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MODEL OF FINANCIAL CRISIS CONTAGION:
A SURVEY-BASED SIMULATION BY MEANS
OF THE MODIFIED KAPLAN-MEIER SURVIVAL PLOTS

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Abstract

The aim of this paper is to present a broad picture and novel aspects of the financial crisis contagion with respect to the stages of crisis contagion and its propagation factors. We employ a pioneering approach to a simulation of the financial crisis contagion by embarking on a qualitative query rather than on empirical data (i.e. by adopting an international investor's perspective by conducting the qualitative query backed by semi-structured interviews with financial markets' participants). Building on modified Kaplan-Meier Survival Plots, we suggest a model for the financial crisis contagion based on international linkages between markets, with particular attention paid to spot vulnerabilities in regulatory frameworks that allowed for the crisis to spread. Simulation results showed that there were several phases of crisis contagion in Europe, and different countries (regions) were contained via different paths, propagated by different factors with not equal intensity. The diversity of European countries' susceptibility is evident not only when comparing advanced markets to the emerging ones, but also within these groups. Hereto, both international investment practitioners, as well as pan European market authorities should analyse with scrutiny the links emerging from the simulation, so that to develop sound and efficient investment strategies or impose tailor-made regulations for financial markets.

Introduction

The nascent financial crisis started mainly in USA as a result of several factors: extraordinary boom in the housing market, historically low-interest rates, introduction of financial innovations exploiting the pervasive deregulation, virtual decline of the inflation fear among central banks, thereby relaxing their customary vigilance, strong payment imbalances between countries resulting in global large scale investing, new financial products, e.g. derivatives[1]. International character of these and other factors propagated the crisis to spread gradually during the years 2007–2012, embracing numerous markets worldwide, affecting almost all European countries. However, not necessarily at the same time and due to the same initiators.

The global crisis exposed the fragility of financial markets' surveillance and regulations that were supposed to shield market participants from the adverse effects of financial distress. In the face of the nascent crisis new challenges emerged for policymakers and market regulators that served to promote the prevention of similar events of financial distress in the future. This, however, requires a detailed overview of international financial linkages between markets, with particular attention paid to spot vulnerabilities in regulatory frameworks that allowed for the financial crisis contagion to spread. Henceforth, the current research paper attempts to address issues associated with the overconfidence of policy makers and financial supervisory authorities who believed that the financial crises affecting advanced markets would not be transferred also to the emerging ones.

The findings reported in this paper gain in importance for the reason that the current financial crisis escalated tensions between national and supranational financial institutions in Europe which experienced difficulties in delivering stability arrangements for European markets. According to Fonteyne et al.[2], it became vital for European authorities to take care of the ways that were believed to propagate the financial turmoil, hence removing that tension. Although recognition of the flawed regulations and cross-market linkages in Europe was suggested several years ago by the pivotal studies of Dermine[3], Eichengreen et al.[4], and Véron[5], the global financial crisis added fuel to academic and political debates about possible prevention from similar events. In addition to this, Véron postulated resolutions for the arrangements managing the financial crisis contagion in the future. With this in mind, the current paper contributes to the fierce, albeit complex debate in political and academic circles by addressing challenges which lie ahead of regulators and policy makers in Europe, and by advising on prudential resolutions for reducing cross-market exposures to the financial crisis contagion. Assuming that different paths of crisis contagion are possible across European countries, and propagation factors vary

among particular contagion channels - this paper acknowledges that the choice for macro-prudential supervisory systems should account for country-specific factors when dealing with the financial crisis contagion.

This research paper is designed to deal with the notion of the international financial crisis contagion that still remains the least understood phenomenon confusing practitioners associated with financial markets worldwide. As spotted by Rigobon[6], a lack of comprehensive knowledge of the ways financial crises spread throughout stock markets caused substantial investment losses. These losses were manly incurred by investors diversifying their portfolios with suboptimal choices. Therefore, a study that would shed light on the contagion processes across contemporary financial markets would be of great benefit to global investors. To this point, the current research paper focuses on the financial crisis contagion by adopting stock market practitioners' perspectives. Moreover, the paper attempts to report findings that could contain useful advice for markets' authorities by suggesting an implementation of policies, stock market regulations, stimulus packages and fiscal plans that consider and manage the cross-market transfers of investment risks.

Finally, the current paper aims to address the question whether financial crises (shock transmission channels) can be predicted. This would provide implications of interest to international investors willing to diversify their portfolios with assets traded on European markets, advising them on trading strategies, hedging possibilities that can be applied in time of the global financial crisis. To this point, the current research paper attempts to broaden the context of the financial crisis contagion to encompass the European markets that constitute international investment hubs attracting large numbers of practitioners. Especially important remains the focus on Central European emerging stock markets, as these investment hubs remain relatively under-researched.

1. Embeddings in literature

The existing body of academic and business literature failed to provide a precise definition of the financial crisis contagion due to the fact that recent financial crises manifested themselves in a multiplicity of diversified factors that propagated shocks across markets. Pericoli and Sbracia[7] presented six definitions of contagions, whereas The World Bank Group specialists distinguish at least three – broad, restrictive and very restrictive definition – not suggesting, however, that any is more precise nor adequate to the nascent financial crisis than the others[8].

The lack of commonality among financial crises imposed difficulties to investigate financial crisis contagion processes.

The scholars, by analyzing historical events of international financial crises, were able to distinguish between various types of the financial crisis contagion that pointed to different ways the financial turmoil is spread across markets. For example, Glick and Rose, Rigobon, Forbes and Rigobon, Pavlova and Rigobon[9] investigated a broad range of fundamental propagation channels such as trade, financial and liquidity links, Espinosa-Vega and Solé[10] investigated the transmission of a pure credit shock, whereas Morgan and Murtagh[11] revealed interactions between primary debt markets. The correlation test conducted by Abd Majid and Hj Kassim[12] showed increased degree of correlation between individual stock markets during the crisis compared to before the crisis period. Gray[13] suggests that the EU–8 were subject to financial contagion, perhaps as a result of a banking sector that had strong cross-border links. However, given the volatility among currencies of smaller economies, the increased bonding, and targeting of the euro, the scope for deflecting shocks through exchange rate adjustments was much reduced. As it transpired, the current global financial crisis was propagated by additional links that previous studies have overlooked. In order to address these omitted links, this research paper attempts to shed light on the channels that facilitated the transmission of the financial crisis across contemporary European markets. In doing so, the paper employs a broader and more insightful approach towards the existing regulatory frameworks and the contemporary linkages between European markets. This purpose follows theoretical avenues suggested by Dungey and Martin, Rigobon, and Kodres, Pritsker[14] who provided both an empirical and theoretical explanation for mechanisms propagating the financial turmoil. Furthermore, Vinals and Moghadam[15] proposed regulatory solutions for the financial crisis contagion by postulating an employment of a cross-market, pan-European surveillance system. More in-depth analysis of crisis propagation factors, including references to the existing scholarly literature, provides Table 2 in Appendix 2.

By shifting its focus on Europe, this paper attempts to illustrate cross-market linkages between diverse groups of advanced and emerging markets. Such diversified research background enables the simulation model included in Section 3, to capture how propagation factors/links were being modified at different stages of the current financial contagion. Thus this paper strives to enrich the reviewed existing academic literature with novel and pioneering findings suggesting that the contagion factors/links are not constant over the period of transmission of the financial turmoil across European markets. To date, findings derived from previous simulations conducted by Rigobon, Kodres and Pritsker, and Pasquariello[16] assumed that the financial crisis contagion is propagated through constant links to all markets being affected simultaneously by

the financial crises. Such theoretical underpinnings were suggested by Boyer et al., Upper, Nier et al., Allen and Gale[17]. In addition, the majority of studies devoted to the analysis of the links for the financial crisis contagion were limited to investigating how the contagion processes were fuelled within a domestic, regional context; similarly like *studies on stock market integration* – Sharma and Seth[18] showed that 89 out of 105 studies considered a sample of at most 10 countries. Boss et al. and Elsinger et al.[19] conducted simulations of the financial crisis contagion for the Austrian banking system and the UK respectively. Furfine[20] focused on the ways the contagion is spread within the US financial markets. Marquez and Martinez[21] focused solely on Latin markets with particular attention paid to Mexico, whereas Allen and Gale[22] as well as Girard and Rahman[23] investigated the crisis contagion process in the Asian region. To this point, the current research paper attempts to broaden the context of the financial crisis contagion to encompass the European markets that constitute international investment hubs attracting large numbers of practitioners. Furthermore, recent qualitative analysis of published research materials about previous financial crises and the variability of empirical results of around 75 studies of financial contagion by Paas and Kuusk[24] showed no clear results, since the researchers had been using different definitions and testing methodologies. This paper departs from examining if the contagion constituted the reason for the global economic distress. Rather (in doing so), an attempt was made to show the capital market practitioners' views on crisis transmission channels and stages of contagion, based on the 2007–2012 events taking place in Europe, to draw conclusions for future actions and give advice on trading strategies, portfolio diversification that minimizes the risk of contagion.

Moreover, the current paper aims at revealing linkages between several European countries (precise crisis contagion paths), so that to advise global investors on which markets can be infected in the future, if any shock occurs in a specified country. Few academics investigated this problem, though not providing a comprehensive analysis for all the European countries. Maneschiöld[25] found that the Baltic States' stock markets are integrated with those of the Germany, France and the UK. Gray[26] concluded that financial contagion occurred from developed economy markets directly related to the crisis to emerging markets, and showed the shock transmission (money flows) between Euro zone and Baltic countries depending on currency exchange – Gray[27]. To this end, Iannuzzi and Berardi[28] suggest systemic approach to the current financial crisis, stating that national financial systems are strictly interconnected and interdependent each other ("system of systems") – small initial events can lead to complexity cascades of avalanche proportions, because of latent forces and that borders and relations of these systems are informal and unstable.

Recent economic and financial events revealed the weaknesses and vulnerabilities in regulatory framework, supervisory systems, that allowed nascent financial crises to spread across Europe. The existing literature focused on various ways the financial turmoil might be disseminated across markets and provided interesting implications for policies and regulations that may prevent the contagion. Lowenstein , Jorion, Flood and Marion[29] linked the contagion to macroeconomic factors and advised on response-policies in this premise. Alexander[30] stressed that post-Bretton Woods liberalisation of financial markets resulted in the privatisation of financial risk, which created pressure to eliminate controls on cross-border capital movements and the further deregulation of financial markets and – based on financial crises in Asia, Russia and Latin America experiences – suggested international regulation of financial markets and supra-national standards (i.a. authorisation of financial institutions, generation of rules and standards of regulatory practice, surveillance of financial markets, and coordination with national authorities in implementing and enforcing such standards) of prudential supervision[31]. Kaminsky and Reinhart[32] highlighted the role of speculative attacks pertaining to shocks that were triggered in financial markets and addressed regulatory shortcomings in this spectrum. Similar implications for policies and regulations were reached by Allen and Gale, Bekaert et al., Kaminsky and Yuan[33] who investigated regulatory shortcomings set against the background of institutional imbalances and information asymmetries prevailing in financial sectors. Post crisis advises on reform agenda concerning markets regulations and supervision has already been suggested by Gupta, Giustiniani and Thornton, Atle Berg, Nguyen, Prorokowski[34], including i.a. strengthening prudential regulation, enhancing supervision, mitigating pro-cyclicality, integrating micro- and macro-prudential oversight, reducing the systemic risk associated with large and complex financial institutions, expanding resolution process and fortifying financial market structure, separating proprietary trade, enhancing information transparency, creating a robust and resilient financial system. In contrary, Grosse[35] argues that no policy can eliminate future crises, so market authorities should rather focus on designing responses to the behaviors of market participants.

The debate moves further to the question of total market liberalization vs. covering most aspects of financial markets with regulations. This, however, does not suggest that markets lack regulations; rather this paper argues that the current policies are not effective in dealing with nascent problems concerning global capital flows. Already a decade ago Wood[36] stressed that careful thought should be given to what regulation is for before it is put in place, for "imaginary perfect regulator" is not applicable to the functioning markets, what was confirmed by Willett[37]: the main issue is how to get better regulation, not whether there should be more or

less. Addressing these emergent problem requires a more insightful analysis that would prevent from the occurrence of overregulation – e.g. taxation of capital flows as suggested decades ago by Tobin[38], recently discussed within the structures of European Union. By building on the aforementioned studies, this paper aims to emphasize the regulatory debacle that allowed for the shocks to grow into the global financial crisis. To this point, conclusions for markets' authorities on how to improve, amend policies, stock market regulations, what stimulus packages and fiscal plans to implement to minimize the transfer of investment risks, seem to be of great importance.

One of the groups most affected by the crisis contagion are investors, either institutional or retail. Hereto, the empirical framework adopted in this paper is designed in a way that shows the threats and benefits of international portfolio diversification processes in times of the global financial crisis. Whereas, Bekaert et al., Gebka and Serwa, Gilmore and McManus as well as Patev and Kanaryan[39] highlighted the lack of unison in co-movements between stock markets from Central Europe and USA, in times of the global financial crisis, gains from international portfolio diversification are strongly related to the paths of crisis contagion, for not all the financial markets were affected in the same time nor with the same strength. Moreover, Central European emerging stock markets such as Poland became more integrated with their advanced counterparts due to the membership in the European Union and – according to Syriopoulos[40] – global factors. Therefore, a need emerged for a study that analyses crisis contagion process that advises on new potential investment strategies that reduce investment risk by showing which countries were infected at first stance and by what factors.

Moreover, popularity of international portfolio diversification is derived from the broad advantages and benefits analysed in a large body of literature devoted to advancing the knowledge of investing in different markets. To this point, the existing reviewed literature rekindled vigorous debate on the purposes for international portfolio diversification. These purposes were boiled down to the two main characteristics of returns achieved by international practitioners. The first motivation was rooted in the return characteristics that guaranteed reduction of investment risks. The second purpose related to the return enhancement from international portfolio diversification processes with emerging stock markets. Against this backdrop, a set of scholarly contributions by Divecha et al., Middleton et al., as well as Harvey[41] argued that targeting emerging stock markets led to the substantial decrease in an overall portfolio risk. In contrast to these studies, Errunza and Padmanabhan, Fifield et al.,, as well as Bekaert and Harvey[42] posited that international portfolio diversification with emerging stock markets resulted in higher returns. This paper aims to reconcile these two opposing camps by setting its premise on the crisis-induced changes to

international portfolio diversification with equities from a relatively under-researched markets. With regard to the recent crisis, emerging markets may turn out to be not solely the genuine of the problems, rather they were contained in further phases. Thus, new diversification strategies may evolve.

Finally, the current paper aims to address the question whether financial crises can be predicted, especially in terms of their contagion across markets – this would provide implications of interest to international investors willing to diversify their portfolios with assets traded on European markets. This question remains open in academic circles and among practitioners associated with financial markets worldwide. Henceforth, there are two opposing camps in the academic literature with the former camp arguing that signals warning about the looming financial crisis existed in the past – Young, Corsetti et al.[43]. The latter camp supported the thesis that financial crises could not be predicted – Yuan and Krugman[44]. The following study attempts to reconcile these two opposing camps by providing evidence suggesting that the financial crisis contagion can be predicted, to the extent that facilitates employment of a proper regulatory framework shielding financial markets' participants from the adverse effects of the crises. Furthermore, the paper endeavors to shed light on a common presumption found in the reviewed academic literature, stating that events of the financial contagion differ due to the links and factors propagating the financial turmoil. Dornbusch et al., Pericoli and Sbracia, Dungey et al., Dungey et al., Favero and Giavazzi, Bae et al., and Pesaran and Pick[45] pointed to additional factors propagating the financial crisis beside the fundamental links of transmission, which made the prevention of further contagion episodes increasingly difficult. This research paper posits that the aforementioned issues warrant investigation against the backdrop of the current global financial crisis.

2. Methodology

2.1. Description of the simulation model

As indicated previously, there is already abundant literature devoted to investigating the transmission and development of the global financial crisis – Berkmen et al., Brunnermeier, Lane and Milesi-Ferretti[46] – with additional forthcoming studies suggesting that an empirical model measuring the contagion paths across financial markets can be feasibly specified and employed in the following methodology. An attempt was made to design an empirical model simulating the financial crisis contagion and reflecting the cross-border linkages between contemporary European markets.

The model and the robustness check specified in the Appendix is rooted in the methodology presented by Pasqueriello, Kyle, Kordes and Pritsker, as well as Caballe and Krishnan[47]. To increase the robustness of the model, its methodology is in line with the empirical frameworks made by Kordes and Pritsker and Pasqueriello[48] who proposed a simulation that assumed the existence of a single core economy, regarded as a crisis originator, which influences a further three peripheral economies. However, in this paper, the simulation model was modified to cover a large number of z economies that shared diversified exposure to the financial contagion – $Y_{n,t}$. Unlike Caballe and Krishnan and Pasqueriello[49] who assumed a two-period economic environment, this study expands its analysis to cover n stages of the financial crisis contagion. These stages are to occur at equal and successive intervals in time – t. The paper also looks at a set of different propagation channels following the advice of Pasqueriello, and Bekaert, Harvey and Ng[50] who argued that the financial contagion is transmitted beyond economically fundamental channels and real cross-market links. Therefore, by analyzing a range of propagation factors, this paper is able to distinguish the financial crisis contagion from the cross-market interdependencies. According to Pasqueriello, Cass and Pavlova, Backus et al., as well as Baxter and Crucini[51], high cross-country correlations in stock markets performance, consumption and productivity may lead to biased and spurious results derived from existing simulation models. In order to address these concerns, inclusion of additional propagation channels in the empirical analysis has been facilitated.

For the purpose of maintaining realism in the empirical framework, the model builds on variables that stem from the qualitative query and theoretical studies rather than tangible data sets. These variables are contained in Table 1. Quantitative data failed to deliver a clear picture of the propagation factors that in many cases remained immeasurable, hence overlooked by standard simulation models. The model adopted for the purpose of this paper is presented in Appendix 1 and accompanied by the robustness check. Moreover, the qualitative query factored into the empirical model ascertains timely conclusions highlighting issues that have remained ambiguous for practitioners and academics. The semi-structured interviews complement the quantitative findings with interesting observations and proposals for regulatory resolutions, preventing the occurrence of a financial crisis contagion in the future. Thanks to its methodological framework, this research paper can report findings that constitute principal lessons from the global financial crisis.

2.2. Propagation factors

The paper looks at a set of different propagation channels following the advice of Pasqueriello, and Bekaert, Harvey and Ng[52] who argued that the financial contagion is transmitted beyond economically fundamental channels and real cross-market links. Therefore, by analyzing a range of propagation factors, this paper is able to distinguish the financial crisis contagion from the cross-market interdependencies. According to Pasqueriello, Cass and Pavlova, Backus et al., as well as Baxter and Crucini[53], high cross-country correlations in stock markets performance, consumption and productivity may lead to biased and spurious results derived from existing simulation models. In order to address these concerns, inclusion of additional propagation channels in the empirical analysis has been facilitated. All propagation factors used in the simulation contains Table 2 in Appendix 2, covering factors' explanations and literature references.

2.3. Data collection process, research limitations

The main motive underlying the selection of data sample was to focus on the capital markets practitioners' views on financial crisis contagion process, so that to draw sound practical implications for international investors. Hereto, a cross-section of practitioners were selected from a group of 200 respondents who filled in the questionnaires, and subsequently participated in semi-structured interviews, ranging from the sell-side (international brokers, brokerage house analysts, investment advisors), to the buy-side (portfolio, investment funds' managers, stock market analysts, private investors) as well as financial newspapers' columnists, economists, members of supranational financial institutions; for details see Table 3 in Appendix 3. The paper is therefore able to provide greater insight into the investigated matters and ensures obtaining a variety of meaningful opinions. Additionally, the multi-background perspective of the interviewees improves the quality of the results' generalization processes, hence increasing the merit of the research paper. Ultimately, 36 practitioners were selected for the interviews. The small number of the selected interviewees results from the high-profile selection criteria. The interviewees were assured of their anonymity and - to protect this - their names were replaced by unique codes.

The semi-structured interviews were aimed at investigating issues raised by the experienced practitioners, who were actively monitoring the global financial crisis and cross-market linkages. The interviews took place in Europe during the period 2007–2012 (most of them just recently: April–June 2012), and hence the qualitative findings should not be treated as an ex-post analysis of the global financial crisis. The multi-round interviews procedure resulted

in an in-depth analysis of the global financial crisis contagion, exploring resulting implications for policymakers, stock markets' regulators and international investors. The interviews lasted approximately one hour. Transcripts of the recorded conversations were made within 24 hours upon the completion of each interview. The structure of the interviews and immediate analyses of the results allowed for any further questions to be followed up in a timely manner. The structure of the interviews enabled the purpose and direction of the research to be explained to the practitioners at the first round of the interviews. Frequent meetings with the individuals helped to establish sound relationships and further bolstered cooperation as the interviewees became more engaged in the current research.

The empirical model is derived from medical research and, to date, has not been applied to economics or finance. However, due to its enhanced capabilities it was chosen to analyze contagion processes in Europe. The current empirical framework is rooted in the modified model of the Kaplan-Meier Survival Plots utilized commonly in cancer research. To this point, a more satisfying approach would be an adoption of the Cox Hazard Model. However, the latter is accompanied by the demanding assumptions that cannot be met when utilizing the data from a small number of questionnaires (data sample for this kind of methodology might be too small to make sound conclusions or extrapolate findings, however, this was the pioneer attempt to use it in for such investigation). Due to the innovativeness and complexity of the methodological approach, discussion of the empirics and data treatment is shifted to Appendix 1.

3. Results

3.1. Simulation results

The graphs (Figure 1) were generated using equations [1–2]. The graphs show delineated timing of the financial crisis contagion across the selected European markets. The "At Risk" Indicator informs about the risk of being affected by the progressing financial crisis. This indicator takes values from 0 to 1. The higher values (above 0.4000) of the "At Risk" Indicator suggest that the chosen markets are more susceptible to the financial crisis at the particular phases of contagion t. There are twenty constant time intervals that denote the phases of the financial crisis contagion. A visual inspection of this figure reveals that Ireland, Belgium, Holland, Switzerland, Germany, France and Sweden were the first economies/markets to be flagged "at risk" of being affected by the financial crisis contagion triggered in the UK. However, Sweden positively distinguished itself from these markets as the empirical findings indicated a relatively small risk of transferring the financial crisis to Sweden. Norway also appeared to be crisis-resistant
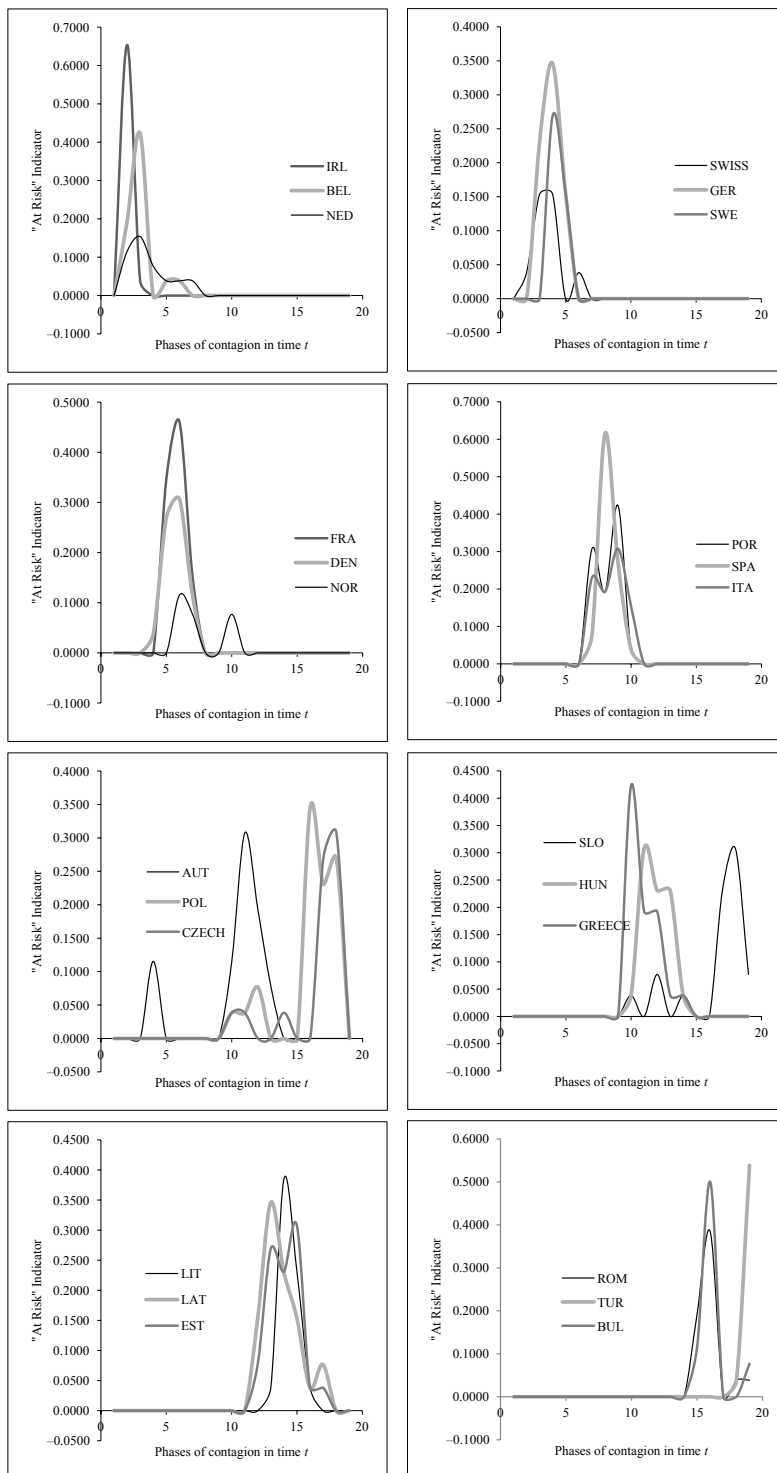
Fig. 1. Financial Crisis Contagion – Cross-market Progression

Source: own calculations.

– affected by the financial crisis contagion in the secondary phases and with a muted response to the progressing financial crisis. Then, the financial crisis contagion would reach France (high risk of contagion) and Denmark. Portugal, Spain and Italy would be affected in the tertiary phases of the financial crisis contagion. However, at this stage of the propagation, Portugal displayed the highest risk of being affected by the cross-market financial crisis. Although the risk of spreading the crisis over Italy was significantly smaller in comparison to Spain and Portugal, the risk of receiving the negative economic and financial shocks would be of a prolonged nature in Italy. Central European markets were affected to a similar extent as compared to Spain, Germany, Belgium and Italy by the financial crisis contagion. However, the risk of the financial crisis contagion was of a prolonged nature in the Central European region due to the multiplicity of diversified propagation factors actively fuelling the spreading of the financial crisis from the advanced markets to the emerging ones. As far as Greece is concerned, it displayed similar patterns of susceptibility to the financial crisis contagion as Hungary. However, in this case, the risk of contagion was of a greater magnitude. The Baltic Basin economies/market would experience an increased risk (higher than the advanced European markets) of the financial crisis in its later phases of contagion. According to the simulation based on the modified Kaplan-Meier Survival Plots, the Eastern European emerging markets (Romania, Bulgaria, Turkey) were last to be reached by the financial crisis contagion.

The strength of the propagation factors in the subsequent phases of the financial crisis contagion was calculated based on the equations [3–6]. The maximum value = 1 means that the chosen factor acted as the strongest link propagating the financial crisis across the markets. The minimum value = 0 means that the chosen factor was inactive at the particular phase $(t + n)$ of the financial crisis contagion. The above table reveals that the shock originated from the UK was transmitted first to Ireland, Belgium, Netherland and Switzerland. In the contagion nexus, financial markets in Germany and Sweden were negatively affected by the financial crisis. Successively, the contagion spread to France, Denmark and Norway. Having affected the majority of advanced markets, the financial crisis was then empirically reported for Portugal, Spain and Italy. The following stage saw the crisis step into Central European stock markets such as Poland, Austria, Czech Republic, Slovakia and Hungary. Subsequently the Baltic Basin countries – Lithuania, Latvia and Estonia were hit. Finally, Turkey and Romania were negatively affected by the spreading financial crisis contagion.

The quantitative simulation brought forward important conclusions. It turned out that the contagion channels were being transformed throughout the process of the financial crisis contagion. In the initial phase of the analyzed contagion, the crisis was spread through regulatory

Table 1. Financial Crisis Contagion – Strength of Propagation Factors

Propagation Factors				
Factor/Channel responsible for propagating the financial crisis contagion across Europe	Code	Factor/Channel responsible for propagating the financial crisis contagion across Europe	Code
Equity Market	V1	Hedge Funds' Operations	V9
Real Estate Market	V2	Currency Exchange	V10
Debt Market	V3	Rating Agencies	V11
Derivative Market	V4	Macroeconomic Factors	V12
Accounting Framework	V5	Bank Credit	V13
Regulatory Framework	V6	Investors' Confidence	V14
Cross-border Trade	V7	Investment Capital Flow	V15
Trade Relationships	V8	Others	V16

Contagion Strength – SCALE: 0–1 points						
	PROGRESSION					
Factor	UK→X1	UK, X1 → X2	UK, X1, X2 → X3	UK, X1, X2, X3 → X4	UK, X1, ..., X4 → X5	UK, X1, ..., X5 → X6
	t + 1	t + 2	t + 3	t + 4	t + 5	t + 6
V1	0.31	0.21	0.26	0.21	0.24	0.18
V2	0.17	0.13	0.13	0.25	0.16	0.14
V3	0.26	0.25	0.18	0.19	0.27	0.19
V4	0.30	0.26	0.19	0.13	0.14	0.11
V5	0.23	0.11	0.10	0.09	0.06	0.10
V6	0.29	0.10	0.13	0.09	0.07	0.11
V7	0.11	0.31	0.16	0.22	0.10	0.12
V8	0.16	0.13	0.29	0.20	0.09	0.10
V9	0.23	0.24	0.13	0.12	0.18	0.12
V10	0.12	0.28	0.13	0.06	0.19	0.12
V11	0.05	0.06	0.14	0.12	0.23	0.35
V12	0.12	0.14	0.21	0.36	0.17	0.21
V13	0.04	0.12	0.19	0.14	0.22	0.12
V14	0.08	0.10	0.16	0.20	0.14	0.33
V15	0.03	0.06	0.10	0.12	0.24	0.20

Sample Countries – Grouped					
Country	Code	Group Code	Country	Code	Group Code
United Kingdom	UK	X0	Austria	AUS	
Belgium	BEL		Poland	POL	
Ireland	IRL		Czech Republic	CZE	
Netherlands	HOL	X1	Slovakia	SLO	X5
Switzerland	SWI		Hungary	HUN	
Germany	GER	X2	Russia	RUS	
Sweden	SWE		Greece	GRE	
France	FRA		Lithuania	LIT	
Denmark	DEN	X3	Latvia	LAT	
Norway	NOR		Estonia	EST	X6
Portugal	POR		Romania	ROM	
Spain	SPA	X4	Turkey	TUR	
Italy	ITA		Bulgaria	BUL	

Source: own calculations.

and accounting frameworks which, at the later stage, became inactive transmitters of the global financial crisis. During the final phase indicated by the simulation model, rating agencies and their assessments became significant propagators of the financial crisis. Ultimately, the Central European emerging stock markets were affected by the simulated financial crisis through equity and debt market relationships, and the retrenchment of the investment capital inflow coupled with negative opinions about the region expressed by rating agencies. However, formerly affected countries – Italy, Spain and Portugal displayed different crisis transmission carriers. In this case, the simulated contagion among advanced stock markets in Western Europe was propagated by macroeconomic conditions and trade relationships. Nevertheless, equity and debt markets played equally significant roles in disseminating the simulated financial crisis.

3.2. General findings

The findings presented in a graphical form call for an active monetary policy that might improve markets' liquidity and capitalization figures. However, the flawed monetary policy was also found to add fuel to the financial crisis contagion by stimulating such propagation links as [V1 – equity markets], [V10 – currency exchange], [V12 – macroeconomic factors] and [V14 – investors' confidence]. While considering the aspects of the monetary policy and its active role in curbing the financial crisis contagion, the simulation highlighted the importance of [V10 – currency exchange] and the international significance of the monetary policy created by the Swiss Central Bank. It turned out that the constructive devaluation of the Swiss Franc (CHF), in the case of the currency exchange propagation factors, might bring relief to European financial markets, especially those from Central Europe. [V10 – currency exchange] was the second most significant propagation factor during the contagion spreading from [UK] and [X1 – Belgium, Ireland, Netherlands, Switzerland] to [X2 – Germany, Sweden]. In relation to the financial contagion being transmitted from the Euro Area to the Central European financial markets, the simulation generated implications pointed to the competitive devaluation that led to the feebleness of domestic currencies in Central Europe, and hence could shield those markets from the financial turmoil.

European economies which operated under the hard-peg exchange arrangements failed to prevent economic overheating and proved susceptible to the financial turmoil propagated by [V7 – cross border trade] and [V10 – currency exchange]. By implication, the prudential macroeconomic policies and enhanced market supervision could not do to shield European financial markets from the crisis. In case of Bulgaria, which developed relatively strong financial market regulations coupled with prudential economic resolutions prior to the appearance of the

first symptoms of the current financial crisis but operated under the hard-peg currency exchange, turned out to be vulnerable to the adverse effects of the crisis which caused the plunge of stock indices in 2008.

Macroeconomic propagation factors increased in significance in relation to the Central European and Baltic Basin economies. Emerging European countries that did not display a sustainable economic growth preceding the global financial crisis, suffered from abrupt financial shocks. It turned out that these countries (Lithuania, Latvia, Ukraine, Estonia) powered their rapid economic growth by basing the initial impetus on the macroeconomic imbalances. In the face of the financial crisis contagion, these countries experienced massive economic downturn coupled with reversals of the international capital flows [V15 – investment capital flow] because foreign investors realized the brittleness of the economic foundations. The macroeconomic imbalances contributed to a deep contraction of the Lithuanian, Latvian, Ukrainian and Estonian economies compounded by the decline in export demand and poor economic performance.

Empirically [V1 – equity markets] constituted the strongest transmitter of the financial crisis contagion. This enabled to draw up a scenario presenting an interesting approach to head off the financial turmoil. It turned out that investee companies representing innovative industries managed to sustain satisfactory export figures [V7 – cross-border trade] and improved their global competitiveness. [V7 – cross-border trade] and [V8 – trade relationships] remained significant propagation factors in emerging Europe, because export and cross-border trade were confined by labor costs and imperfect mobility of the labor force.

Considering the role of equity markets in propagating the financial turmoil, the model provided strong evidence that [V1 – equity market] lost its contagion powers within Central Europe. Similar results were empirically confirmed for [V4 – derivative] and [V3 – debt market]. The weakening of the financial crisis contagion – reported for the equity, derivatives and debt markets in Central Europe – could be explained by the sound regulatory framework employed in the leading stock markets of Central Europe: Austria, Poland, Czech Republic and Slovakia. The changes in regulations of those financial markets were introduced after previous episodes of financial crises.

[V13 – bank credit] gained its contagion powers at the stage of transferring the financial turmoil from the advanced European economies to their emerging counterparts in Central Europe. In the process of complementing the empirical findings around [V13 – bank credit], it became apparent that the intensity of the global financial crisis could be determined by the existence of bank-related capital inflows. Strong connections between advanced and emerging markets in

Europe partially explained high ratios of the inter-bank capital inflows. The simulation indicated that these ratios were particularly outstanding in countries that received external financial support. Apart from the capital flows, there were other indicators for the economic overheating; overblown current account deficits, economic imbalances propelling growth, nonperforming loans, spiraling inflation and external government debt constituted main determinants and favorable conditions for the financial crisis contagion in Central Europe. The markets that displayed increased levels of bank credit to the private sector turned out to be susceptible to the adverse effects of the financial crisis contagion.

[V14 – investors' confidence] and [V15 – investment capital inflow] were further deteriorated by cross-border tensions caused by the inadequate policy-responses to the global financial crisis. The discrepancies in the timing and ways of monetary and fiscal measures adopted in various European countries in order to fight the financial crisis contagion eventually had negative cross-border consequences leaving the Central European economies and markets at a disadvantage. The cross-border operating financial institutions, when faced with these consequences, failed to protect the emerging markets. Henceforth, international investors targeting equities in Central Europe retrenched their investments. In this vein, the simulation pointed to [V3 – debt market] as one of the most powerful propagators of the financial crisis among the contemporary European markets, both the emerging and advanced ones.

Focusing on the topic of derivative markets [V4– derivative market] and their roles in propagating the financial crisis contagion, the model highlighted the fact that European capital markets were adversely affected by the consequences of putting currency options in operations without proper estimation of the risks associated with this type of financial instruments. The negative consequences of neglecting the risk of complex structures of the currency options and derivative products would curb creditworthiness and investment plans of numerous companies involved in trading currency options during the current financial crisis. With this in mind, the study postulates an introduction of additional protection mechanisms to European capital markets. These mechanisms would shield investors, financial institutions and investee companies from the risks associated with using currency options and other derivatives.

Conclusions

The current paper – combining quantitative and qualitative research methods – has painted the picture of the contemporary European financial markets with particular attention paid to the existing cross-market linkages, vulnerabilities, systemic risks and flawed regulations that

altogether constituted a group of factors propagating the financial crisis contagion. In doing so, the paper reported findings that could be useful for practitioners associated with European financial markets as they have provided insights into the influence of the global financial crisis on the international portfolio diversification and functioning of capital markets in Europe. Moreover, the paper provided implications for policy-makers and financial market regulators advising on the ways of curbing the financial crisis contagion.

Simulation results, on contrary to the previous analyses, models presenting one-, two- or at most a three-stage contagion process, showed that there were several phases of crisis contagion in Europe, and different countries (regions) were contained via different paths, propagated by different factors with not equal intensity. The diversity of European countries' susceptibility is evident not only when comparing advanced markets to the emerging ones, but also within these groups. Hereto, both, international investment practitioners, as well as pan European market authorities should analyse with scrutiny the links emerging from the simulation, so that to develop sound and efficient investment strategies or impose tailor-made regulations for financial markets.

Hence, the simulation highlighted the importance of implementing a cross-European stock markets' surveillance that would ultimately make equity investment in Europe less challenging during the episodes of global financial crises. It remained particularly important as previous studies pertaining to network risks analyses among financial markets indicated that the crisis-induced decisions and activities of institutions in some markets triggered portfolio diversification losses. The findings suggested that the crisis affecting certain equity markets was propagated to other markets when investors – particularly large institutional practitioners – began to sell their equities traded in their host markets and other European bourses influencing a decline in values of portfolios held by other market participants. The simulation also highlighted the negative influence of the financial crisis contagion on the liquidity in European stock markets. To this point, the simulation constituted a quasi-empirical underpinning for the existing academic literature. In this case however, novel findings were delivered that have enriched scholarly literature positions by applying the simulated contagion theory and investigating network effects through an international spectrum.

The findings also delivered important implications for the capabilities and features of the warning signal systems that could be implemented to stem the ensuing financial contagion before it unraveled to affect financial markets in Europe. At this point, the paper postulated mapping European regions that were exposed to the highlighted contagion channels. This would involve evaluation of cross-country connections within specific regions and among a set of these regions.

The financial market authorities, both in emerging and advanced European economies should understand the functioning of these connections and factors on which specific cross-country and cross-regional networks depended. With this end in view, a behavior of certain propagation factors would produce early warning signals and prepare authorities or other network members to counteract.

As far as implications for international practitioners are concerned, the paper advises on several trading strategies that can be applied to the global financial crisis. First, it emerged from the qualitative query that practitioners associated with European stock markets should focus on alternative equity investments in innovative companies. Second, investors should not limit their attention to monitoring debt markets only. Although the paper argues that bond markets deliver information about investment risks and economic stability of host countries, this information can be distorted during times of global financial turmoil. By implication, stock market practitioners should consider monitoring the Euro adoption criteria – especially among Central European economies – as these determinants are associated with country's capacity to resist the global financial crisis. Third, in the light of international portfolio diversification, investors are advised to limit their investments to basic instruments and avoid targeting complex investment products offered on European markets. It turned out that these products did not shield international investors from the financial crisis contagion propagated by currency exchange factors. At this point, a lesson for the market regulators emerged. The paper postulates implementation of a "black list" that summarizes risky or flawed financial instruments. Furthermore, to minimize investment risks in the future, crisis contagion paths developed within the simulation might be of help for designing an international investment portfolio – linkages embracing from the analysis show possible contagion channels in future crisis. Hence, first signs of a difficult situation in one financial market may indicate how to perform subsequent actions in the others.

The simulated findings highlighted the relationship between the financial development of a particular market and its susceptibility to the financial crisis contagion. In order to address this concern, the paper advises market regulators of European markets to implement financial instruments that could smooth consumption and ensure investment capital flows. What emerged from the findings was that better developed financial markets can absorb shocks transmitted through the equity, debt or derivative markets and investment capital flows. This requires local central banks to operate under greater independency and policymakers to ensure increased contribution of the monetary policy to macroeconomic stability. Nonetheless, the authorities should not be too aggressive in the process of enhancing macroeconomic stability, but must

have access to a wide range of financial instruments used against negative effects caused by the contagion.

Another policy lesson that stems from the reported findings refers to better coordination between fiscal and monetary authorities. In the blend of the anti-crisis policies, monetary and fiscal regulators cannot act independently as this would lead to costly conflicts and adjustment of their policies while accommodating shocks propagated by macroeconomic factors and currency exchange volatility. Furthermore, the regulators ought to envisage additional and more insightful measures supported by monitoring of the quality of the monetary and fiscal policy.

As far as other policy lessons derived from the findings are concerned, it became apparent that trade relationships – unlike equity markets – were limited to fuelling the financial crisis contagion only within a narrow group of advanced economies in Europe. Therefore, the regulatory perimeter should be shifted to capture speculative attacks in stock markets that trigger cross-border spillover effects rather than issues related to international trade. This paper supports the idea of the capital cushions that would soften the negative effects of the international financial contagion. The paper advises European authorities to set up a pooled financial aid that could be used in times of the global financial crisis. However, given the severity and abruptness of the current financial crisis coupled with the high indebtedness of European countries, the responsibility for providing financial aid should be granted to supranational institutions such as the European Commission or the International Monetary Fund.

APPENDIX

1. Simulation model

The model adopted for the purpose of this paper appears as follows:

$$S = \begin{bmatrix} Y_{n,t} \\ X_{n,t} \end{bmatrix} \tag{1}$$

$$\widehat{S}(t) = \prod_{t(i) \leq t} \frac{n_{(i-)} - d_i}{n_{(i-)}} \tag{2}$$

The simulation S" is based on the modified model of Kaplan and Maier, Costella and Brown et al. who developed an estimate of the survival function[54]: "Ŝ". In this case, the model estimates two components of the vector derived from the right-censored data (questionnaires). Since the data is of qualitative character, the choice for the Kaplan-Meier Survival Model remains optimal as its methodology requires minimum assumptions but develops strong interpretive powers for the observed variables "Y" and "X". The first component of the vector – "$Y_{n,t}$" measures the strength of each propagation factor at a given time "t". The second component of the simulation ranks European countries in accordance with the timing "t" of the financial crisis contagion. Ultimately, the financial crisis contagion processes are limited to "n" stages that contain most frequently selected countries ordered by the "k^{th}" rank in the sequence. As far as the modified Kaplan-Meier Model is concerned, "t" is re-written to "t(i)" denoting the *ith* ordered wave of the financial crisis contagion and "d(i)" denotes the number of the effected countries/active propagation factors recorded at the wave "n" rewritten to time "t". If "n(i)" is the total number of all countries flagged as crisis-affected at time "t", or propagation factors becoming active during wave "n", then "n(i-)" denotes the sum of all countries flagged *at risk* before the *ith* ordered wave of the financial crisis contagion. Accordingly, "n(i-) encompasses all propagation factors that became active prior the occurrence of the *ith* wave.

Transferred from the medical studies into the field of finance and applied economics, The Modified Kaplan-Meier Survival Model becomes useful in evaluating whether and when the crisis contagion affects particular countries. However, this model fails to assess how each of the sample countries is affected by the spreading contagion. Therefore, the simulation consists of a vector that separately utilizes the Kaplan-Meier Model to both the propagation factors and countries. Furthermore, in order to analyze whether one group of countries is at greater risk of the financial crisis than the other groups, this paper is equipped with additional empirical analyses that constitute the robustness check for the Kaplan-Meier Methodology:

$$S_{RC} = \begin{bmatrix} Y_{n,t} \\ X_{n,t} \end{bmatrix} \tag{3}$$

$$Y_{n,t} = \beta * \Sigma_{i=0}^{y} V_{n,t} + \theta_t \geq 0; \; Y_{n,t} = [0,1] \tag{4}$$

$$X_{n,t} = W_{k,t}; \; k = \Lambda_{i=0}^{y} \quad (z_{1:i}, z_{2:i}, ..., z_{i:i}) \tag{5}$$

$$W_{k,t} = Z_{z,t}^{k} + \theta_t \geq 0; \; k = \Lambda_{i=0}^{y} \quad (z_{1:i}, z_{2:i}, ..., z_{i:i}) \tag{6}$$

Hereto, the robustness check of the simulation "S_{RC}" is built upon a vector of two equations: "$Y_{n,t}$" and "$X_{n,t}$". The first component of the vector – "$Y_{n,t}$" measures the strength of each propagation factor "$V_{n,t}$" at a given time "t". Computation of this measure is based on questionnaires, in which the respondents selected factors of the strongest significance at a given stage "t" of the financial crisis contagion, whereas "i" denotes the number of ticks (with maximum value of "y") for each variable and "n" encompasses all existing options (variables = propagation factors available). A scaler of "β" is introduced to the equation (4) so "$Y_{n,t}$" can take values from 0 to 1 in accordance with the significance of the selected factors. "θ_t" is a nonnegative parameter that eliminates measurement errors. The second component of the simulation is derived from the order statistics "$Z_{z,t}^{k}$" which ranks European countries in accordance with the timing "t" of the financial crisis contagion to affect selected countries "z". Ultimately, they are assigned to "n" stages that contain most frequently selected countries ordered by the "k^{th}" rank in the sequence "$W_{k,t}$" generated from the "i" choices of the respondents.

Both the model and the robustness check are built on the assumptions that the intervals between stages/waves of the financial crisis contagion are constant and unspecified for their duration in time. Hereto, the purpose of the robustness check is limited to rank the selected countries in accordance to their place in a domino effect caused by the global financial crisis. Since the empirical simulation is rooted in the qualitative query, this paper builds upon surveys and semi-structured interviews with stock market practitioners and experts possessing extensive knowledge about European financial markets, applied economics and finance. Combining both research methods enhances the models' ability to mirror reality and deliver practical findings for the policymakers and stock market participants. The questionnaires utilized in the models were sent in April and May 2012 to the targeted experts who displayed the required knowledge and understanding of the cross-market linkages in Europe, functioning of European financial markets and the current economic situation in Europe. The respondents were asked to assign European economies to the delineated stages of the financial crisis contagion. The respondents were also asked to assign the propagation factors that transmitted the financial turmoil between the ranked countries. In case of the robustness check, the strength of the propagation factors was calculated upon the cumulative frequency of instances at which they were selected for a given stage. Similar procedure applied for assigning countries to the

specific stages of the global financial crisis – economies that received the maximum number of ticks were included in the corresponding groups. All ambiguous issues that arouse from the questionnaires were clarified with the participant in a timely manner. An example of the questionnaire is enclosed in Appendix 4.

European countries "z" (Equation 5) are presented in Table 1. Additionally, Table 1 lists all variables utilized in the empirical model. Such a specified model allows for the financial crisis contagion to be tracked by monitoring several different cross-market links. The algorithm of the above equation is built on the assumption that propagation factors varied during the event of the global financial crisis. The model is therefore able to capture the successive changes triggered by an economic debacle of one financial market. For the purpose of consistency with previous findings, the United Kingdom was chosen as the country that triggered the global financial crisis. This allows the simulation results to be in keeping with the findings presented by Vinals and Moghadam, Poirson and Weber as well as Espinosa-Vega, Sole[55]. It also reflects the development and progression of the current financial crisis in Europe.

2. Propagation Factors

Table 2. Propagation Factors – An Overview

Code	Factor Propagating Financial Crisis Contagion	Factor description, literature references
1	2	3
V1	Equity Market	The market in which shares are issued and traded, either through exchanges or over-the-counter markets; global investors diversify their portfolios with international shares, therefore shocks contribute to the capital flows throughout countries – Pasqueriello (2007), Cass and Pavlova (2004), Backus et al. (1992) as well as Baxter and Crucini (1993), Girard and Rahman (2002), Abd Majid and Hj Kassim (2009), Pericoli and Sbracia (2003)
V2	Real Estate Market	The market for trading immovable property consisting of land and the buildings on it – Sakbani 2010
V3	Debt Market	The market for trading debt instruments; global investors diversify their portfolios with international bonds, therefore shocks contribute to the capital flows throughout countries – Allen and Gale (1999), Tarr (2010), Morgan and Murtagh (2012)
V4	Derivative Market	The financial market for derivatives, financial instruments like futures contracts or options, which are derived from other forms of assets; global investors diversify their portfolios with international shares, therefore shocks contribute to the capital flows throughout countries – Sakbani 2010
V5	Accounting Framework	A compulsory set of rules or principles (either US GAAP or IFRS) on data collection, measurement and disclosure for financial reporting purposes (and, separately, tax reporting purposes) as determined by the jurisdictional accountancy (and tax) authorities; practical application determines i.a. investment safety – Jeanne and Masson (2000)
V6	Regulatory Framework	A system of regulations and enforcement, usually established by a government to regulate a specific activity (incl. economy activities, law system, accounting, ect.); they vary among countries diversifying i.a. investment conditions – Allen and Gale (2000), Bekaert et al. (2005), Kaminsky (2006) and Yuan (2005), Willett (2010)

1	2	3
V7	Cross-border Trade	Trade between neighboring countries; depends on mainly on exchange rates and country specific regulations – Glick and Rose (1999), Rigobon (2002), Forbes and Rigobon (2002), Pavlova and Rigobon (2007)
V8	Trade Relationships	A form of arbitrage in which products/services are bought and sold between different economies – Didier et al. (2008), Eichengreen et al. (1996), Goldstein (1998) and Gerlach and Smets (1995), Glick and Rose (1999), Rigobon (2002), Forbes and Rigobon (2002), Pavlova and Rigobon (2007)
V9	Hedge Funds' Operations	A wide range of investment and trading activities concerning unconventional instruments in the hope of generating sound profits (arbitrage, futures, options) – Bookstaber (2007), Bernstain (2007)
V10	Currency Exchange	The rate at which one country's currency is traded against that of another country; it is one of the most vital determinants of trade, field and financial (equity) investment – Gray (2012), Eichengreen and Rose (1999), Forbes (2001, 2004) and Glick and Rose (1999), Pericoli and Sbracia (2003)
V11	Rating Agencies	Organizations that give a rating to companies, other organizations issuing bonds, countries (in general), influencing investors' behavior, opinions (investing activities) – Tarr (2010), Mazumder and Ahmad (2010)
V12	Macroeconomic Factors	Factors that are pertinent to a broad economy at the regional or national level and affect large population rather than selected individuals (e.g. economic output, unemployment, inflation, savings, investment), closely monitored by governments, businesses and consumers – Eichengreen et al. (1996), Lowenstein (2001), Jorion (2000), Flood and Marion (1999)
V13	Bank Credits	The amount of funds available to a company or individual from the banking system (financial institutions), depending on the borrower's capacity to repay and the overall amount of credit in the banking system; aggregated problems with individual repayments may cause distress in the whole (national or supranational) financial system – Allen and Gale (1999), Tarr (2010), Pericoli and Sbracia (2003), Espinosa-Vega and Solé (2011)
V14	Investors' Confidence	Investors' risk appetite measured usually by buying and selling patterns – Kaminsky and Reinhart (2003), Claessens et al. (2001), Alvarez-Plata and Schrooten (2003), Eichengreen et al. (1996), Woo (2000)
V15	Investment Capital Flow	Movement of money for the purpose of investment, analyzed internationally within the model (simulation)
V16	Other	–

Source: own calculations.

3. Data sample

Table 3. Interviewees' Details

Code	Loc.	Age	Sex	Area of Expertise
1	2	3	4	5
A01	SWE	30–40	M	Pan-European Listing; Corporate Trust Operations; Treasury; European Capital Markets
A02	SWE	40–50	M	Investment Fund Management; Pension Management Services; Equity Structured Products
A03	GRE	40–50	M	Financial Economics; Asset Management; Financial Crises; Financial Contagion Theory

1	2	3	4	5
A04	TUR	40–50	M	International Portfolio Diversification; Emerging Stock Markets; Equity Portfolio Analysis
A05	TUR	30–40	F	Intraday Stock Price Movements; Cross-market Correlations; Day-trading; Datamining
A06	ITA	20–30	M	Equity Investments; Derivatives; Hedge Funds' Operations; Equity Structured Products
A07	HUN	20–30	M	Investment Communications; Java Developing; European Financial Markets
A08	CZE	50–60	F	Financial Market Risks; Financial Contagion Theory; European Debt Markets
A09	SLO	30–40	M	Investment Banking; Accountancy; Global Equity Management;
A10	UK	50–60	M	Monetary Policy; Investment Risks; Stock Markets Regulations; Cross-market Linkages
A11	UK	50–60	M	Deregulation and Demutualization Processes; Central European Emerging Stock Markets
A12	SPA	30–40	M	European Equity Investments; Trading Strategies; Economics; Investors' Relations
A13	AUS	50–60	F	Banking; Accountancy; Financial Markets' Regulatory Frameworks; Investment Advisory
A14	UK	50–60	M	Financial Analyses; International Portfolio Diversification; Small-cap Investments
A15	UK	40–50	M	Investment Banking; Corporate Banking; Financial Markets' Risks Assessment
A16	POL	50–60	M	Transition Economies; International Trade; Economics; Economic and Political Relations
A17	POL	40–50	M	Financial Market Supervision; Financial Markets' Regulations; Corporate Governance
A18	UK	40–50	M	Financial Analyses; Corporate Finance; Accountancy; Financial Markets' Regulations
A19	UK	50–60	M	Corporate Responsibility; Investors' Relations; Stock Markets' Correlations; Derivatives
A20	POL	40–50	M	Trading Strategies; Emerging European Stock Markets; Global Financial Crises
A21	ITA	30–40	M	European Derivative Markets; Debt Markets; Equity Structured Products; Hedging
A22	POL	40–50	F	Supreme Market Control; International Finance; EU Economies; Financial Regulations
A23	GER	50–60	M	European Capital Markets; European Economies; International Finance
A24	GER	40–50	F	European Economies; Macroeconomics; Trade Relationships; Economic Policy
A25	UK	50–60	M	Debt Markets; Bonds; Monetary Policy; Fiscal Policy; Global financial Crises
A26	GER	30–40	M	International economics; Central Banks' Operations; International Finance; EU Markets
A27	POL	40–50	M	Quantitative Analyses; Equity Investments; European Stock Markets; Investment Advisory
A28	UK	30–40	M	Insider Trading; Corporate Governance; Financial Markets' Regulations; Financial Crises
A29	POL	30–40	F	Financial Newspaper Columnist; European Economies and Financial Markets
A30	POL	30–40	M	Investment Fund Management; Capital Markets; Macroeconomics
A31	POL	40–50	M	Asset Management; Equity Investments; Capital Markets
A32	POL	20–30	M	Corporate Finance; Capital Markets; Investment Banking
A33	POL	20–30	M	Risk Management; Financial Markets in Europe;
A34	POL	40–50	M	Capital Market; Stock Market Analysis
A35	POL	20–30	F	Financial Markets; Equity Investments; Analysis of Equity Markets
A36	POL	20–30	M	International Portfolio Diversification; Financial Markets; Investment Fund Management

Source: own calculations.

4. Questionnaire

CASE STUDY – FINANCIAL CRISIS CONTAGION

Let's assume that the global financial crisis has been triggered in the UK and then, in several consecutive phases, the crisis spreads on other European financial markets. Your task is to model how - according to your best knowledge - the financial crisis contagion spreads across Europe. In doing so, you are required to fill in the below table indicating which countries are affected at certain stages of the contagion. You must also select propagation factors (from the list provided) that facilitate the cross-market transfer of the crisis at the chosen phases and between the selected countries.

The table is constructed in a way that indicates several phases of the financial crisis contagion with the T0 stage denoting the UK triggered crisis and the T + 1, T + 2, ... stages corresponding to the delineated time periods of the financial crisis contagion. Every row in the table relates to the propagation factor and the "affected" country/market. Filling in this table, you should select countries from List A – that you believe are affected by the crisis at the stage T + 1. Then, you should assign proper propagation factors selected from List B. These factors are responsible for transmitting the contagion from the UK to the selected countries in phase T + 1. You may select as many propagation factors as you wish. This is due to the fact that certain countries might be affected by more than one propagation factor. You continue the procedure for the T + 2 phase. You decide how many phases there should be. An example of the filled-in table is provided below:

Crisis Originator	Factor from list B	Country T + 1	Factor from list B	Country T + 2	Factor from list B	Country T + 3	Factor from list B	Country T + 4	... .
UK	V3	GER	V5, V11	PL	V4	SLK			
	V3	GER	V5, V11	PL	V4, V13	CZE			
	V4	SLK							

In the above table, the financial crisis contagion was transmitted to the German financial market by the following propagation factor: V3 – Debt Market. Then the financial crisis was spread on Poland through the V5 – Accounting Framework and V11 – Rating Agencies. Then, the Slovakia was affected by the ensuing financial crisis contagion using V4 – Derivative market as the propagation channel. At the same time (T + 3) the Czech republic was affected. If such scenario happens, you should repeat the simulation up to the T + 3 phase, in which you place a new country/market. Do not forget to indicate different propagation factors at the final stage. You can deliver as many simulations and scenarios as you feel right. Remember, you can only place one country in one row. It is assumed that there is no halo effect and once the country is affected (in phase T + i) it cannot be re-affected again in the same scenario/row (phase T + j). This assumption does not pertain to the propagation factors that can be constant over all phases or vary depending on countries and financial crisis contagion phases.

The table you are asked to fill in is placed below. Good luck!

Crisis Originator	Factor from list B	Country T + 1 (list A)	Factor from list B	Country T + 2 (list A)	Factor from list B	Country T + 3 (list A)	Factor from list B	Country T + 4 (list A)	... ...
UK									

Notes

[1] Sakbani (2010).

[2] Fonteyne et al. (2010).

[3] Dermine (2005).

[4] Eichengreen et al. (1995).

[5] Véron (2007).

[6] Rigobon (2002).

[7] Pericoli, Sbracia (2003).

[8] The World Bank Group (2009).

[9] Glick, Rose (1999); Rigobon (2002); Forbes, Rigobon (2002); Pavlova, Rigobon (2007).

[10] Espinosa-Vega, Solé (2011).

[11] Morgan, Murtagh (2012).

[12] Abd Majid, Hj Kassim (2009).

[13] Gray (2009).

[14] Dungey, Martin (2007); Rigobon (2002); Kodres, Pritsker (2002).

[15] Vinals, Moghadam (2010).

[16] Rigobon (2002); Kodres, Pritsker (2002); Pasquariello (2007).

[17] Boyer et al. (2006); Upper (2007); Nier et al. (2007); Allen, Gale (2000).

[18] Sharma, Seth (2012).

[19] Boss et al. (2005), Elsinger et al. (2006).

[20] Furfine (2003).

[21] Marquez, Martinez (2009).

[22] Allen, Gale (1999).

[23] Girard, Rahman (2002).

[24] Paas, Kuusk (2012).

[25] Maneschiöld (2006).

[26] Gray (2009).

[27] Gray (2012).

[28] Iannuzzi, Berardi (2010).

[29] Lowenstein (2001); Jorion (2000); Flood, Marion (1999).

[30] Alexander (2001a).

[31] Alexander (2002b).

[32] Kaminsky, Reinhart (2003).

[33] Allen, Gale (2000); Bekaert et al. (2005); Kaminsky (2006); Yuan (2005).

[34] Gupta (2010); Giustiniani, Thornton (2011); Berg (2011); Nguyen (2011); Prorokowski (2011).

[35] Grosse (2012).

[36] Wood (2001).

[37] Willett (2010).

[38] Tobin (1978).

[39] Bekaert et al. (2009); Gebka, Serwa (2007); Gilmore, McManus (2002) as well as Patev and Kanaryan (2003).

[40] Syriopoulos (2004).

[41] Divecha et al. (1992); Middleton et al. (2007) as well as Harvey (1995).

[42] Errunza, Padmanabhan (1988); Fifield et al. (1999) as well as Bekaert and Harvey (1997).

[43] Young (1995); Corsetti et al. (2000).

[44] Yuan (2000); Krugman (1998).

[45] Dornbusch et al. (2000); Pericoli, Sbracia (2003); Dungey et al.(2010); Dungey et al. (2005); Favero, Giavazzi (2002); Bae et al. (2003); Pesaran, Pick (2007).

[46] Berkmen et al. (2009); Brunnermeier (2009); Lane, Milesi-Ferretti (2010).

[47] Pasqueriello (2007); Kyle (1985); Kordes, Pritsker (2002) as well as Caballe and Krishnan (1994).

[48] Kordes, Pritsker (2002); Pasqueriello (2007).

[49] Caballe, Krishnan (1994), Pasqueriello (2007).

[50] Pasqueriello (2007); Bekaert et al. (2005).

[51] Pasqueriello (2007); Cass, Pavlova (2004); Backus et al. (1992) as well as Baxter and Crucini (1993).

[52] Pasqueriello (2007); Bekaert et al. (2005).

[53] Pasqueriello (2007); Cass, Pavlova (2004); Backus et al. (1992) as well as Baxter and Crucini (1993).

[54] Kaplan, Maier (1958); Costella (2010) and Brown et al. (1974).

[55] Vinals, Moghadam (2010); Poirson, Weber (2011) as well as Espinosa-Vega, Sole (2010).

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