597***	28.307***	80.872***	-65.299***	-15.700*
N	2,651	2,651	2,651	2,651	2,651	2,651
R2	0.050	0.127	0.080	0.118	0.077	0.070
R2 adj	0.048	0.125	0.077	0.116	0.075	0.068

note: .01 - ***; .05 - **; .1 - *;

Studying spillovers using a country-specific index is particularly valuable as it allows for the localization of the conflict's origin and the assessment of how it influences risk transmission to other regions. This approach provides insights into the direct impact of geopolitical events on sovereign risk and financial interconnectedness. Expanding the research to focus on specific events that involve particular regions would add an additional layer of detail, enhancing the analysis. For example, while the current model tracks all geopolitical events involving the US, some of these events may not directly affect its financial relationship with the EU or China. Narrowing the scope to regionally relevant conflicts would refine the understanding of spillover effects.

Table 10 reveals intriguing dynamics in how geopolitical events impact CDS spread spillovers. Geopolitical events originating in the EU show no significant effect on risk spillovers to other nations, indicating a limited influence of EU-specific events on global risk transmission. In contrast, events originating in the US significantly affect the relationship between the US and the EU. Specifically, US geopolitical events reduce the bidirectional risk transmission between these two blocs, suggesting that such events dampen their financial interconnectedness. However, US events simultaneously increase the risk transferred from China to the EU, highlighting how geopolitical tensions in one region can alter financial dynamics between

[1] See Appendix for the SUR results. The Seemingly Unrelated Regression (SUR) method was employed to ensure that the equations were not interrelated through correlations in the residuals.

unrelated regions. Events originating in China also increase the risk transmitted to the EU. Interestingly, in this scenario, the EU reciprocates by transmitting a nearly equivalent level of risk back to China, creating a balancing effect that appears to cancel out the net risk transmission between these regions. Nonetheless, these Chinese-origin events dramatically increase the spillover transmitted from the EU to the US, underscoring the interconnectedness of these major economies and how indirect effects can amplify risk in unexpected ways.

What stands out from these findings is the apparent shift in the dynamics of global financial interconnectedness among the US, EU, and China. Geopolitical events originating in the US tend to reduce the spillover between the US and the EU, while simultaneously increasing spillovers between China and the EU. This dynamic suggests that the EU may be gradually strengthening its alignment with the US, reinforcing their coalition in response to geopolitical pressures. When geopolitical events originate in China, they propagate risk across all three blocks, with the US absorbing much of this risk indirectly through the EU rather than directly from China. This pattern further underscores the coalition-building tendencies between the Western powers, with the US and EU demonstrating similar responses to geopolitical shocks. However, Europe emerges as a particularly critical player, being more exposed to geopolitical risk than the US.

Table 10. Reg. model: effect of the BBVA Geopolitical Index on the spillover (daily)[2]

	(a) China -> US	(b) China -> EU	(c) US -> China	(d) US -> EU	(e) EU -> China	(f) EU -> US
Geo risk EU	22.563	-12.898	3.518	5.919	8.106	19.361
Geo risk US	9.184	47.323***	-7.611	-24.905*	-25.042	-49.140***
Geo risk China	-16.525	66.018***	-12.522	7.023	67.973***	117.018***
Interest rate EU	2.676***	0.615	-0.173	0.802	3.389***	-3.453***
Interest rate US	0.175	2.063***	1.777***	-2.367***	4.649***	2.527***
Interest rate China	(dropped)	(dropped)	(dropped)	(dropped)	(dropped)	(dropped)
MOVE	-0.022	0.033	-0.194***	-0.036*	0.357***	0.108***
VIX	0.096**	0.557***	0.263***	-0.080*	-0.115**	0.519***
CCBBSS5y	-2.867***	-3.078***	2.546***	5.317***	-13.418***	0.541
Constant	10.061***	-4.766**	16.667***	17.633***	-11.616***	-9.405***
N	1,701	1,701	1,701	1,701	1,701	1,701
R2	0.032	0.105	0.085	0.098	0.239	0.200
R2 adj	0.027	0.101	0.080	0.093	0.236	0.196

note: .01 - ***; .05 - **; .1 - *;

[2] See Appendix A for the SUR results. The Seemingly Unrelated Regression (SUR) method was employed to ensure that the equations were not interrelated through correlations in the residuals.

IV. Qualitative analysis

In this chapter, we analyze the European debt crisis during 2010 and the subsequent years, focusing on the interaction between Spain, Greece, and the EU. Instead of war or traditional conflict, as stipulated in the game theory model, we frame the "conflict" as the potential dramatic consequences of a full default within the European Union. Such an event could have exacerbated the financial crisis, led to some member states leaving the EU, or, in the worst-case scenario, resulted in its dissolution.

After the 2008 financial crisis, several European nations faced severe economic difficulties, with Portugal, Spain, Italy, Greece, and Ireland particularly affected. For this example, we focus on Spain and Greece. By 2010, Greece's debt-to-GDP ratio had reached 127%, and the country was on the verge of default. In response, the Troika — comprising the European Union, the European Central Bank (ECB), and the International Monetary Fund (IMF) — stepped in with a €110 billion bailout package. This assistance came with strict reforms but failed to alleviate Greece's financial distress. By 2011, Greece's debt-to-GDP ratio had surged to 172%, leading to a second bailout package in 2012, amounting to €130 billion (IMF, 2024)

Meanwhile, Spain's banking sector faced a major crisis, prompting the Spanish government to formally request assistance from European institutions in mid-2012. In response, Spain received a €100 billion bailout package specifically targeted at its banking sector (BIS, 2022). By the beginning of 2015, the three players were cooperating within the same coalition.

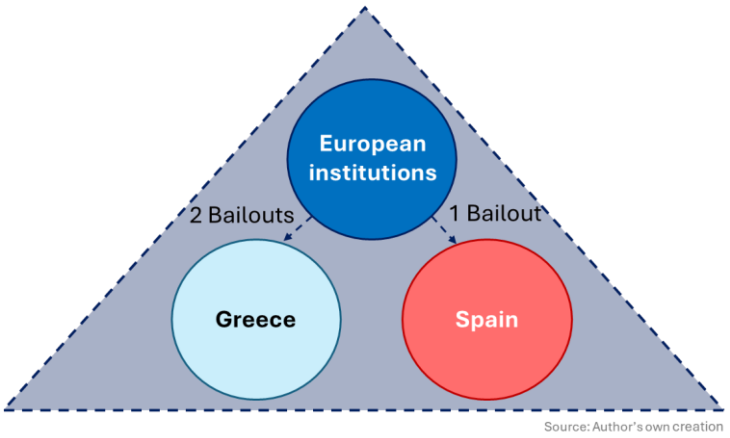

Figure 15. Beginning state of the three players (EU, Greece, Spain) until 2015

In 2015, the dynamics shifted with the election of the left-wing Syriza party in Greece, led by Alexis Tsipras, which marked the onset of conflict within the coalition. Syriza challenged the austerity measures and reforms imposed by the EU and the Troika (the European Commission, ECB, and IMF), defying their demands and creating tensions within the European framework. Isolated politically within Europe, Tsipras found himself unable to form coalitions to support his stance. By mid-June 2015, Greece defaulted on a €1.6 billion payment to the IMF, becoming the first developed country to do so. This default marked a significant escalation in the crisis and underscored Greece's isolation within the European political landscape. Figure 16 illustrates this situation, showing Greece diverging from the coalition while Spain remains aligned with the EU.

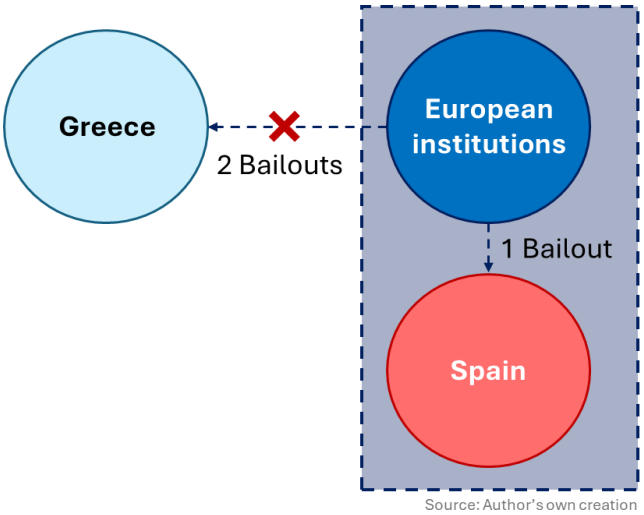

Figure 16. The current state of the three players (EU, Greece, Spain) by mid-June 2015

This scenario aligns closely with the three-player model, where one player — in this case, Greece — defaults on its debt to boost its current consumption, initiating the conflict. However, unlike Greece, Spain remains within the EU coalition. Greece's defiance ultimately fails, and it receives another rescue package of €83 billion to address the crisis, bringing Greece back into the coalition. This resolution reflects the model's prediction that coalitions stabilize when conflict does not yield sufficient support or resources.

At the same time, Spain faced the rise of Podemos, a left-wing party led by Pablo Iglesias, which gained significant traction. If Podemos had won the elections and aligned with Greece,

the coalition dynamics could have shifted dramatically. With Spain, the fifth-largest economy in the eurozone, joining Greece, their combined weight at the negotiation table would have been considerably greater. Such an alliance would have increased their leverage against the EU, potentially altering the outcomes of the crisis. If both nations had defaulted, the risk of escalation — leading to more severe economic and political consequences, including the potential unraveling of the EU — would have been much higher.

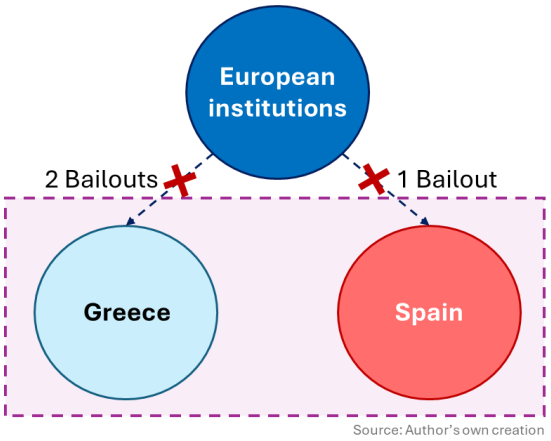

Figure 17. Hypothetical game situation in 2015

This hypothetical scenario underscores the critical role of coalition dynamics within the three-player model, highlighting how political developments can dramatically shift the balance of power and influence the outcomes of economic and geopolitical conflicts. The alignment of the third player is particularly pivotal, as it determines whether the conflict escalates or subsides. In this case, Spain's decision to remain within the EU coalition ensured the containment of the crisis, leading to Greece's eventual return to the fold. However, had Spain aligned with Greece, the combined leverage of these two nations could have significantly increased the risk of escalation, potentially destabilizing the eurozone and amplifying the conflict's economic and political repercussions.

CHAPTER 6. COMPARING VARIABLES

This section examines various geopolitical indices, focusing on their respective strengths and limitations. While the analysis primarily utilizes the Geopolitical Risk Index (GPR) and the BBVA Risk Index, it acknowledges that these tools, despite their utility, have inherent constraints. Emerging indices offer opportunities for improvement and provide alternative perspectives that may address some of these shortcomings.

Geopolitical indices are essential instruments for evaluating country-specific risks that influence investments, trade, and economic operations (Salisu *et al*., 2021). They are frequently employed to predict the impact of geopolitical events on macroeconomic variables such as GDP, inflation, exchange rates, and consumer confidence (Soybilgen *et al*., 2019). Beyond their practical applications, these indices facilitate systematic research into the broader implications of geopolitics on global development (Khadka, 1992), making them invaluable for both academic study and policy formulation.

The Geopolitical Risk Index (GPR) is a pivotal tool used to gauge geopolitical risk by analyzing the frequency of specific keywords in newspaper articles that pertain to adverse geopolitical events (please refer to the Figure 23 in the appendix for additional details on the words measured and the newspapers used.). The methodology is straightforward: articles mentioning terms associated with geopolitical conflicts are divided by the total number of articles, excluding irrelevant topics like entertainment or anniversaries. This approach provides a numerical representation of geopolitical risks, offering country-specific indices for 44 nations. The GPR has demonstrated its utility in evaluating how geopolitical tensions influence investments, employment, and stock returns (Caldara & Iacoviello, 2022). Studies have shown that heightened geopolitical risk correlates with declines in these economic metrics, underscoring its significance for financial markets.

The GPR has notable limitations. Its reliance on news sources introduces inherent biases, as the majority of newspapers analyzed are based in the United States, the United Kingdom, and Canada. This geographical concentration skews the index toward a US-centric perspective, limiting its applicability in regions with distinct geopolitical dynamics. For instance, during the 1999 US bombing of the Chinese embassy in Belgrade, the GPR did not register a significant change in risk, as Western media largely portrayed the event as collateral damage, whereas in

China it was considered a major crisis (see Figure 18 and Figure 19). While the GPR can provide valuable insights into financial variables such as the S&P500, its US-centric focus constrains its ability to measure global spillovers. Consequently, models relying on the GPR may overlook critical perspectives from regions outside the Western media's influence.

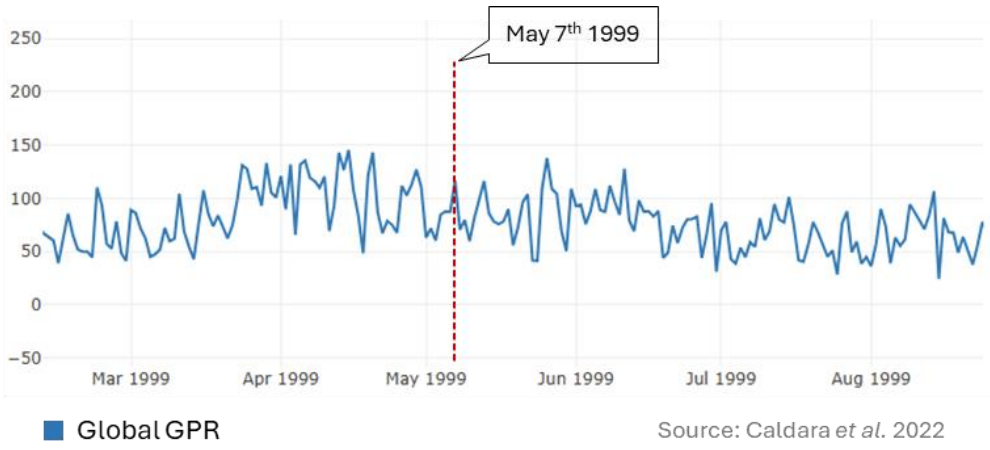

Figure 18. Daily global GPR during c. Jan 1999 - Oct. 1999

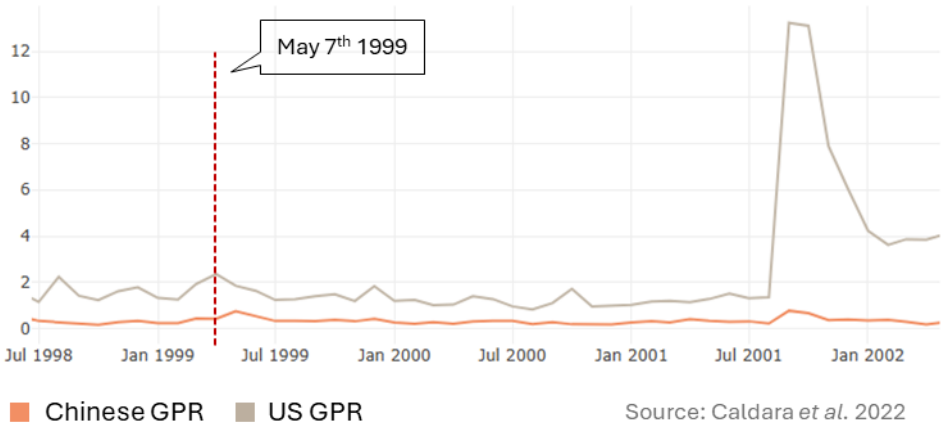

Figure 19. Monthly Chinese and American GPR during c.Jul.1998 - Mar. 2003

Furthermore, the GPR is reactive rather than predictive, meaning it reflects the aftermath of events rather than anticipating them. Additionally, the GPR does not capture systemic tensions, such as latent hostilities or subtle shifts in power dynamics, which are often precursors to overt conflicts.

Despite these limitations, the GPR remains a valuable tool for understanding the immediate impacts of geopolitical events. Its simplicity and focus on widely available news data make it accessible and easy to update.

The BBVA Geopolitical Index builds on methodologies similar to the GPR but incorporates modern computational tools, such as natural language processing (NLP) in particular, large language models (LLMs), to enhance its analytical capabilities.

The index has been developed by the BBVA research team, who have granted us access to utilize it for the purposes of our research, however it is not publicly available. Unlike the GPR, the BBVA index offers customizable conflict-specific indices, making it particularly useful for tracking bilateral relations and regional dynamics. It draws data from over 150 international and regional newspapers, covering more than 100 languages. This extensive data collection is powered by the GDELT (Global Database of Events, Language, and Tone).

The GDELT is a powerful open-source platform that monitors global news media in real time, analyzing events, emotions, and themes across over 100 languages. It collects and processes vast amounts of data from a wide range of sources, including newspapers, broadcasts, and online outlets, to catalog geopolitical and social dynamics. By using advanced natural language processing techniques, GDELT captures information on political events, protests, diplomatic activities, and conflicts, among others, allowing researchers and policymakers to track trends and patterns at both regional and global levels. Its real-time capabilities and extensive linguistic coverage make it an essential tool for understanding the rapidly evolving geopolitical landscape. However, its reliance on news data introduces potential biases, as the framing of events depends on the media's perspective and coverage priorities.

One of the standout features of the BBVA index is its real-time monitoring capability. By continuously updating its data, the index provides timely insights into geopolitical events and their regional impacts. Additionally, its ability to monitor events by region allows for tailored analyses of specific geopolitical events. For instance, Figure 20 illustrates how the BBVA Geopolitical Index effectively captures shifts in geopolitical sentiment across individual countries. It highlights how the Israel – Hamas conflict heightened geopolitical awareness in the Middel East, but the US is tending to a neutral position, and in western democracies, it triggered widespread protests. This example underscores the index's ability to provide personalized insights by tailoring analyses to regional contexts. Such customization, developed by the BBVA research team, demonstrates the index's capability to adapt to diverse geopolitical

scenarios.

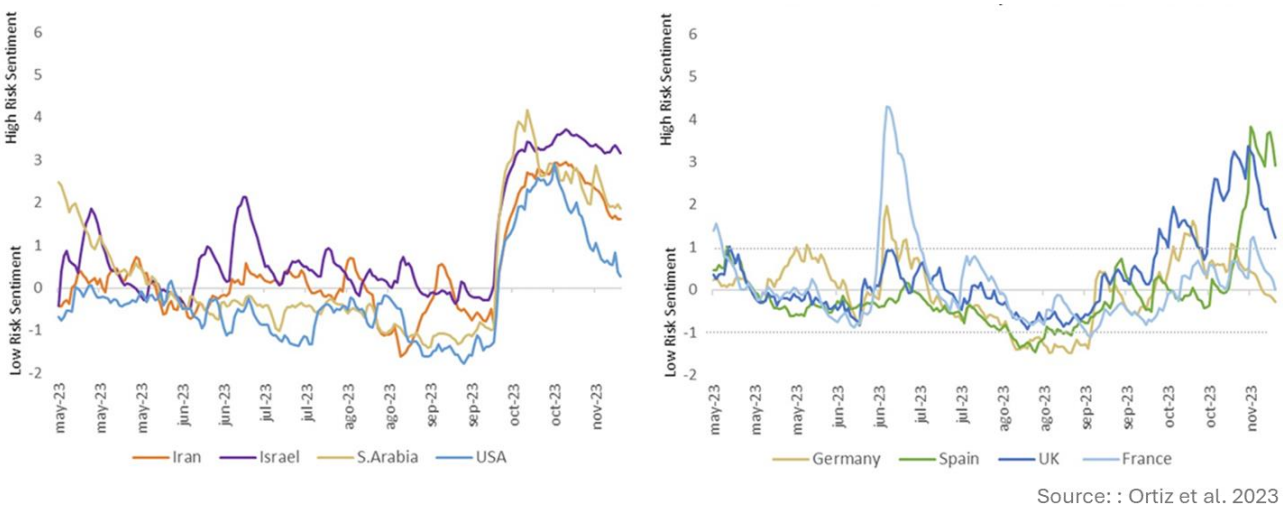

Figure 20. Geopolitical sentiment in the middle east and protest index in western countries

However, the BBVA index also has its drawbacks. Like the GPR, it is reactive rather than predictive, which limits its use in anticipating future events. Furthermore, it provides an external perspective on geopolitical issues without delving into internal tensions or the underlying causes of conflicts. This limitation can lead to an incomplete understanding of the geopolitical landscape, particularly in regions where internal dynamics play a significant role in shaping external relations.

Despite these challenges, the BBVA index represents a significant advancement in geopolitical analysis. Its integration of cutting-edge NLP techniques and its expansive data coverage make it a powerful tool for understanding the real-time implications of geopolitical events.

The Correlates of War (COW) project is a comprehensive database that tracks an extensive range of conflict metrics dating back to 1816. It offers multiple datasets, including those on militarized interstate disputes, national military capabilities, alliances, and diplomatic exchanges. Unlike indices that rely on news articles, COW uses a wide array of sources, including historical archives, government records, and expert analyses. The database covers numerous variables, such as casualties, participants, alliances, war outcomes, and the duration and timing of conflicts. It defines conflict as any confrontation resulting in more than 1,000 deaths.

Its strengths lie in its depth and historical scope. By offering detailed records of conflicts

spanning over two centuries, the Correlates of War (COW) project enables long-term trend analysis and the identification of patterns in international relations. It also serves as a foundational dataset for developing more specialized geopolitical indices, such as the International Political Relations (IPR) Index discussed below. However, the project is not without its limitations. Its reliance on formal records and official data often leads to the underrepresentation of informal conflicts such as protests. Additionally, the significant time lag in updating the database means it cannot adapt to the fast-evolving nature of contemporary geopolitics. This lack of real-time functionality highlights the need for complementary tools that can address current geopolitical dynamics. Despite these drawbacks, COW remains one of the most comprehensive and rigorous resources for analyzing historical conflicts.

The International Political Relations Index (IPR) captures the international political stance of a country through a range of factors, including military alliances, conflict engagement, diplomatic presence, and intergovernmental organization (IGO) memberships. It evaluates 152 countries from 1880 to 2014, offering a standardized annual score that reflects a country's level of political integration and peaceful relations. The index has been developed by Consuelo Silvia-Buston, Marcela Valenzuela and Iknur Zer and is not publicly available.

The IPR incorporates data from three key areas to assess international political relations. First, it examines military conflicts and alliances, utilizing data from Militarized Interstate Disputes (MID) and alliance strength to evaluate the spectrum of relations, from peaceful cooperation to outright war. Second, it tracks political integration by measuring the number of memberships in intergovernmental organizations, reflecting a country's level of global engagement. Third, it analyzes diplomatic representation, ranging from consulates to embassies, to gauge the extent of a nation's formal diplomatic presence. For each category they use multiple databases, and they assign scores on a scale from 1 to 5. These scores are then aggregated and normalized on a scale from 1 to 100, providing a comprehensive and standardized measure of a country's international political standing.

The IPR is primarily retrospective, with updates often lagging behind contemporary events. This delay limits its ability to reflect real-time dynamics, such as shifts in alliances or the sudden emergence of new geopolitical tensions. Additionally, its reliance on formal records and official data can result in the exclusion of informal or underlying tensions that play a

significant role in shaping international relations. Despite these limitations, the IPR mitigates issues of bias found in other indices, making it a valuable tool for retrospectively studying bilateral events and assessing long-term trends in international political relationships.

The Conflict Forecast Index represents a cutting-edge approach to geopolitical analysis, emphasizing real-time monitoring and predictive modeling to assess conflict risks. It employs advanced natural language processing (NLP) to analyze global news data in real time, identifying key geopolitical events and tracking sentiment. The core of the index is its Dynamic Early Warning and Action Model (DEWAM), which classifies countries into 12 stages of conflict, ranging from stable peace to severe conflict. By modeling transitions between these stages, the index estimates the likelihood of conflict escalation or de-escalation over time, offering probabilistic forecasts for the next three to twelve months. Additionally, the Conflict Forecast Index integrates various dimensions of conflict analysis, such as government stability, alliance monitoring, and protest activities, to provide a holistic view of geopolitical risks. On Figure 21 here is a diagram detailing how the index is built.

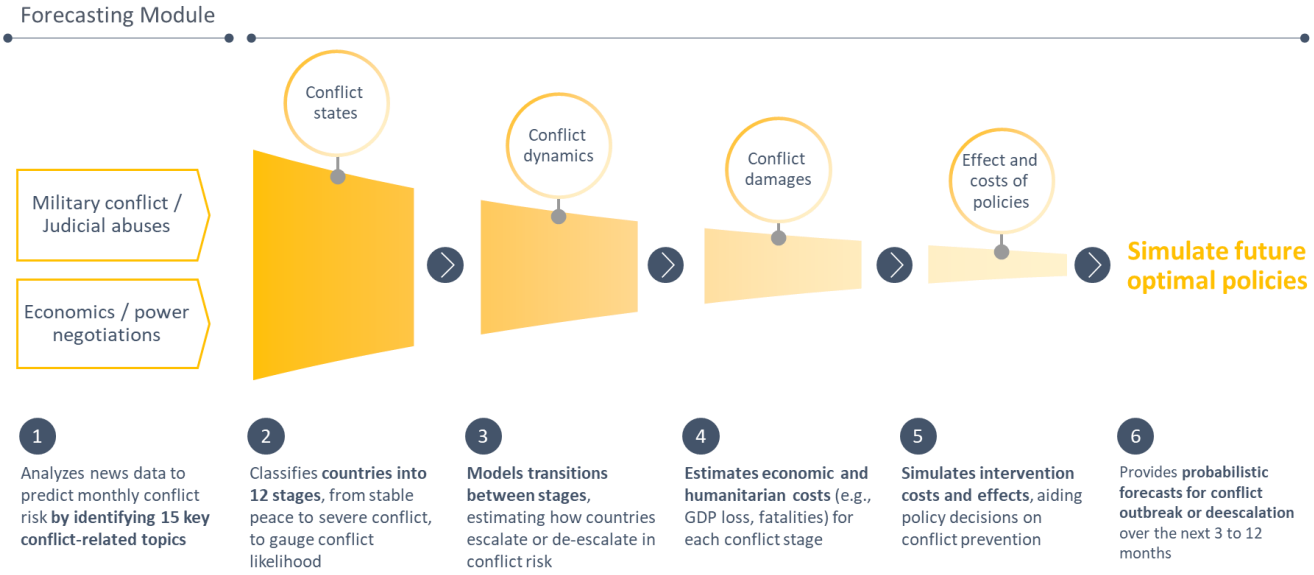

Figure 21. Conflict forecast construction diagram

A notable strength of this index is its ability to simulate the economic and humanitarian costs of conflicts, including GDP losses, fatalities, and other measurable impacts. This capability allows policymakers to evaluate the costs and benefits of intervention strategies, aiding in proactive conflict prevention. For example, the index can simulate the effects of potential

policy actions and provide recommendations to mitigate risks or stabilize volatile regions.

Figure 22 highlights global conflict risks, with darker shades indicating higher levels of instability and lighter shades representing more stable regions. The visualization underscores significant geopolitical hotspots, particularly in parts of Africa, the Middle East, and Central Asia, which are areas often associated with active conflicts or heightened tensions. Conversely, regions such as North America, Europe, and parts of East Asia display lighter tones, suggesting relative stability, though these areas may still experience underlying, less-visible tensions.

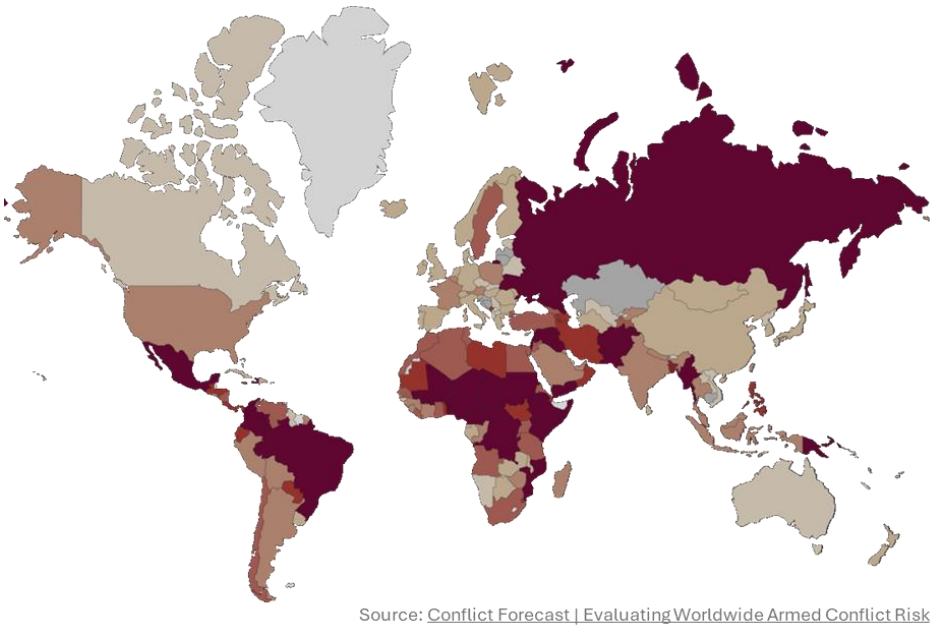

Figure 22. 12-motnh conflict forecast prediction. Last updated October 2024

However, the model has certain limitations. Its reliance on text-based data introduces potential biases, as media coverage may disproportionately represent certain conflicts or regions while neglecting others. Additionally, the low frequency of extreme geopolitical events makes precise predictions challenging, as these events often follow non-linear patterns. Another limitation is the lack of spatial spillover modeling, which means the index does not account for how conflicts or policy decisions in one country might influence neighboring nations or global dynamics.

Despite these challenges, the Conflict Forecast Index stands out for its focus on real-time adaptability and its forward-looking approach. By combining predictive analytics with real-time monitoring, it fills a crucial gap left by retrospective indices, offering actionable insights for both researchers and policymakers seeking to address emerging geopolitical challenges.

This makes it a valuable tool in understanding and mitigating the complexities of modern international relations.

Geopolitical indices each bring distinct strengths and limitations to the table, making them complementary rather than interchangeable. The Geopolitical Risk Index (GPR) and BBVA Geopolitical Index excel in real-time monitoring of geopolitical sentiment through their reliance on news data. The GPR provides a focused lens on adverse geopolitical events but remains reactive and limited in its geographical perspective. In contrast, the BBVA index expands coverage through advanced computational tools, offering broader linguistic and regional representation. Both, however, fail to capture systemic tensions or provide predictive insights. The Correlates of War (COW) and the International Political Relations Index (IPR) take a more historical approach, offering robust datasets for analyzing long-term trends in conflict and international relations. While COW retrospective nature limits its utility for addressing contemporary dynamics. Similarly, the IPR provides a comprehensive measure of global political integration but lacks the real-time adaptability needed to capture rapidly shifting geopolitical landscapes. In comparison, the Conflict Forecast Index bridges some of these gaps by integrating real-time monitoring with predictive modeling. Its ability to simulate policy outcomes and evaluate the costs of intervention makes it particularly valuable for proactive conflict prevention. Overall, the choice of index depends on the specific application.

CHAPTER 7. NEXT STEPS

In this chapter, we outline potential next steps and unresolved questions that could be explored in future research.

One avenue for expansion relates to the theoretical game model. Professor Claeys suggests several ways to complement and refine the framework. First, he proposes rethinking how resources are obtained from war. In the current model, conflict is assumed to generate sufficient resources to form coalitions. However, in reality, war may fail to produce the necessary resources, shifting the dynamics of the game toward a more bilateral conflict structure. This adjustment could change coalition-building behavior and the resulting outcomes.

Second, the addition of more players to the 3-player game could provide intriguing insights. Increasing the number of players to four or more might reduce the likelihood of war, as it would require additional resources to incentivize neutrality among a larger set of actors. This expanded setup could more accurately reflect complex international dynamics where multilateral considerations play a critical role.

Third, incorporating trade alongside debt introduces an important dimension to the model. While defaulting on debt yields an immediate consumption benefit, it can simultaneously disrupt trade flows, potentially causing a long-term decline in consumption that outweighs the initial gain. This trade-debt interplay could offer deeper insights into the motivations and consequences of sovereign decisions under geopolitical tensions.

Finally, transitioning from a static to a dynamic game could substantially enhance the model's realism by capturing the evolving nature of interest rates and long-term debt issuance. This variation is particularly relevant, as highlighted in the empirical study, debt markets often respond contrary to the game's predictions when faced with geopolitical news. The game assumes that an increase in debt heightens the likelihood of war because the immediate gains from defaulting grow larger. However, in reality, the long-term negative consequences of defaulting — such as impaired creditworthiness, disrupted trade relationships, and diminished market access — can outweigh these short-term benefits. As a result, financial markets may perceive the likelihood of default on geopolitical terms as highly improbable, reflecting a long-term perspective that prioritizes stability over immediate economic advantages.

The empirical analysis raises several important questions, particularly concerning the variables and time frame used. First, during normal periods, financial markets may perceive the possibility of defaulting due to geopolitical events as highly unlikely. However, in moments of high stress — when war appears imminent or inevitable — the short-term gain from defaulting, combined with the urgent need to finance conflict, may outweigh long-term considerations. In such scenarios, the model's predictions could align more closely with market behavior. To address this, it is crucial to narrow the research to periods of low and high geopolitical stress to identify whether market reactions differ across these contexts.

Additionally, replacing the GPR or BBVA Geopolitical Index with alternative indices, such as the International Political Relations Index (IPR) or the Conflict Forecast Index, could yield more nuanced results. The Conflict Forecast Index, in particular, measures the likelihood of war, offering a more targeted perspective on the geopolitical factors that may influence sovereign risk. Combining these changes in the analysis would enhance the accuracy and relevance of the findings.

Another consideration is whether CDS spreads are the appropriate dependent variable for this analysis. While CDS spreads are widely used as a proxy for sovereign risk, the underlying assumption linking them to geopolitical events may require further scrutiny. During periods of turmoil, investors may shift from volatile assets into sovereign debt, viewing it as a safer option. This behavior could obscure the relationship between geopolitical events and CDS spreads, as markets may not perceive geopolitical tensions as increasing the likelihood of default but rather view financial stability as the primary determinant.

To address these concerns, it would be beneficial to conduct further analysis focusing on specific, short time frames characterized by heightened geopolitical stress. Events such as the onset of the war in Ukraine or Chinese military exercises near Taiwan. Additionally, the model could be applied to middle-ground players that are caught between the geopolitical influence of China and the United States such as Mali, Sri Lanka, or Pakistan. In these countries, which tend to be less stable, geopolitical factors are likely to exert a more pronounced influence on their CDS spreads.

CHAPTER 8. CONCLUSION

In this concluding chapter, we will review the objectives set out at the beginning of the thesis, assess whether they have been achieved, and reflect on the insights gained throughout the research process.

The first and primary objective of this thesis was to support the research for the paper "Multilateral Financial Integration and Political Conflict: A 3-Player Game of Debt Negotiation." This objective has been successfully achieved. Over the past months, significant progress has been made in contributing to the paper, despite challenges such as the initial rejection from a journal during the summer. Following the setback, the paper was revised and improved. Since then, it has gained recognition, with Professor Claeys presenting it at a conference at Sciences Po Aix in France in September 2024, and a presentation scheduled at the University of Loyola in Seville in 2025. Additionally, my research contributions have been further validated through an opportunity to teach a class on geopolitical indices at ICADE. This experience not only reinforced the value of my work within the context of the paper but also highlighted its relevance and applicability for academic purposes for the school.

We conducted an OLS analysis and, on a smaller scale, a VAR analysis. The SUR regression has been used and is shown in the appendix. Additionally, a panel regression was explored but ultimately not employed, as the dataset evolved in ways that made this approach unsuitable given the structure of the data. The results of the analysis presented unexpected conclusions. In particular, geopolitical adverse events were found to decrease credit default risk. This could be explained by the behavior of debt markets, which can be perceived as safer investments during periods of uncertainty in equity markets. To build on this research, it would be valuable to apply the model specifically to moments of heightened geopolitical tensions to determine if the market reacts differently under such conditions. Furthermore, we observed that geopolitical events reduce the risk of spillover between the US and the EU. This finding could indicate a strengthening coalition between the two allies.

The OLS model was conducted using both the GPR and BBVA Geopolitical Indices, with a discussion on their respective limitations and differences. Nonetheless, this objective was expanded beyond the initial scope by incorporating the International Political Relations Index and the Conflict Forecast Index. Chapter 6 provides an explanation of the limitations, strengths,

and methodologies of each index, offering a critical comparison of their applicability and utility in analyzing geopolitical risk. Looking ahead, it would be valuable to extend the research by utilizing the Conflict Forecast Index to explore its empirical results and compare them with those obtained using the GPR and BBVA indices.

The game model has been qualitatively applied to a European use case, specifically examining the relationship between the EU, Spain, and Greece during the European debt crisis. In this application, the potential dissolution of the EU is treated as the "conflict or war" element within the three-player game framework. The model explores the dynamics of 2015, a pivotal year when Alexis Tsipras won the Greek elections and defaulted on Greece's payment to the IMF. The analysis delves into the possibility of Spain's left-wing party, Podemos, winning the elections and forming a coalition with Greece. Such a coalition would have altered the balance of power in Europe, potentially challenging the EU's austerity-driven policies and increasing the risk of broader financial and political instability.

We acknowledge the limitations of this thesis and outline areas where further research could provide valuable insights. One key limitation is the scope of the OLS model, which could benefit from being applied to periods of both high and low geopolitical tension to explore how market responses vary under different conditions. Additionally, expanding the analysis to include countries that are more susceptible to geopolitical events would enhance our understanding of the relationship between geopolitical risk and sovereign debt in less stable economies. The VAR analysis also presents opportunities for improvement. Currently focused on the direct impact of geopolitical risk on a single player's sovereign risk, the model could be extended to include additional variables. Lastly, incorporating the Conflict Forecast Index into the analysis alongside the GPR and BBVA indices would enrich the comparison of these tools, offering a more comprehensive perspective on how different measures of geopolitical risk perform, and helping to refine our understanding of the specific ways geopolitical tensions impact sovereign risk.

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APPENDIX A

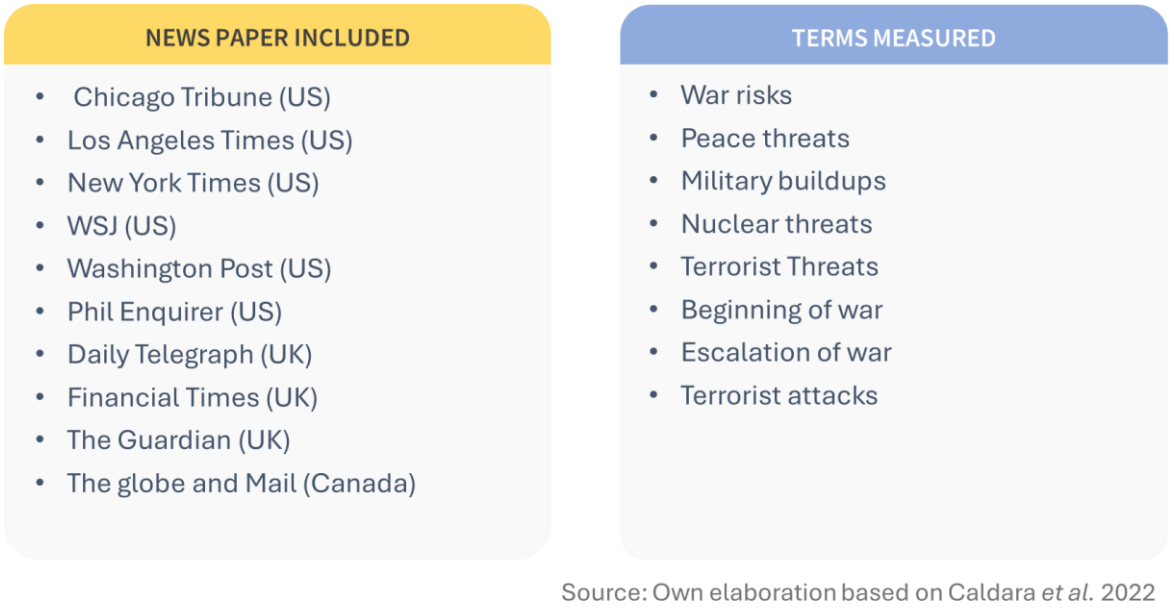

Figure 23. Words and newspapers used in the GPR construction

Table 11. Reg. model: effect of the GPR on the CDS (monthly)

	(a) China	(b) EU	(c) US
GPR China	-28.798**	-6.971	2.877
GPR EU	0.377	-13.268	-5.555
GPR US	9.208	1.179	-0.336
EPU China	-0.093***	-0.080***	-0.032***
EPU EU	0.092**	0.122***	0.032**
EPU US	-0.147**	0.108	0.064***
Interest rate China	55.217**	163.784***	15.488*
Interest Rate EU	5.848**	-1.676	3.577***
Interest US	6.424***	4.738**	2.470***
MOVE	0.145	-0.361***	-0.169***
VIX	0.390	-0.697*	-0.247**
CCBBSS5y	-26.441***	1.576	-5.718**
Constant	-16.709	-389.932***	10.423
N	133	133	133
r2	0.590	0.548	0.687
r2_a	0.549	0.503	0.655

note: .01 - ***; .05 - **; .1 - *;

Table 12. Reg. model: effect of the BBVA Geopolitical Index on the CDS (monthly)

	(a) China	(b) EU	(c) US
Geo risk China	-21.442	-90.194	-22.520
Geo risk EU	-178.199	-92.734	-9.977
Geo risk US	150.646**	70.215	-6.244
EPU China	-0.058***	-0.036**	-0.022***
EPU EU	0.119***	0.098***	0.023
EPU US	-0.092	-0.036	0.032
Interest rate China	(dropped)	(dropped)	(dropped)
Interest Rate EU	-6.463**	-4.458**	4.456***
Interest US	3.642*	7.698***	3.078***
MOVE	-0.146	-0.244**	-0.117***
VIX	-0.374	-0.022	-0.096
CCBBSS5y	19.347*	1.633	-10.292***
Constant	69.948***	54.062***	59.609***
N	84	84	84
r2	0.488	0.426	0.757
r2_a	0.410	0.339	0.720

note: .01 - ***; .05 - **; .1 - *;

Table 13. Reg. model: effect of the GPR on the spillover (monthly)

	(a) China -> US	(b) China -> EU	(c) US -> China	(d) US -> EU	(e) EU -> China	(f) EU -> US
epu china	-0.003	-0.011	0.006	0.000	-0.043**	-0.030
epu eu	-0.012	-0.015	-0.040**	0.017	0.065*	-0.040
epu us	0.014	-0.030	0.020	-0.048	-0.008	0.131**
shadow eu	-0.840	-1.789	-0.375	1.020	0.872	0.158
shadow us	-0.795	-2.289	-0.352	-0.443	2.252	-2.203
interest rate china	0.088	-30.263	7.729	18.846	46.548**	20.054
move	-0.071	0.009	0.092	-0.029	-0.179	-0.047
vix	0.076	0.516*	0.026	0.086	0.069	0.051
gprd china	0.997	-2.462	2.622	7.084	7.912	-0.793
gprd eu	-10.065	-13.101	-5.426	1.478	5.130	15.795
gprd us	2.965	-0.915	1.354	-3.915	-5.502	-4.362
ccbbss5y	5.097	9.571	0.740	-0.159	-3.522	7.783
cons	8.008	108.818*	-20.987	-33.655	-98.991	-36.684
N	133	133	133	133	133	133
r2	0.053	0.087	0.072	0.191	0.147	0.347
r2 a	-0.042	-0.004	-0.021	0.111	0.061	0.282

note: .01 - ***; .05 - **; .1 - *;

Table 14. SUR. model: effect of the GPR on the spillover (daily)

	(a) China -> US	(b) China -> EU	(c) US -> China	(d) US -> EU	(e) EU -> China	(f) EU -> US
GPR	-0.013***	-0.012**	-0.007*	-0.002	0.027***	0.003
Interest rate EU	3.398***	2.835***	0.122	0.916*	4.138***	-1.996***
Interest rate US	-0.010	1.431***	1.778***	-2.116***	1.791***	0.417
Interest rate China	-0.710	31.121***	-5.034***	-22.099***	24.221***	5.663**
MOVE	0.094***	0.240***	-0.110***	-0.078***	0.158***	0.115***
VIX	-0.011	0.348***	0.157***	0.012	-0.183***	0.272***
CCBBSS5y	-5.866***	-9.517***	0.414	6.072***	-7.291***	0.996
Constant	10.322	-94.597***	28.307***	80.872***	-65.299***	-15.700*
N			2,651			

note: .01 - ***; .05 - **; .1 - *;

Table 15. SUR model: effect of the BBVA Geopolitical Index on the CDS (daily)

	(a) China -> US	(b) China -> EU	(c) US -> China	(d) US -> EU	(e) EU -> China	(f) EU -> US
Geo risk EU	22.563	-12.898	3.518	5.919	8.106	19.361
Geo risk US	9.184	47.323***	-7.611	-24.905*	-25.042	-49.140***
Geo risk China	-16.525	66.018***	-12.522	7.023	67.973***	117.018***
Interest rate EU	2.676***	0.615	-0.173	0.802	3.389***	-3.453***
Interest rate US	0.175	2.063***	1.777***	-2.367***	4.649***	2.527***
Interest rate China	(dropped)	(dropped)	(dropped)	(dropped)	(dropped)	(dropped)
MOVE	-0.022	0.033	-0.194***	-0.036*	0.357***	0.108***
VIX	0.096**	0.557***	0.263***	-0.080*	-0.115**	0.519***
CCBBSS5y	-2.867***	-3.078***	2.546***	5.317***	-13.418***	0.541
Constant	10.061***	-4.766**	16.667***	17.633***	-11.616***	-9.405***
			1,701			

note: .01 - ***; .05 - **; .1 - *;

APPENDIX B

```
//
// Author: Javier Aramburu
//Last edited: 25/11/2024
//

local log_path "C:***\05-logs\00-results_geo_29042024.log"

local db_path_reg_daily "C:***\01-data\general\00-dataset_reg_daily.dta"
local db_path_reg_monthly "C:***\01-data\general\00-dataset_reg_monthly.dta"
local db_path_reg_bbvadaily "C:***\01-data\general\00-dataset_reg_daily_bbva.dta"
local db_path_panel_daily "C:***\01-data\general\00-dataset_panel_cds_daily.dta"
local db_path_panel_monthly "C:***\01-data\general\00-dataset_panel_cds_monthly.dta"
local db_path_sureg_daily "C:***\01-data\general\00-dataset_sureg_daily.dta"
local db_path_sureg_bbvadaily "C:***\01-data\general\00-dataset_sureg_daily_bbva.dta"
local db_path_sureg_monthly "C:***\01-data\general\00-dataset_sureg_monthly.dta"

local results_path_var "C:***\04-Results\results_var_1.xml"
local results_path_reg "C:***\04-Results\results_reg_1.xml"

/// LOG ///

log using "`log_path'", replace

//// Descriptive analysis ////

        /// Daily Regression w/o BBVA///

        use "`db_path_reg_daily'", clear

        keep if id == 1

        // Summarize the variables across all sheets
        summarize interest_eu interest_us interest_china vix vstoxx move ccbbss5y cds_eu cds_us
        cds_china gprd_global

        // Correlation table for the selected variables
        correl interest_eu interest_us interest_china vix vstoxx move ccbbss5y cds_eu cds_us
        cds_china gprd_global

        // Generate individual histograms

        // Generate individual histograms
        histogram interest_eu, name(hist_interest_eu) title("Interest Rate EU") nodraw
        histogram interest_us, name(hist_interest_us) title("Interest Rate US") nodraw
        histogram interest_china, name(hist_interest_china) title("Interest Rate China") nodraw
        histogram vix, name(hist_vix) title("VIX") nodraw
        histogram vstoxx, name(hist_vstoxx) title("VSTOXX") nodraw
```

```
histogram move, name(hist_move) title("MOVE") nodraw
histogram ccbbss5y, name(hist_ccbbss5y) title("CCBBSS5Y") nodraw
histogram cds_eu, name(hist_cds_EU) title("CDS EU") nodraw
histogram cds_us, name(hist_cds_us) title("CDS US") nodraw
histogram cds_china, name(hist_cds_china) title("CDS China") nodraw
histogram gprd_global, name(hist_gprd_glob) title("Global Geopolitical Risk") nodraw

// Combine all histograms in a single graph
graph combine hist_interest_eu hist_interest_us hist_interest_china hist_vix hist_vstoxx
hist_move hist_ccbbss5y hist_cds_EU hist_cds_us hist_cds_china hist_gprd_glob, xsize(12)
ysize(8)
graph save combined_regress, replace



/// Daily Regression BBVA///

use "`db_path_reg_bbvadaily'", clear

keep if id == 1

// Summarize variables in Set 1
summarize interest_eu interest_us interest_china move vstoxx vix gprd_global ccbbss5y
cds_china cds_us cds_eu geo_risk_eu geo_risk_us geo_risk_china t

// Correlation table for Set 1
correl interest_eu interest_us interest_china move vstoxx vix gprd_global ccbbss5y
cds_china cds_us cds_eu geo_risk_eu geo_risk_us geo_risk_china t

// Generate individual histograms for Set 1 without displaying them
histogram interest_eu, name(hist_interest_eu1, replace) title("Interest Rate EU (Set 1)")
nodraw
histogram interest_us, name(hist_interest_us1, replace) title("Interest Rate US (Set 1)")
nodraw
histogram interest_china, name(hist_interest_china1, replace) title("Interest Rate China
(Set 1)") nodraw
histogram move, name(hist_move1, replace) title("MOVE (Set 1)") nodraw
histogram vstoxx, name(hist_vstoxx1, replace) title("VSTOXX (Set 1)") nodraw
histogram vix, name(hist_vix1, replace) title("VIX (Set 1)") nodraw
histogram gprd_global, name(hist_gprd_global1, replace) title("Global Geopolitical Risk
(Set 1)") nodraw
histogram ccbbss5y, name(hist_ccbbss5y1, replace) title("CCBBSS5Y (Set 1)") nodraw
histogram cds_china, name(hist_cds_china1, replace) title("CDS China (Set 1)") nodraw
histogram cds_us, name(hist_cds_us1, replace) title("CDS US (Set 1)") nodraw
histogram cds_eu, name(hist_cds_eu1, replace) title("CDS EU (Set 1)") nodraw
histogram geo_risk_eu, name(hist_geo_risk_eu1, replace) title("Geopolitical Risk EU (Set
1)") nodraw
histogram geo_risk_us, name(hist_geo_risk_us1, replace) title("Geopolitical Risk US (Set
1)") nodraw
```

```
histogram geo_risk_china, name(hist_geo_risk_china1, replace) title("Geopolitical Risk
China (Set 1)") nodraw

// Combine all histograms of Set 1 into a single graph
graph combine hist_interest_eu1 hist_interest_us1 hist_interest_china1 hist_move1
hist_vstoxx1 hist_vix1 hist_gprd_global1 hist_ccbbss5y1 hist_cds_china1 hist_cds_us1
hist_cds_eu1 hist_geo_risk_eu1 hist_geo_risk_us1 hist_geo_risk_china1, xsize(12) ysize(8)
graph save combined_regressBBVA, replace

/// Regression Monthly ///

use "`db_path_reg_monthly'", clear

keep if id == 1

// Summarize variables in Set 2
summarize cds_china cds_eu cds_us epu_china epu_eu epu_us shadow_eu shadow_us
interest_rate_china move vstoxx vix gprd_china gprd_eu gprd_us ccbbss5y t

// Correlation table for Set 2
correl cds_china cds_eu cds_us epu_china epu_eu epu_us shadow_eu shadow_us
interest_rate_china move vstoxx vix gprd_china gprd_eu gprd_us ccbbss5y t

// Generate individual histograms for Set 2 without displaying them
histogram cds_china, name(hist_cds_china2, replace) title("CDS China (Set 2)") nodraw
histogram cds_eu, name(hist_cds_eu2, replace) title("CDS EU (Set 2)") nodraw
histogram cds_us, name(hist_cds_us2, replace) title("CDS US (Set 2)") nodraw
histogram epu_china, name(hist_epu_china2, replace) title("EPU China (Set 2)") nodraw
histogram epu_eu, name(hist_epu_eu2, replace) title("EPU EU (Set 2)") nodraw
histogram epu_us, name(hist_epu_us2, replace) title("EPU US (Set 2)") nodraw
histogram shadow_eu, name(hist_shadow_eu2, replace) title("Shadow EU (Set 2)") nodraw
histogram shadow_us, name(hist_shadow_us2, replace) title("Shadow US (Set 2)") nodraw
histogram interest_rate_china, name(hist_interest_rate_china2, replace) title("Interest
Rate China (Set 2)") nodraw
histogram move, name(hist_move2, replace) title("MOVE (Set 2)") nodraw
histogram vstoxx, name(hist_vstoxx2, replace) title("VSTOXX (Set 2)") nodraw
histogram vix, name(hist_vix2, replace) title("VIX (Set 2)") nodraw
histogram gprd_china, name(hist_gprd_china2, replace) title("Global Geopolitical Risk China
(Set 2)") nodraw
histogram gprd_eu, name(hist_gprd_eu2, replace) title("Global Geopolitical Risk EU (Set
2)") nodraw
histogram gprd_us, name(hist_gprd_us2, replace) title("Global Geopolitical Risk US (Set
2)") nodraw
histogram ccbbss5y, name(hist_ccbbss5y2, replace) title("CCBBSS5Y (Set 2)") nodraw

// Combine all histograms of Set 2 into a single graph
graph combine hist_cds_china2 hist_cds_eu2 hist_cds_us2 hist_epu_china2 hist_epu_eu2
hist_epu_us2 hist_shadow_eu2 hist_shadow_us2 hist_interest_rate_china2 hist_move2
```

```
        hist_vstoxx2 hist_vix2 hist_gprd_china2 hist_gprd_eu2 hist_gprd_us2 hist_ccbbss5y2,
        xsize(12) ysize(8)
        graph save combined_regress_monthly, replace

//
//// VAR ////
//

        // BBVA //

           use "`db_path_reg_bbvadaily'", clear
           keep if id == 1
           tsset t

           // EU
           varsoc cds_eu geo_risk_eu
           varbasic cds_eu geo_risk_eu, lags(1/3) irf
           xml_tab, replace sheet("Var CDS EU Daily", color(3) nogridlines) stats(N) font("Verdana"
        8) tblank(1) lines(_cons 2 LAST_ROW 13 COL_NAMES 2 EST_NAMES 2) nolabel
        save("`results_path_var'")

           // US
           varsoc cds_us geo_risk_us
           varbasic cds_us geo_risk_us, lags(1/3) irf
           xml_tab, append sheet("Var CDS US Daily", color(3) nogridlines) stats(N) font("Verdana"
        8) tblank(1) lines(_cons 2 LAST_ROW 13 COL_NAMES 2 EST_NAMES 2) nolabel
        save("`results_path_var'")

           // China
           varsoc cds_china geo_risk_china
           varbasic cds_china geo_risk_china, lags(1/3) irf
           xml_tab, append sheet("Var CDS China Daily", color(3) nogridlines) stats(N)
        font("Verdana" 8) tblank(1) lines(_cons 2 LAST_ROW 13 COL_NAMES 2 EST_NAMES 2) nolabel
        save("`results_path_var'")


        // Monthly //

           use "`db_path_reg_monthly'", clear
           keep if id == 1
           tsset t_monthly

           // EU
           varsoc cds_eu gprd_eu
           varbasic cds_eu gprd_eu, lags(1) irf
           xml_tab, append sheet("Var CDS EU Monthly", color(3) nogridlines) stats(N)
        font("Verdana" 8) tblank(1) lines(_cons 2 LAST_ROW 13 COL_NAMES 2 EST_NAMES 2) nolabel
        save("`results_path_var'")
```

```
        // US
        varsoc cds_us gprd_us
        varbasic cds_us gprd_us, lags(1) irf
        xml_tab, append sheet("Var CDS US Monthly", color(3) nogridlines) stats(N)
    font("Verdana" 8) tblank(1) lines(_cons 2 LAST_ROW 13 COL_NAMES 2 EST_NAMES 2) nolabel
    save("`results_path_var'")

        // China
        varsoc cds_china gprd_china
        varbasic cds_china gprd_china, lags(1) irf
        xml_tab, append sheet("Var CDS China Monthly", color(3) nogridlines) stats(N)
    font("Verdana" 8) tblank(1) lines(_cons 2 LAST_ROW 13 COL_NAMES 2 EST_NAMES 2) nolabel
    save("`results_path_var'")

//
//// REGRESIONES ////
//

    /// CDS///
        // DAILY //

            use "`db_path_reg_daily'", clear
            keep if id == 1

            regress cds_china interest_eu interest_us interest_china move vix gprd_global
    ccbbss5y
            estimate store CDS_China, title(CDS China)

            regress cds_us interest_eu interest_us interest_china move vix gprd_global
    ccbbss5y
            estimate store CDS_US, title(CSD US)

            regress cds_eu interest_eu interest_us interest_china move vix gprd_global
    ccbbss5y
            estimate store CDS_EU, title(CDS EU)

            xml_tab CDS_China CDS_EU CDS_US, replace sheet(Reg CDS Daily, color(3)
    nogridlines) stats(N r2 r2_a) font("Verdana" 8) tblank(1)   lines(_cons 2 LAST_ROW 13
    COL_NAMES 2 EST_NAMES 2)  nolabel save("`results_path_reg'")

            // BBVA //
            use "`db_path_reg_bbvadaily'", clear
            keep if id == 1

            regress cds_china interest_eu interest_us interest_china move vix ccbbss5y
    geo_risk_eu geo_risk_us geo_risk_china
            estimate store CDS_China_bbva, title(CDS China)
```

```
        regress cds_us interest_eu interest_us interest_china move vix ccbbss5y
geo_risk_eu geo_risk_us geo_risk_china
        estimate store CDS_US_bbva, title(CSD US)

        regress cds_eu interest_eu interest_us interest_china move vix ccbbss5y
geo_risk_eu geo_risk_us geo_risk_china
        estimate store CDS_EU_bbva, title(CDS EU)

        xml_tab CDS_China CDS_EU CDS_US CDS_China_bbva CDS_EU_bbva CDS_US_bbva, append
sheet(Reg CDS Daily BBVA, color(3) nogridlines) stats(N r2 r2_a) font("Verdana" 8)
tblank(1)   lines(_cons 2 LAST_ROW 13 COL_NAMES 2 EST_NAMES 2)  nolabel
save("`results_path_reg'")

   // MONTHLY //
      use "`db_path_reg_monthly'", clear

      correl cds_china cds_us cds_eu
      correl gprd_china gprd_eu gprd_us

      // Sin EPU
            keep if id == 1
            regress cds_china gprd_china gprd_eu gprd_us interest_rate_china shadow_eu
shadow_us move vix ccbbss5y
            estimate store CDS_China, title (CDS China)

            regress cds_eu gprd_china gprd_eu gprd_us interest_rate_china shadow_eu
shadow_us move vix ccbbss5y
            estimate store CDS_EU, title (CDS EU)

            regress cds_us gprd_china gprd_eu gprd_us interest_rate_china shadow_eu
shadow_us move vix ccbbss5y
            estimate store CDS_US, title (CDS US)


      // Con EPU
            regress cds_china gprd_china gprd_eu gprd_us interest_rate_china shadow_eu
shadow_us move vix ccbbss5y epu_china epu_eu epu_us
            estimate store CDS_China_epu, title (CDS China)

            regress cds_eu gprd_china gprd_eu gprd_us interest_rate_china shadow_eu
shadow_us move vix ccbbss5y epu_china epu_eu epu_us
            estimate store CDS_EU_epu, title (CDS EU)

            regress cds_us gprd_china gprd_eu gprd_us interest_rate_china shadow_eu
shadow_us move vix ccbbss5y epu_china epu_eu epu_us
            estimate store CDS_US_epu, title(CDS US)

         // BBVA //
            drop if geo_risk_eu == 0
```

```
            regress cds_china geo_risk_china geo_risk_eu geo_risk_us interest_rate_china
shadow_eu shadow_us move vix ccbbss5y epu_china epu_eu epu_us
            estimate store CDS_China_epu_bbva, title(CDS China)

            regress cds_eu geo_risk_china geo_risk_eu geo_risk_us interest_rate_china
shadow_eu shadow_us move vix ccbbss5y epu_china epu_eu epu_us
            estimate store CDS_EU_epu_bbva, title(CDS EU)

            regress cds_us geo_risk_china geo_risk_eu geo_risk_us interest_rate_china
shadow_eu shadow_us move vix ccbbss5y epu_china epu_eu epu_us
            estimate store CDS_US_epu_bbva, title(CDS US)

            xml_tab CDS_China CDS_EU CDS_US CDS_China_epu CDS_EU_epu CDS_US_epu
CDS_China_epu_bbva CDS_EU_epu_bbva CDS_US_epu_bbva, append sheet(Reg CDS Motnhly, color(3)
nogridlines) stats(N r2 r2_a) font("Verdana" 8) tblank(1)   lines(_cons 2 LAST_ROW 13
COL_NAMES 2 EST_NAMES 2)  nolabel save("`results_path_reg'")


/// SPILLOVER ///

   // DAILY
      use "`db_path_reg_daily'", clear

         foreach value in "cue_china_china" "cue_china_us" "cue_china_eu" "cue_us_china"
"cue_us_us" "cue_us_eu" "cue_eu_china" "cue_eu_us" "cue_eu_eu" {
            di "//// `value' ////"
            keep if name_spillover == "`value'"
            regress spillover interest_eu interest_us interest_china move vix gprd_global
ccbbss5y
            estimate store `value'
            use "`db_path_reg_daily'",clear
         }

         xml_tab cue_china_china cue_china_us cue_china_eu cue_us_china cue_us_us cue_us_eu
cue_eu_china cue_eu_us cue_eu_eu , append  sheet(Reg Spillover Daily, color(3) nogridlines)
stats(N r2 r2_a) font("Verdana" 8) tblank(1)   lines(_cons 2 LAST_ROW 13 COL_NAMES 2
EST_NAMES 2)  nolabel save("`results_path_reg'")


      // BBVA //

      use "`db_path_reg_bbvadaily'", clear

         foreach value in "cue_china_china" "cue_china_us" "cue_china_eu" "cue_us_china"
"cue_us_us" "cue_us_eu" "cue_eu_china" "cue_eu_us" "cue_eu_eu" {
            di "//// `value' ////"
            keep if name_spillover == "`value'"
```

```
            regress spillover interest_eu interest_us interest_china move vix ccbbss5y
geo_risk_eu geo_risk_us geo_risk_china
            estimate store `value'
            use "`db_path_reg_bbvadaily'",clear
         }

         xml_tab cue_china_china cue_china_us cue_china_eu cue_us_china cue_us_us cue_us_eu
cue_eu_china cue_eu_us cue_eu_eu , append  sheet(Reg Spillover Daily BBVA, color(3)
nogridlines) stats(N r2 r2_a) font("Verdana" 8) tblank(1)   lines(_cons 2 LAST_ROW 13
COL_NAMES 2 EST_NAMES 2)  nolabel save("`results_path_reg'")


   // Monthly
      use "`db_path_reg_monthly'", clear

         foreach value in "cue_china_china" "cue_china_us" "cue_china_eu" "cue_us_china"
"cue_us_us" "cue_us_eu" "cue_eu_china" "cue_eu_us" "cue_eu_eu" {
            di "//// `value' ////"
            keep if name_spillover == "`value'"
            regress spillover epu_china epu_eu epu_us shadow_eu shadow_us
interest_rate_china move vix gprd_china gprd_eu gprd_us ccbbss5y
            estimate store `value'
            use "`db_path_reg_monthly'", clear
         }

         xml_tab cue_china_china cue_china_us cue_china_eu cue_us_china cue_us_us cue_us_eu
cue_eu_china cue_eu_us cue_eu_eu , append sheet(Reg Spillover Motnhly, color(3)
nogridlines) stats(N r2 r2_a) font("Verdana" 8) tblank(1)   lines(_cons 2 LAST_ROW 13
COL_NAMES 2 EST_NAMES 2)  nolabel save("`results_path_reg'")

         // BBVA //

         use "`db_path_reg_monthly'", clear

         foreach value in "cue_china_china" "cue_china_us" "cue_china_eu" "cue_us_china"
"cue_us_us" "cue_us_eu" "cue_eu_china" "cue_eu_us" "cue_eu_eu" {
            di "//// `value' ////"
            drop if geo_risk_eu == 0
            keep if name_spillover == "`value'"
            regress spillover epu_china epu_eu epu_us shadow_eu shadow_us
interest_rate_china move vix geo_risk_china geo_risk_eu geo_risk_us ccbbss5y
            estimate store `value'
            use "`db_path_reg_monthly'", clear
         }

         xml_tab cue_china_china cue_china_us cue_china_eu cue_us_china cue_us_us cue_us_eu
cue_eu_china cue_eu_us cue_eu_eu , append sheet(Reg Spillover Motnhly BBVA, color(3)
nogridlines) stats(N r2 r2_a) font("Verdana" 8) tblank(1)   lines(_cons 2 LAST_ROW 13
COL_NAMES 2 EST_NAMES 2)  nolabel save("`results_path_reg'")
```

```
//
//// REGRESION DE PANEL //// cueeuus (eu-->us)
//
          /// CDS ///
             // Daily
             use "`db_path_panel_daily'",clear
                xtset id t
                xtreg cds interest_eu interest_us interest_china move vix gprd_global ccbbss5y, fe
                estimates store CDS_Daily_fe
                xtreg cds interest_eu interest_us interest_china move vix gprd_global ccbbss5y, re
                estimates store CDS_Daily_re

                xml_tab CDS_Daily_re CDS_Daily_fe, append sheet(Reg Panel CDS Daily, color(3)
          nogridlines) stats(N r2 r2_a) font("Verdana" 8) tblank(1)   lines(_cons 2 LAST_ROW 13
          COL_NAMES 2 EST_NAMES 2)  nolabel save("`results_path_reg'")


                hausman CDS_Daily_fe CDS_Daily_re
                //xtcsd, friedman
                //xtcsd, pesaran


             // Monthly
                // Sin EPU
                   use "`db_path_panel_monthly'",clear
                      xtset id t
                      xtreg cds shadow_eu shadow_us interest_rate_china move vix gprd_eu gprd_us
          gprd_china ccbbss5y, fe
                      estimates store CDS_Monthly_fe
                      xtreg cds shadow_eu shadow_us interest_rate_china move vix gprd_eu gprd_us
          gprd_china ccbbss5y, re
                      estimates store CDS_Monthly_re

                      hausman CDS_Monthly_fe CDS_Monthly_re
                      xtcsd, friedman
                      xtcsd, pesaran


                // Con EPU
                   use "`db_path_panel_monthly'",clear
                      xtset id t
                      xtreg cds epu_eu epu_us epu_china shadow_eu shadow_us interest_rate_china move
          vix gprd_eu gprd_us gprd_china ccbbss5y, fe
                      estimates store CDS_Monthly_epu_fe
                      xtreg cds epu_eu epu_us epu_china shadow_eu shadow_us interest_rate_china move
          vix gprd_eu gprd_us gprd_china ccbbss5y, re
                      estimates store CDS_Monthly_epu_re
```

```
            hausman CDS_Monthly_epu_fe CDS_Monthly_epu_re
            xtcsd, friedman
            xtcsd, pesaran

            xml_tab CDS_Monthly_fe CDS_Monthly_re CDS_Monthly_epu_fe CDS_Monthly_epu_re,
append sheet(Reg Panel CDS Monthly, color(3) nogridlines) stats(N r2 r2_a) font("Verdana"
8) tblank(1)   lines(_cons 2 LAST_ROW 13 COL_NAMES 2 EST_NAMES 2)  nolabel
save("`results_path_reg'")


/// Spillover ///
   //DAILY
      use "`db_path_reg_daily'",clear
         keep if id == 1
         correl interest_eu interest_us interest_china move vix gprd_global ccbbss5y

      use "`db_path_reg_daily'",clear

         drop if id > 6
         xtset id t
         xtreg spillover interest_eu interest_us interest_china move vix gprd_global
ccbbss5y, fe
         estimates store Spill_Daily_fe
         xtreg spillover interest_eu interest_us interest_china move vix gprd_global
ccbbss5y, re
         estimates store Spill_Daily_re

         hausman Spill_Daily_fe Spill_Daily_re
         //xtcsd, friedman
         //xtcsd, pesaran
         xml_tab Spill_Daily_re Spill_Daily_fe, append sheet(Reg Panel Spillover Daily,
color(3) nogridlines) stats(N r2 r2_a) font("Verdana" 8) tblank(1)   lines(_cons 2 LAST_ROW
13 COL_NAMES 2 EST_NAMES 2)  nolabel save("`results_path_reg'")

   // Monthly
      // Sin EPU
      use "`db_path_reg_monthly'", clear

      drop if id > 6
      xtset id t

      xtreg spillover shadow_eu shadow_us interest_rate_china move vix gprd_eu gprd_us
gprd_china ccbbss5y, fe
      estimates store Spill_Monthly_fe
      xtreg spillover shadow_eu shadow_us interest_rate_china move vix gprd_eu gprd_us
gprd_china ccbbss5y, re
      estimates store Spill_Monthly_re
```

```
        hausman Spill_Monthly_fe Spill_Monthly_re
        xtcsd, friedman
        xtcsd, pesaran


        // Con EPU
        xtreg spillover epu_eu epu_us epu_china shadow_eu shadow_us interest_rate_china move
    vix gprd_eu gprd_us gprd_china ccbbss5y, fe
        estimates store Spill_Monthly_epu_fe
        xtreg spillover epu_eu epu_us epu_china shadow_eu shadow_us interest_rate_china move
    vix gprd_eu gprd_us gprd_china ccbbss5y, re
        estimates store Spill_Monthly_epu_re
      hausman Spill_Monthly_epu_fe Spill_Monthly_epu_re
        xtcsd, friedman
        xtcsd, pesaran

        xml_tab Spill_Monthly_fe Spill_Monthly_re Spill_Monthly_epu_fe Spill_Monthly_epu_re,
    append sheet(Reg Panel Spillover Monthly, color(3) nogridlines) stats(N r2 r2_a)
    font("Verdana" 8) tblank(1)   lines(_cons 2 LAST_ROW 13 COL_NAMES 2 EST_NAMES 2)  nolabel
    save("`results_path_reg'")


//
//// SUREG  ////
//

    //Daily
      use "`db_path_sureg_daily'",clear

        sureg (cue_china_us cue_china_eu cue_us_china cue_us_eu cue_eu_china cue_eu_us =
    interest_eu interest_us interest_china move vix gprd_global ccbbss5y)

        estimates store list_dai

        xml_tab list_dai, append sheet(Sureg Spillover Daily, color(3) nogridlines) stats(N
    r2 r2_a) font("Verdana" 8) tblank(1)   lines(_cons 2 LAST_ROW 13 COL_NAMES 2 EST_NAMES 2)
    nolabel cnames(cue_china_us . cue_china_eu . cue_us_china . cue_us_eu . cue_eu_china .
    cue_eu_us .) save("`results_path_reg'")

        // BBVA //
        use "`db_path_sureg_bbvadaily'",clear

        sureg (cue_china_us cue_china_eu cue_us_china cue_us_eu cue_eu_china cue_eu_us =
    interest_eu interest_us interest_china move vix ccbbss5y geo_risk_eu geo_risk_us
    geo_risk_china)

        estimates store list_dai_bbva
```

```
      xml_tab list_dai list_dai_bbva, append sheet(Sureg Spillover Daily BBVA, color(3)
nogridlines) font("Verdana" 8) tblank(1)   lines(_cons 2 LAST_ROW 13 COL_NAMES 2 EST_NAMES
2)  nolabel cnames(cue_china_us . cue_china_eu . cue_us_china . cue_us_eu . cue_eu_china .
cue_eu_us .) save("`results_path_reg'")

// Monthly
   use "`db_path_sureg_monthly'",clear

   //Sin EPU
      sureg (cue_china_us cue_china_eu cue_us_china cue_us_eu cue_eu_china cue_eu_us =
shadow_eu shadow_us interest_rate_china move vix gprd_eu gprd_us gprd_china ccbbss5y)
      estimates store sin_epu

   // Con EPU
      sureg (cue_china_us cue_china_eu cue_us_china cue_us_eu cue_eu_china cue_eu_us =
epu_eu epu_us epu_china shadow_eu shadow_us interest_rate_china move vix gprd_eu gprd_us
gprd_china ccbbss5y)
      estimates store con_epu

      drop if geo_risk_eu == 0
      sureg (cue_china_us cue_china_eu cue_us_china cue_us_eu cue_eu_china cue_eu_us =
shadow_eu shadow_us interest_rate_china move vix geo_risk_eu geo_risk_us geo_risk_china
ccbbss5y)
      estimates store con_epu_bbva

      xml_tab sin_epu con_epu con_epu_bbva, append sheet(Sureg Spillover Monthly, color(3)
nogridlines) stats(N r2 r2_a) font("Verdana" 8) tblank(1)   lines(_cons 2 LAST_ROW 13
COL_NAMES 2 EST_NAMES 2)  nolabel cnames(cue_china_us . cue_china_eu . cue_us_china .
cue_us_eu . cue_eu_china . cue_eu_us . cue_china_us . cue_china_eu . cue_us_china .
cue_us_eu . cue_eu_china . cue_eu_us . cue_china_us . cue_china_eu . cue_us_china .
cue_us_eu . cue_eu_china . cue_eu_us .) save("`results_path_reg'")


log close
clear
```