EUROPEAN FINANCIAL MARKETS EXPOSED TO EXOGENOUS SHOCKS: COMMUNICATION DYNAMICS AMONG INVESTORS AND TECH MODELS TO DETECT FINANCIAL CONTAGION

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Abstract

Brexit, the Covid Pandemic and the Russia-Ukraine War represent the latest three major global events that have demonstrated that financial contagion is a phenomenon that needs careful study because its global effects can cause unprecedented shocks to regional and global financial markets. The main reason is related to the interconnectedness of these markets, the interdependence between countries, and the connections created over decades between national and international financial institutions. In this paper, we aim to analyze, using the Diebold-Yilmaz (DY) methodology proposed by Diebold and Yilmaz in 2014, the effects of financial contagion in the three major crises Brexit, Covid and the Russia-Ukraine war (first year). Financial contagion is primarily a fear-driven phenomenon. Financial network connectivity has the potential to change due to investors' fear during events that are disturbing and cause exogenous turbulence. We use the network analysis established by Diebold and Yilmaz (2014) to study how SCDS (Credit Default Sovereign Markets) markets changed their interconnectedness around exogenous shocks in the last decade (Brexit, the Covid-19 pandemic, and the Russian invasion of Ukraine).

Keywords

Financial contagion, DY methodology, VAR model, SCDS Markets, exogenous shocks

JEL Classification

G11, G15.

Introduction

Financial contagion represents (Dornbusch et al., 2000) a major change, a shock, that initially affects several financial institutions, and then spreads various issues, economic aberrations, harmful changes throughout the entire financial system of the respective

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country, before infecting the economies of other countries. The main characteristic of financial contagion is the spread of financial shocks horizontally and vertically across various markets due to institutional interconnectedness, with contamination possible through credit channels, capital markets, and then spreading throughout the international banking system. Another essential factor for financial contagion is behavioral irrationality in times of crisis and the herd effect.

The phenomena of contagion across financial crisis is often used to describe moments when events cannot find their rational economic explanations: volatile and uncertain situations occurring because of irrational behavior. When exogenous shocks occur the potentiality of a crisis darkens the outlook for financial markets, leaving investors exposed. Various mathematical models present how where risk sharing agreements move capital from one country to another, but in a zero-sum game (Stiglitz, 2010). The interconnectedness of financial markets may be associated with even worse outcomes if investors choose a high degree of risk diversification coupled with sentiments of "fear".

This article analyses from a network perspective how exogenous shocks changed market connectedness on Sovereign Credit Default Swaps (SCDS) across the European Union. We take into account three main exogenous shocks that occurred in the last decade: Brexit, Covid-19 pandemic and the Russian invasion of Ukraine. We use the network analysis established by Diebold and Yilmaz (2014) which is based on a VAR decomposition model. We find that in general the GIIPS countries (Greece, Italy, Ireland, Portugal, and Spain) and CEE countries (Central and Eastern European) are the most affected by exogenous shocks. For Brexit, the results suggest that investors viewed all EU countries as riskier, but the above-mentioned countries were most affected. The pandemic significantly impacted sovereign risk, particularly in GIIPS countries which already had high public debt, while the CEE countries transmitted fewer negative spillover effects during the pandemic. For the Russian invasion of Ukraine, CEE countries were the most affected immediately after the invasion, although it subsided somewhat in the long term. The analysis suggested that geopolitical shocks resulted in changes to network structures, indicating shifts in spillover transmission of sovereign risk across EU member states. Overall, the results confirm the findings of already existing research on the impact of these events on financial markets.

Although several channels transmit contagion across markets, one of the most influential theoretical models attributes financial panic to the expectations channel. Contagion phenomena can be caused by simply random events that cause "informational cascades" where the market participation uses the information of their peers at data collection and interpretation tools (Bierth et al., 2015). Diamond and Dybvig (2000) argue that changes in creditor expectations are driven by almost anything and others have described changes in expectations as being caused by shifts of the business cycles driven by the lack of information or by the information asymmetry (Scott & Gelpern, 2014). It is clear that there is a consensus on the existence of "crowd" behavior regardless of the causes of contagion. Most of the theoretical models acknowledge the fact that financial contagion does not necessarily imply insolvency, but it is rather a short-term liquidity driven phenomenon. Pure contagion is driven by shifts in expectations that have the potential to be self-fulfilling and most of the time these expectations are not related directly and timely with changes in macroeconomic fundamentals. Thus, is worth studying how the interconnectedness of financial markets shifted after these events to observe how investors change their expectations in the short term, but also on the long-term.

The remainder of the paper is structured as follows. The next section presents the theoretical and empirical literature discussing the impact of exogenous shocks on financial markets. The third section describes the methodology. The fourth section presents the results obtained to the application of network analysis, while the last section concludes.

1. Review of the scientific literature

The literature on contagion mostly focusses on how markets react in different stressed environments, but it is limited to event study methodologies. The literature on contagion and volatility spillovers is even more limited for SCDS markets and it is narrowed to stock markets. As earlier described, market connectedness is highly influenced by exogenous shocks which are both geopolitical events, political decisions, natural disasters, and more recently global pandemics which require supplementary financial spending. Market connectedness intrinsically depends on the type of exogenous shock as they are out of the control of economic institutions and agents. Moreover, policy responses to balance the impact of exogenous shocks depend on the magnitude of the effect and on further developments related to unexpected events. Uncertainty measures and indexes have been advanced in the empirical literature to cover or predict the impact of the exogenous shocks on the regional/ global financial systems.

The effects of uncertainty on SCDS are transmitted through two channels. The first one is the price required to deal with the sovereign risk, known in the finance literature, as risk premium. The second one is related to investors' expectations about the default losses. Pastor and Veronesi (2013) develop a model based on a general equilibrium for stock prices that are influenced by political news. Their model accounts for political uncertainty and determines the magnitude of the risk premium, which depends on the state of the economy: weaker economic conditions coupled with political uncertainty determines a higher risk premium. Specific to sovereign risk, Pouzo and Presno (2016) develop a model with the central premise focused on the fact that international investors are worried about their own model's effectiveness of assessing the financial health of a borrowing country. In other words, if the statistical model they use does not accurately reflect the real economic situation of a country, uncertainty kicks in and investors ask for higher interest rates to compensate for the perceived default risk. Although their model matches the empirical data that exists on the sovereign bond spreads successfully explores how bond spreads changes over time, their model is based on endogenous default assumptions. Gilchrist and Zakrajsek (2012) create a credit spread index based on micro-data that allow for the measurement of the difference in interest rates between corporate bond, which hold a high credit risk, and government bond, instruments which hold a lower credit risk. Their decomposition into the index measures the supplementary returns that investors ask for riskier bonds. Their model is comprehensive indicating that changes, especially excess of risk premiums for government bonds, and reflect investors' capacity to absurd risk, which in turn is a good predictor for future economic activity. Pan et al. (2019) correlate the World Uncertainty

Index (WUI) developed by Ahir, Bloom, and Furceri (2018) with a large dataset on SCDS from advanced and emerging economies finding that a 1% increase in the global uncertainty leads to a 0.86% increase in the SCDS spread.

Uncertainty, from a theoretical standpoint, is quite a vague concept. It rather represents the lack of capacity to predict or estimate the potential future outcomes on the financial markets. Overall, uncertainty covers the unknowns that can affect decision-making and planning.

2. Research methodology

To assess stock market connectedness to exogenous shocks, we estimate spillover indices applying Diebold-Yilmaz connectedness index (DY) methodology proposed by Diebold and Yilmaz (2014). This extensively popular method allows for the examination of connectedness over-time dynamics across multiple markets: it extracts an overall time-varying connectedness index. For simplicity, we present our methodological choice in connection to our graphical representations. Based on a generalized variance decomposition of a vector autoregressive (VAR) model, the methodology (Diebold, F.X.; Yilmaz, K, 2016) is consistent with network graphical representations connecting forecast error variance decompositions matrices with network edge weights. In other words, the methodology and its applicable network representations uncover how much of future uncertainty in the stock market of variable i results from shocks in variable j. DY methodology starts with the implementation of a covariance-stationary VAR model with N variables, defined as follows:

$$Y_t = \sum_{i=1}^{p} \emptyset_i \, x_{t-i} + \varepsilon_t \qquad (1)$$

With error vector $\varepsilon_t \sim (0, \Sigma)$. The moving average representation of VAR takes the following form:

$$Y_t = \sum_{i=0}^{\infty} A_i \varepsilon_{t-i} \qquad (2)$$

where A_i is a N*N is a coefficient matrix. A_i follows recursive pattern as $A_i = \emptyset_1 A_{i-1} + \emptyset_2 A_{i-2} + \cdots + \emptyset_p A_{p-1}$. A_0 is an identity matrix and $A_i = 0$ = 0 for $i < 0$. The decomposition records how much variance of the forecast error of stock market returns at h=100 days ahead is due to the shocks in another variable included in the VAR model. Each matrix element is normalized by summing the row so that spillover numerical values obtained for each market equals the total decomposition of all variables sums to N:

$$\tilde{\varphi}_{ij}(H) = \frac{\varphi_{ij}(H)}{\Sigma_{j=1}^{N} \varphi_{ij}(H)} \qquad (4)$$

where $\Sigma_{j=1}^{N}\varphi_{ij}(H) = 1$ and $\Sigma_{i,j=1}^{N}\varphi_{ij}(H) = N$. In addition, $\varphi_{ij}(H)$ is the directional pairwise connectedness from j to i. In network representation, the pairwise connectedness measures are transformed into edges from one market to another. The size indicates spillover intensity between two or more variables. Finally, the total connectedness index is calculated as:

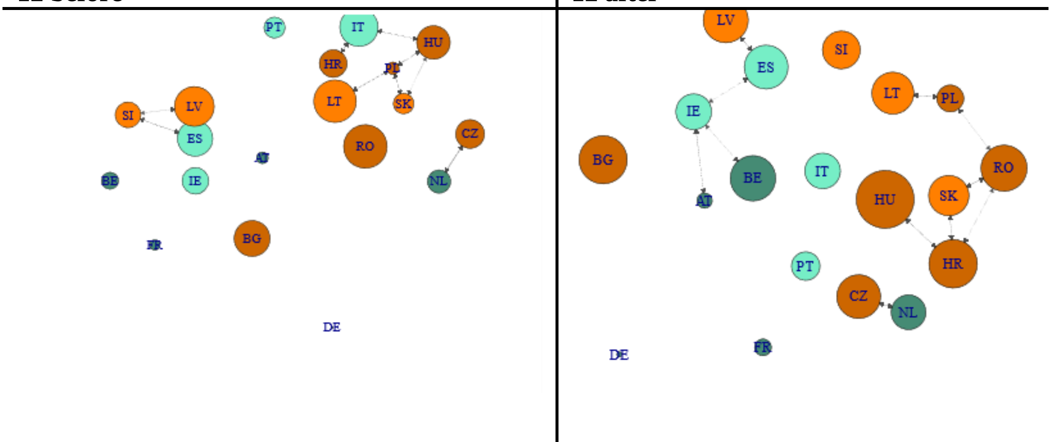
$$S(H) = \frac{\Sigma_{i,j=1,i\neq j}^{N}\tilde{\varphi}_{ij}(H)}{N} x\,100 \quad (5)$$

denoting the overall spillover magnitude originating that originates in all other stock markets. This measure represents "system-wide connectedness" or "dynamic connectedness index". This measure allows for over-time comparisons between connectedness indices before and after the event. To examine how exogenous shocks changed connectedness over time in exact terms, we compute average dynamic connectedness in three reference windows: [-12, +12], [-6, +6], [-3, +3]. To sum up the network graphical specifications of the network representations, we use the results obtained from DY to present estimated connectedness before and after each exogenous shock.

3. Results and discussions

The first event analyzed to assess risk spillover transmission across the EU is Brexit. The UK referendum for renouncing its EU membership can be categorized as a political exogenous shock disturbing the initial state of financial markets. Brexit has broad policy and political implications from the diplomatic relations between the UK and the member states to the consequences of the exit for the European single market. The literature on the effects of Brexit for the financial markets is quite extensive with empirical evidence leading the way to analyze what can be done to avoid other exists. For instance, Belke et al. (2018) study the far-reaching consequences of Brexit for other financial markets, as their inter-connectedness is intrinsic and inevitably harmful for other markets. Their study estimates how Brexit-driven uncertainty related to the UK volatility over time and uses two different measures of expectations on Brexit to analyze the impact on various financial assets across other 19 EU markets. In their selection of financial assets, they include sovereign credit default swaps (CDS), and 10-year interest rates. Their findings indicate that the GIIPS economies are particularly vulnerable to Brexit-driven uncertainty and are at the forefront of investors' perceptions in terms of losers outside the UK. The current analysis plots the network structures 12/6/3 days before and after the Brexit referendum (1) to capture specifically the changes in terms of spillover transmission and sovereign credit risk. Before the referendum, all network structures tend to remain the same regardless of the time before the event: Latvia, Slovenia and Spain are connected among them; Netherland is connected with the Czech Republic; Portugal, Germany, Austria, Ireland, France and Belgium are rather stand-alone markets in terms of spillover transmission; the other CEE markets are interconnected with Italy. The nodes sizes do not change before the referendum, which reflects a certain degree of optimism from investors as the Brexit vote was a highly debated event across the EU. However, after the announcement network structures change substantially and the first observation is related to the dimension of the nodes: all EU countries started to transmit more spillovers, being perceived as being riskier. After the event, Italy detaches itself from the network structure, while the trio formed by Latvia, Slovenia and Spain connect to Belgium, Ireland and Austria indicating transmission of negative spillover across SCDS markets. All other CEE economies transmit more spillover effects, and they increased the credit risk. The analysis of SCDS's market network structures before and after the Brexit referendum reveals noteworthy changes. Before the referendum, stability and optimism prevailed, with interconnectedness among select European nations and relatively isolated nodes. However, post-referendum, a substantial shift occurred, with increased transmission of spillover effects across EU countries, indicating heightened risk perception. Italy detached from the network, while a trio of Latvia, Slovenia, and Spain connected with other countries, signifying the transmission of negative spillovers. Additionally, Central and Eastern European economies amplified spillover transmission and experienced heightened credit risk. These alterations underscore the significant impact of the Brexit referendum on SCDS market dynamics and risk perception. The results are in line with the empirical evidence suggesting that GIIPS countries are the most affected by Brexit, but they also highlight the impact of the event for CEE countries.

12 before	**12 after**



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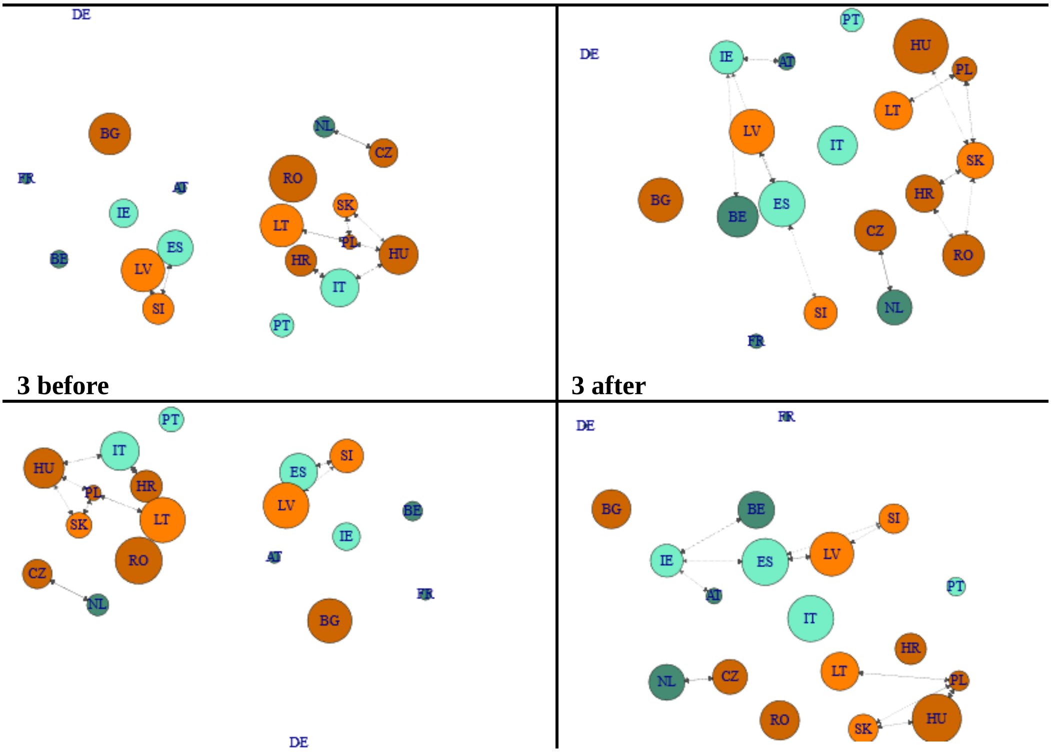


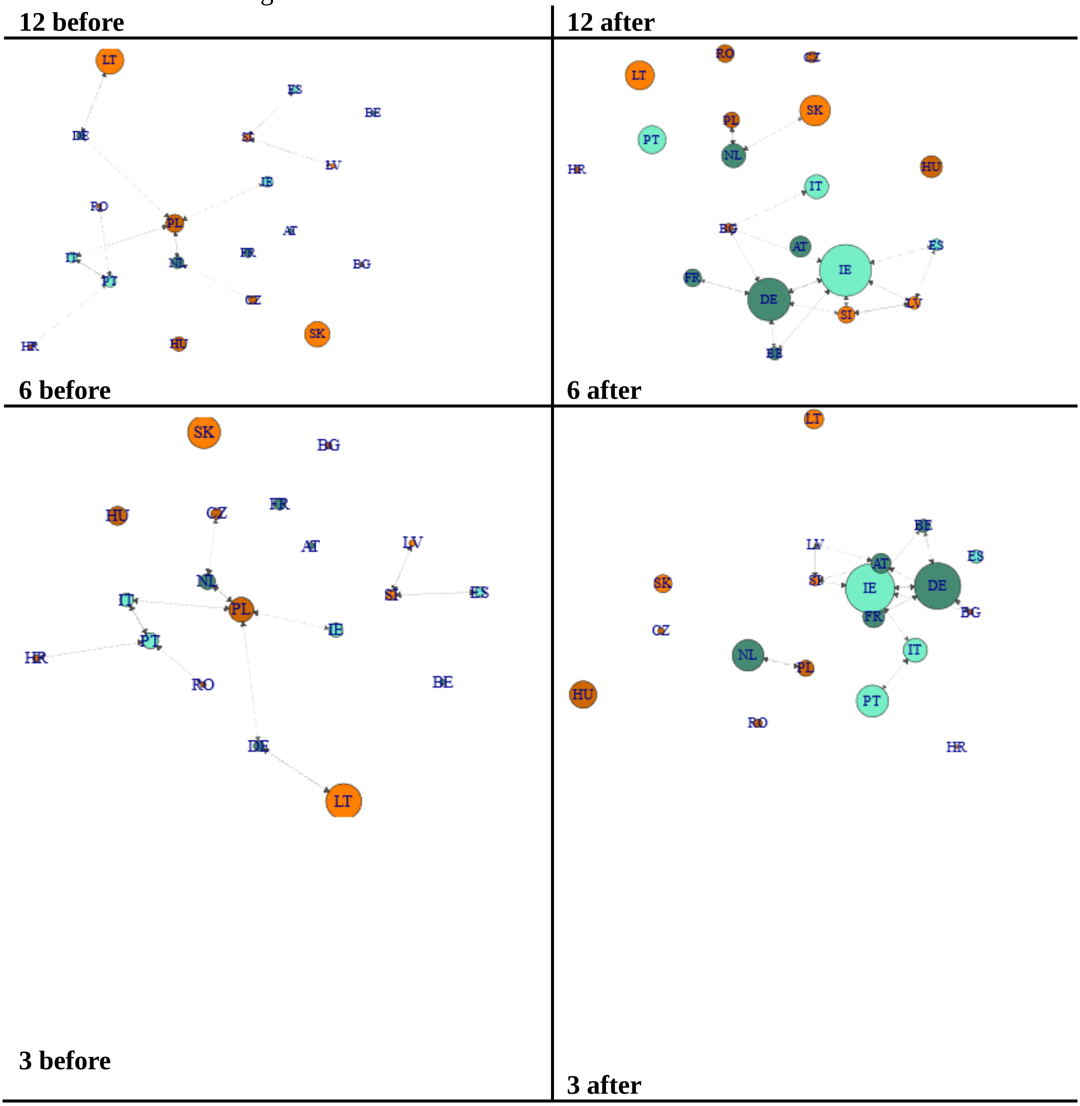
Figure no. 1: SCDS market connectedness structure before and after Brexit

Source: own processing

The second analyzed event is the Covid-19 pandemic. At the beginning of 2020, an unprecedented shock hit the global economies. The supply side of the global economy was affected by the lockdown measures leading to a decrease in production, while the demand side was affected by decreased consumption and fear-motivated behavior from people afraid of unemployment. Uncertainty regarding the duration and severity of the pandemic further exacerbated economic challenges, making it difficult for businesses and policymakers to formulate effective responses. Monetary and fiscal stimulus packages were implemented at the beginning of pandemic in an effort to contain the potential harmful effects of increased sovereign risk. As the EU has already experienced a contagion crisis during the European sovereign debt crisis, concerns over another vicious cycle transferring the sovereign risk to the banking sector were at the frontline of policy debates. However, a few months after the pandemic bond spreads stabilized and the markets reached stability again. Empirical studies sought to investigate the effects of policies and their contribution to stabilization. Corradin et al. (2021) decompose the government bond yields into different components assessing anticipated future interest rates on risk-free assets and an additional term premium, a risk premium for the default possibility, one for redenomination, a redenomination risk premium as well as a market segmentation premium. The study analyzed the impact of ECB's measures for reducing the sovereign risk during the pandemic. Similar to part 3.3 from chapter 3, the study finding that both fiscal and monetary measures implemented at the European level reduced bond spreads. González-Velasco et al. (2022) examine the impact of the pandemic on the European banking sector. The results indicate that GIIPS countries encountered an increase in the sovereign risk, but there is no proof that negative volatility spillovers were transmitted to core EMU economies. Karaman (2022) analyses the impact of the ECB's policy measures and the Covid-19 pandemic on SCDS markets but only for EMU countries. Their sample period ranges from March 2020 at the beginning of the pandemic and end in November 2020 when most of the lockdown measures were closed. The study uses a panel regression with fixed effects showing that the impact of the pandemic led to increased risks associated with government debt. The most affected countries are the GIIPS countries. However, they also examine the effectiveness of ECB's monetary policy concluding that the measures supported the mitigation of the financial negative impact driven by the pandemic.

The effects of the pandemic have also been studied from a global perspective, but at the European level spillover transmission dynamics were disregarded. Using a global sample of 78 economies, Pan et al. (2021) find that the pandemic increased the credit risk in the majority of countries: an increase of 1% in the number of infections determined an increase of 0.17% in the SCDS spreads. They indicate that this effect is particularly significant in emerging economies where the healthcare systems are not effective. This part studies the spillover transmission among EU member states before and after the pandemic to observe how the pandemic changed market dynamics. The results are in line with the empirical evidence suggesting that GIIPS countries were among the most affected countries: in GIIPS countries both the rate of infections and the sovereign risk was quite high. For instance, Italy was one of the countries in Europe that was particularly hard-hit during the early stages of the COVID-19 pandemic. Moreover, GIIPS countries have entered the pandemic with very high public debt levels leaving policy makers little leverage to cope with the pandemic. Conclusions from the network structures are as follows. First, before the official announcement of the pandemic and the start of the lockdown measures (18th of March 2020), there was a low level of sovereign credit risk across all the European SCDS markets: only Lithuania, Slovakia and Poland seem to show higher levels of credit risk in terms of magnitude. After the pandemic, all node sizes which show the magnitude of the credit risk increase substantially, but the increase is particularly relevant for Portugal, Italy and Ireland. Second, there is also an increase in the credit risk magnitude for advanced economies in the EMU: Germany, Austria, Netherlands, and France increase their spillover nodes and start to transmit spillovers across the sample. Third, another interesting dynamic occurs after the pandemic: while CEE SCDS's markets such as Poland, Lithuania or Czech Republic are connected with other markets before the pandemic, after the announcement they detach from the network and transmit less spillovers. This part of the study examines the transformation in market dynamics and spillover transmission among EU member states before and after the onset of the COVID-19 pandemic. The findings underscore the significant impact of the pandemic on sovereign risk, showing the effects particularly for GIIPS countries, which were already grappling with high levels of public debt. The analysis of network structures reveals a notable shift: prior to the official pandemic announcement, sovereign credit risk was generally low across

European SCDS markets, with a few exceptions. However, following the pandemic, there was a substantial increase in credit risk magnitude, especially in Portugal, Italy, and Ireland. Advanced economies within the EMU also experienced increased spillover nodes, transmitting risk across the network. Intriguingly, certain CEE SCDS markets, initially interconnected with others, detached from the network, and transmitted fewer spillovers post-pandemic. These observations highlight the profound influence of the COVID-19 pandemic on European market dynamics and the complex interplay of economic forces among member states.



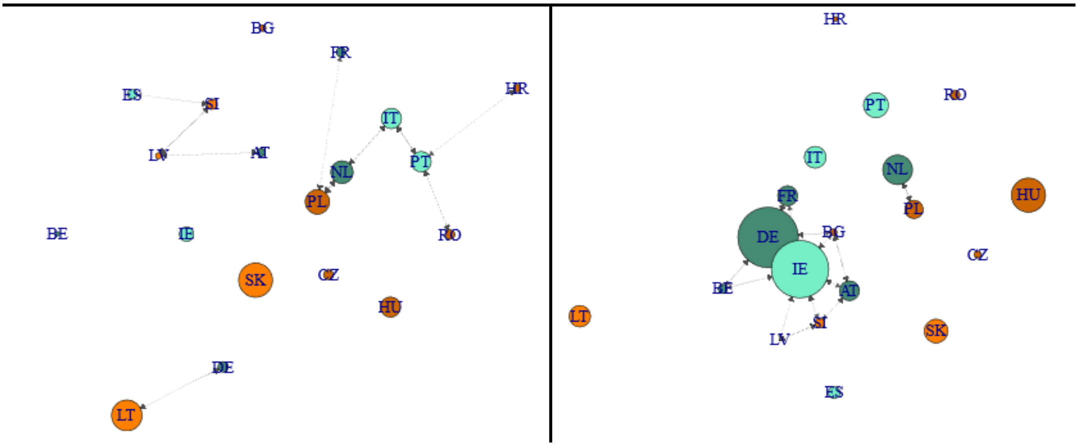


Figure no. 2: SCDS market connectedness structure before and after the pandemic

Source: own processing

The third analyzed event can be characterized clearly as a geopolitical exogenous shock. The unfortunate Russian invasion of Ukraine shocked the global financial markets and prefunded impacted commodity prices as trade relations are challenged by the stop of the supply chains. The impact of geopolitical events has been extensively analyzed for stock markets. Geopolitical risks are a very serious threat to financial stability and they act predominantly through an information channel (Dornbusch et al., 2000). Empirical literature identifies geopolitical shocks as being contagious episodes. The initial studies addressing the impact of geopolitical shocks on financial markets focused on the impact of September 11th attacks on global markets. Most of the studies indicate long-term and short-term consequences of the impact for stock markets around the global especially for the US and the Middle East (Graham and Ramiah, 2012; Nikkinen et al., 2008; Kollias et al., 2011; Chen et al., 2004) showing that geopolitical risk has a transitory impact.

On the impact of the Ukrainian war, the empirical literature still unfolds as the geopolitical event did not find a diplomatic solution for the conflict. Zhang et al. (2022) investigate the effects of volatility in global commodity prices for sovereign risk in 18 emerging economies concluding that geopolitical risk has affected the solvency of Russia following the Ukrainian war due to its long-term dependency between commodity prices and public debt. As the author suggest, there may be a strong relationship between Russia's prices of commodities (oil, gas, minerals which account for a large part of the Russian exports) and its sovereign risk. However, the analysis only related to the short-term dynamics and further research is needed to understand the long-term patterns of dependencies between changes in commodity prices and changes in sovereign risk. Lo et al. (2022) also study the dependency between commodity prices and systemic risk but they focus on the stock markets. They show how regardless of the level of dependence on Russian commodities, the Ukrainian conflict intensified market volatility.

Similar to this part’s analysis, Qureshi et al. (2022) examine the impact of the Russia-Ukraine conflict focusing on systemic vulnerabilities and risk spillovers. They create a database of news events as the main transmission channel of risk is an information channel which is related to the coverage of news. Indeed, the empirical literature finds that investors overreact to geopolitical news coverage at least in the short-term (Zaremba et al., 2022). Qureshi’s study refers to the impact of the conflict on the systemic risk for the most important global economies: Russia, Ukraine, France, Germany, Italy, the UK, the USA, and China. Their findings indicate that the Ukrainian war has implications far beyond the main actors engaged directly in the conflict with European markets being particularly exposed to systemic risk and instability. Moreover, they highlight the risks of imposing economic sanctions which can trigger the accumulation of risk despite their targeted character.

This part plots the network structures before and after the Russian invasion (24th of February 2022). It is clear that network structures and market connectedness level changed after the invasion, but the most significant impact is observed immediately after the military attack of Ukraine. Before market connectedness stays more or less the same: strong spillover effects are observed between CEE SCDS’s markets and GIIPS countries, while core EMU countries remain detached from high-risk networks. Not only does the spillover transmission maintain its position before the invasion, but also the credit risk magnitude keeps its levels. However, three days after the invasion CEE countries (with or without EMU membership), particularly Poland, Croatia, Hungary, Slovakia, Bulgaria, Romania, and Latvia, increase their levels of credit risk. Poland has the highest increase in credit risk. Moreover, six days into the war, CEE credit risk level return to adequate levels, but some countries, particularly Poland, Hungary, Romania, remain high transmitters of sovereign credit risk. The spillover transmission patterns do not significantly change three days after the invasion as CEE countries remain highly interconnected, but they change on the long-term. Six and twelve days after the invasion, less spillover effects are transmitted from CEE and the network structures start to be characterized through bilateral or trilateral connections. Moreover, the several CEE countries (Bulgaria, Romania, Croatia) start to transmit and receive spillover from several advanced EMU countries such as Austria, Netherlands or Germany. These effects can be both positive and negative and may result from factors such as trade, investment, financial linkages, or policy decisions. In conclusion, market connectedness remains stable, with strong spillover effects between CEE countries and GIIPS countries. Over the long term, spillover transmission patterns change, with fewer effects from CEE countries and increased interaction with advanced EMU countries like Austria, the Netherlands, and Germany.

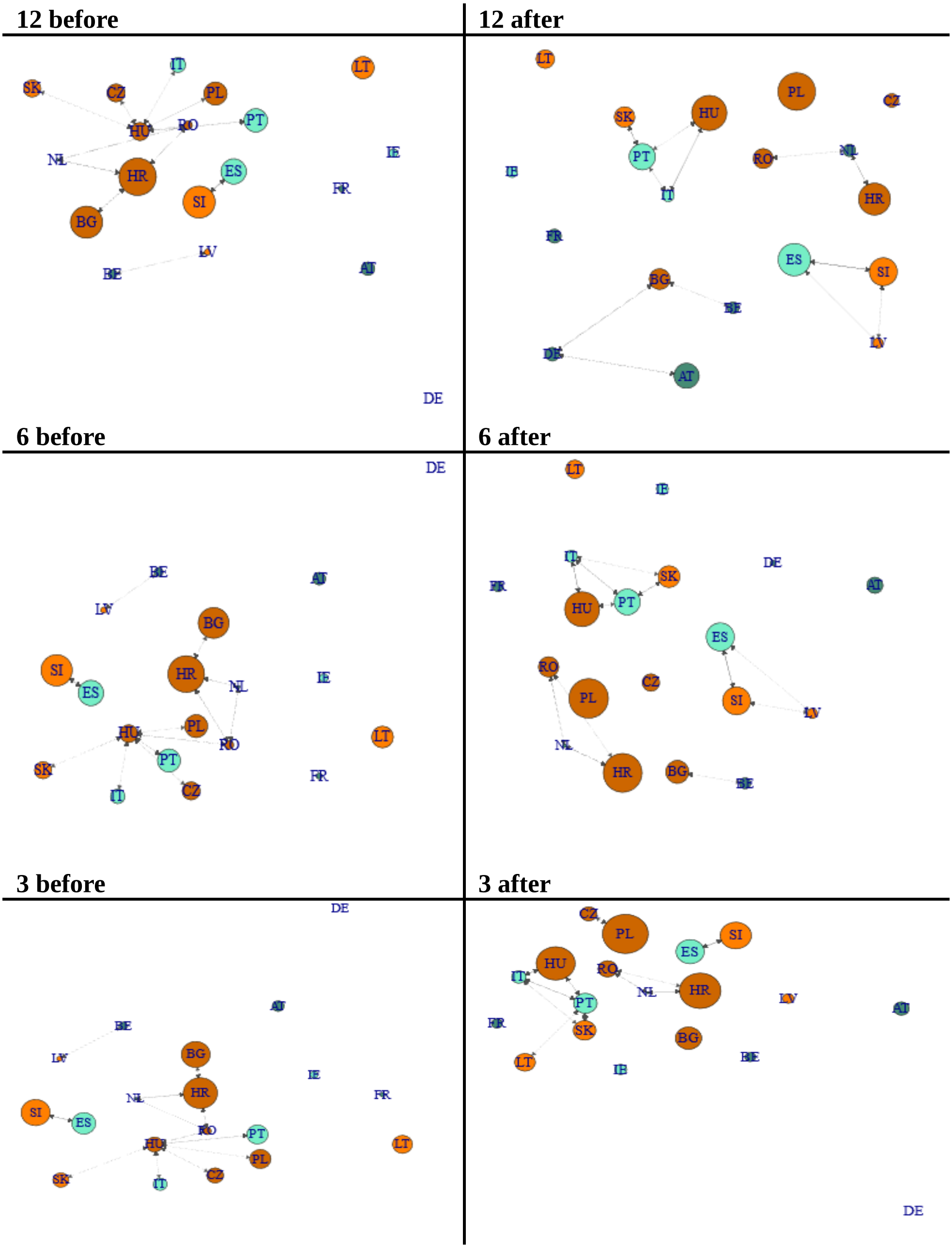


Figure no. 3: SCDS market connectedness structure before and after the Russian invasion of Ukraine

Source: own processing

Conclusions

Following the analysis conducted, it can be clearly observed that the three major events of the last decade have generated irreversible effects with negative impacts on global economies and national and international financial systems, and financial contagion has had a considerable dimension, being one of the characteristics of these crises.

In the case of Brexit, there was notable volatility in financial markets both in the United Kingdom and across Europe. Investors changed their strategies due to uncertainty regarding the economic impact of Brexit and the potential consequences for the financial sector. Equally noteworthy are the capital withdrawals, which affected the liquidity and stability of financial markets, as well as the cost of credit for businesses and households. Additionally, the depreciation of the pound sterling and the downgrade of the UK's credit rating influenced currency markets and the cost of financing for the government and firms. Brexit also had effects on financial markets in the rest of Europe. Some European markets were affected by uncertainty regarding the UK's future relationship with the European Union, and certain sectors, such as finance and trade, felt the negative impact of Brexit. The impact on the financial sector and services in the UK, especially for financial institutions with cross-border operations, forced some financial institutions to partially relocate their operations to other financial centers.

In the case of the COVID pandemic, financial contagion had a significant impact on sovereign risk, especially in GIIPS countries that already had high public debt, while CEE countries transmitted fewer negative transmission effects during the pandemic. Moreover, the Covid pandemic initially caused asymmetric shocks across most of the planet due to restrictions on individual mobility and travel. The closure of some businesses or massive reorganization of others created a domino effect in most financial systems, accentuating market volatility and causing an increase in investor distrust.

Another significant seismic event for financial markets occurred with Russia's invasion of Ukraine, with CEE countries being the most affected immediately after the invasion, although it subsided somewhat in the long term. Fear-based sentiments drove a certain degree of contagion in EU markets, with different impacts in various regions and events. At the same time, there is a noticeable increase in political and economic uncertainty in Eastern Europe, and for this region, there is a rise in sovereign risk especially for countries in the immediate vicinity of the conflict. Increases in financing costs for companies and governments have been recorded, and there has been a strong contagion between the SCDS markets in Central and Eastern Europe and the GIIPS countries, while the core countries of the EMU have remained separate from high-risk networks.

It is noteworthy that all three major events of the last decade demonstrate that to prevent and manage financial contagion, government authorities and international organizations must take measures to strengthen financial systems, monetary policies, and carefully oversee institutional interconnectedness and adapt them as crises unfold to limit their spread.

References

[1] Ahir, H., Bloom, N. and Furceri, D., 2018. The world uncertainty index. SSRN Electron J.

[2] Belke, A., Dubova, I. and Osowski, T., 2018. Policy uncertainty and international financial markets: the case of Brexit. Applied Economics, 50(34-35), pp.3752-3770.
[3] Bierth, C., Irresberger, F., & Weiß, G. N. (2015). Systemic risk of insurers around the globe. *Journal of Banking & Finance*, *55*, 232-245.
[4] Chen, A.H. and Siems, T.F., 2004. The effects of terrorism on global capital markets. *European journal of political economy*, 20(2), pp.349-366.
[5] Corradin, S., Grimm, N. and Schwaab, B., 2021. Euro area sovereign bond risk premia during the Covid-19 pandemic
[6] Diebold FX, Yilmaz K (2014) On the network topology of variance decompositions: Measuring the connectedness of financial firms. *Journal of econometrics* 182:119-134.
[7] Diebold, F.X.; Yilmaz, K. (2016) Trans-Atlantic Equity Volatility Connectedness: U.S. and European Financial Institutions, 2004–2014. *J. Financ. Econom. 14*, 81–127.
[8] Dornbusch, R., Park, Y.C. and Claessens, S., 2000. Contagion: understanding how it spreads. *The World Bank Research Observer*, *15*(2), pp.177-197.
[9] Gilchrist, S., & Zakrajsek, E. (2012). Credit spreads and business cycle fluctuations. *The American Economic Review*, 102(4), 1692–1720.
[10] González-Velasco, C., García-López, M. and González-Fernández, M., 2022. Does sovereign risk impact banking risk in the Eurozone? Evidence from the COVID-19 pandemic. *Finance Research Letters*, *47*, p.102670.
[11] Graham, M.A. and Ramiah, V.B., 2012. Global terrorism and adaptive expectations in financial markets: Evidence from Japanese equity market. *Research in International Business and Finance*, *26*(1), pp.97-119.
[12] Karaman, S.Y., 2022. Covid-19, sovereign risk and monetary policy: Evidence from the European Monetary Union. *Central Bank Review*, 22(3), pp.99-107.
[13] Kollias, C., Manou, E., Papadamou, S. and Stagiannis, A., 2011. Stock markets and terrorist attacks: Comparative evidence from a large and a small capitalization market. *European Journal of Political Economy*, 27, pp.S64-S77.
[14] Lo, G.D., Marcelin, I., Bassène, T. and Sène, B., 2022. The Russo-Ukrainian war and financial markets: the role of dependence on Russian commodities. *Finance Research Letters*, *50*, p.103194.
[15] Nikkinen, J., Omran, M.M., Sahlström, P. and Äijö, J., 2008. Stock returns and volatility following the September 11 attacks: Evidence from 53 equity markets. *International Review of Financial Analysis*, *17*(1), pp.27-46.
[16] Pan, Wei-Fong, Xinjie Wang, Yaqing Xiao, Weike Xu, and Jinfan Zhang. "The effect of economic and political uncertainty on sovereign CDS spreads." *Available at SSRN 3406407* (2019).
[17] Pastor, L., & Veronesi, P. (2013). Political uncertainty and risk premia. *Journal of Financial Economics*, 110(3), 520–545.
[18] Pouzo, D. and Presno, I., 2016. Sovereign default risk and uncertainty premia. *American Economic Journal: Macroeconomics*, 8(3), pp.230-266.
[19] Qureshi, A., Rizwan, M.S., Ahmad, G. and Ashraf, D., 2022. Russia–Ukraine war and systemic risk: who is taking the heat?. *Finance Research Letters*, *48*, p.103036.
[20] Stiglitz, J.E., 2010. Contagion, liberalization, and the optimal structure of globalization. *Journal of Globalization and Development*, 1 (2), 1–45

[21] Zaremba, A., Cakici, N., Demir, E. and Long, H., 2022. When bad news is good news: Geopolitical risk and the cross-section of emerging market stock returns. *Journal of Financial Stability*, *58*, p.100964.
[22] Zhang, Z., Shahzad, S.J.H. and Bouri, E., 2022. Tail risk transmission from commodity prices to sovereign risk of emerging economies. *Resources Policy*, *78*, p.102869