European Commission

EUROPEAN POLICYBRIEF

SYRTO

SYstemic Risk TOmography
Signals, Measurements, Transmission Channels, and Policy Interventions

SYRTO – SYSTEMIC RISK TOMOGRAPHY
SIGNALS, MEASUREMENTS, TRANSMISSION CHANNELS, AND POLICY INTERVENTIONS

This Policy Brief summarizes the second policy relevant findings from the project. Specifically, we discuss how econometric tools in modelling and managing systemic risk can be linked with policy advices for effective macroprudential regulation in the EU.

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INTRODUCTION

The interest of policy makers in predictions on systemic events (early-warning) and the effectiveness of mitigating and stabilizing actions of supervisory authorities are the main motivations of SYRTO. To formulate policy advice in these areas, our objective is to show clearly the value-added of econometric models in modeling and managing systemic risk. Econometric models enhance our understanding of the underlying drivers and links between financial institutions that lead to systemic risk.

On the one hand, the realization of an Early Warning System for systemic risks should represent the synthesis of effective econometric tools, coming up with a bunch of indicators and signals in order to highlight potential abnormalities in the financial system.

On the other hand, we should translate evidence from data analyses into specific policy advices and recommendations, thus detecting possible rule of thumbs to limit the triggers, the shock transmission of systemic risks and ex post policy interventions to stabilize the Euro system.

Both targets should be run in tandem, thereby detecting quantitative tools that really matters prevention, mitigation and stabilization. To this end, many specific studies have been initiated by our group, with promising results we summarize in this Policy Brief.

EVIDENCE AND ANALYSIS

The way we are linking econometric tools in modelling and managing systemic risk with policy advices and recommendations for effective macroprudential policy and financial stability in the EU include the following areas of analysis:

1. Comparative model performance for key policy events;
2. Identification of vulnerable states;
3. Realized defaults as warning signals;
4. Model-based filters for extracting financial cycles;
5. Model selection and combining indicators;
6. Systemic risk and long-run impacts on productivity.

1. Comparative model performance for key policy events

Blasques et al. (2014) compute a spatial dependence parameters from sovereign CDS time-series data. The model captures default dependence between Eurozone countries. The time-series plot of the key dependence mechanism in the model is related to key policy events. A number of important events are related with intuitive changes in the dependence: the bailout of Ireland and the introduction of the first long-term refinancing operations (LTRO) of the ECB are both associated with a sharp drop in the dependence parameter. However, none of these resulted in a persistent decrease in the dependence parameter since the start of the European sovereign debt crisis. The speech of the ECB's president (July 26, 2012) in which he promises to do "whatever it takes" to save the Eurozone, is not associated with a sharp drop in the dependence. However, following the speech and the subsequent announcements of the further details of the outright monetary transactions (OMT), the dependence between the different sovereign CDS spreads decreases persistently to lower levels since the sovereign debt crisis.

In Lucas et al. (2014), a structural model is estimated for the probability that two or more European countries default, based on CDS prices, see Lucas et al. (2014). The outcome of the model can be compared to 10-year sovereign bond yields, which shows both similarities and differences. An interesting result is a rise in Eurozone-risks in 2009, that is not visible in spread differentials. Hence, benchmarking existing approaches against probability-based models is on our agenda for evaluating the usefulness of competing models in capturing systemic risk trends.

2. Identification of vulnerable states

For risk-based models of joint default risk of sovereigns, we are implementing the model of Lucas et al. (2014) using bond prices instead of CDS-data. Bond prices go back much further in time, say, to the 1970s, whereas reliable CDS data starts only after 2002. With the implementation, we can identify systemically vulnerable states prior to 2002, or otherwise test the adequacy of the newly proposed systemic risk measures if we go back further into the past.

This is an ambitious goal, with wide-ranging benefits for policy makers. The outcomes can be used to identify crises periods per country, and be compared with the systemic banking crisis database of Laeven and Valencia (2013). If the risk-based model suggests a crisis, this could make for new systemic events, to supplement the Laeven/Valencia database and increase systemic observations.

In addition, the model can be used to model banks and banking sectors, which is conceptually closer to the ideas behind the crisis database of Laeven and Valencia. Based on their classification, we aim to

obtain a per country measure of systemic risk with a threshold that captures the systemic banking crises.

3. Realized defaults as warning signals

The scaled-credit risk deviations (CRD) from Schwaab et al. (2014) show deviations that are at a 20-year low in the years before the credit crisis. Such a finding is similar to several other measures of systemic risks, which have the same problem, i.e., before the onset of the financial crisis, systemic risk measures are usually at their lowest point. The most simple example is the VIX-index, which was at historically low levels in 2006 and the beginning of 2007. The reason for finding these effects right before a crisis is that financial markets are reflecting the risk preferences and beliefs of traders, which have got used to years of good returns with low risk. However, it is exactly this attitude that is shared among market participants that leads to excessive risk taking by leveraged investors, which is a contributing factor in the severity of the ensuing crash. In the words of Hyman Mynsky: stability can be destabilizing.

Based on the arguments above, there might be a use for CRD as a systemic risk indicator, by using it to indicate artificially low defaults relative to macroeconomic conditions. The use of such an indicator for modeling systemically vulnerable states is new, and we aim to benchmark the model against existing measures for predicting systemic risk, such as Alessi and Detken (2011). They find that the credit-to-GDP ratio is an important crisis predictor, and it might be inversely related to the CRD.

The analysis can be further extended to an international dimension. Much of the variation in international business cycles can be traced back to a common dependence on a world business cycle factor. We already know from earlier studies for the US that credit default cycles partially depend on business cycles, but that there is substantial additional variation in credit default counts.

4. Model-based filters for extracting financial cycles

Policy makers are using the concept of a financial cycle in assessing systemic vulnerabilities, see Borio (2014). The financial cycle captures the idea the credit growth and balance sheet developments in the financial sector are cyclical, with a much longer period than the real business cycle. The highs and lows of the financial cycle indicate high and low systemic threats to the financial system, since high credit growth is usually a signal of a deterioration in credit quality and overindebtedness of households and firms.

The work in Hindrayanto et al. (2015) uses econometric techniques to filter cycles in the financial sector. Using both bandpass filter methods and turning-point analysis, Drehmann et al. (2012) describe the financial cycle by a linear combination of credit and residential property prices. We investigate whether this characterization of the financial cycle can be justified empirically in the Eurozone using a multivariate country model based on the decomposition of time series into long-, medium- and short-term dynamics. The extraction of the common medium-term dynamics can then be interpreted as the Eurozone financial cycle when the original time series are associated with income, credit and house prices. While we can conclude that similar cyclical behavior exists in the data, the support for a common cycle is weaker. However, with the introduction of multiple cycles, stronger support for a partially financial cycle is found. This common financial cycle represents all major events associated with the recent financial crises in the Eurozone.

5. Model selection and combining indicators

A lot of attention has been devoted in academia and regulatory circles to devise methods to measure the systemic importance of financial institutions. Measures range from simple measures reflecting the size of the institution, its covariation with the stock market or with an index of financial institutions, its

centrality in the network of financial institutions, etc. etc. The multitude of different ways to measure systemic importance poses a direct problem to regulators, who need to classify in a clear way which institutions are systemically important, and subsequently impose higher capital requirements on these. In the last year of the SYRTO project, we also aim to combine different indicators and show what aspects the different classifications convey on the importance of individual institutions. The intention of this is that it may lead to further insight into the working of different measurement techniques for systemic risk contributions and their relevance for policy work.

In Arakelian, et al. (2015) we explore the dynamics of sovereign CDS spreads in terms of time-varying dependencies thereby computing the contagion between sovereign risks in the Eurozone also looking at the connectedness with bank and other financial intermediaries systemic risks. Next, we provide a non-parametric way to assemble contagion-based measures together with country-specific fundamentals then proceeding with a variable selection procedure in order to detect the more important leading indicators and corresponding threshold values, we use to identify the main sovereign systemic risk zones (from safe to highly risky zones). To do this, we employed Regression Trees analysis, which will be the core approach we propose as web-based model for our Early Warning System. Our findings revealed that contagion-based variables assumed an increasing importance starting with the Lehman collapse (III quarter of 2008) until the first quarter of 2011. In such a period, fundamental-based variables assumed an opposite tendency with a drop in importance during the 2008 (around the Bears Stearns collapse) with a contained importance throughout the end of 2009. Afterwards, and specifically starting with 2010, the importance has grown progressively with a peak at the end of 2011 next showing a large drop in the second quarter of 2012, but quickly returned to assume high values moving in tandem with contagion-based variables until the end of the year. Next, both importance metrics shown a downtrend towards their median at the end of the period. These results confirm a time-varying importance assumed by fundamentals, which became relevant with the Greek crisis, and contagion-based factors: (i) which assumed a key importance with the Lehman collapse, (ii) that achieved new emphasis with the Euro debt crisis erupted in 2010, (iii) that exhibited a temporary setback during 2011, but (iv) that returned relevant with the same impact of fundamental variables starting with 2012, (v) finally flexing towards a median reverting level at the end of the period together with fundamental-based variables.

6. Systemic risk and long-run impacts on productivity

In Lucchetta, et al. (2015) we investigate what happens to Total Factor Productivity (TFP) growth considering both the oil price and financial risk effects for USA, Germany, and France. To do this, we adopt a different measure of financial risk, i.e. the market adjusted return (MAR) measured as the difference between banking sector stock prices returns and total stock market prices returns. The firms' cost of funding may be influenced by the market power of the banking sector related to a single country and therefore is not a reliable measure in international comparisons. The MAR can be viewed as a measure of the financial health of the banking sector. A huge negative MAR may be considered as an index of systemic real risk since the poor performance of the banking sector may be a signal of a financial disease that may result in credit supply cuts and/or increase in cost of funds.

Within a state space framework, we find that oil price-TFP relationship is strengthening in all countries after the second half of 2000s. The effect of financial risk on TFP growth is particularly reliable for Germany and France where the financial risk variable has a positive and statistically significant impact during the crisis period. USA, instead, shows a positive impact only for period before the half of 2000s. This difference is due to the role played by liquidity provided by the FED.

Given the crucial role of TFP in driving the long run growth, these results have important policy implications. Indeed, reducing the usage of oil by firms (for example with the introduction of appropriate policies favouring the shifting toward alternative energies) is an important issue not only for global warning concerns, but also for avoiding negative impact for productivity. This is particularly important in periods, such as the last 15 years, where oil prices are highly volatile and influenced by external factors such as international political turmoil.

POLICY IMPLICATIONS AND RECOMMENDATIONS

Policy implications from the results commented before regard both the ways trough which policy makers should deal with monitoring activity of financial market dynamics, and how key variables for financial stability should be linked with long-run growth dynamics. More specifically:

1. Policy makers usually interpret statistical systemic risk measures simply by assessing outcomes over time relative to what could be expected at key policy events. This falls short of a model evaluation that an econometrician might typically do, but it is the starting point for assessing whether model outcomes are consistent with the experience of policy makers. Such an intuitive assessment is important, since policymakers have to conduct policy on a day-to-day basis, where trends and events can be more important than numerical model estimates.

2. Credit default cycles partially depend on business cycles, but that there is substantial additional variation in credit default counts. From a policy perspective, it is interesting to see whether such additional variation across countries also has a common global component, or whether credit default cycles are much more idiosyncratic at the country level. The presence of a strong global component might induce different policy frameworks: for example, if there is no global factor, international credit diversification will typically be risk reducing at the institution's level. By contrast, if there is a strong global credit default factor on top of the business cycle dependence, the benefits from international diversification are much less clear and might even go in the opposite direction.

3. Systemic risks should be studied also based on their impacts on Total Factor Productivity (TFP), the key factor driving the long run growth all countries. Higher financial risks translate into important loss in the banking sector, with an impact in the rise cost of funding and/or credit crunch cases. Exploring the effects between negative financial episodes and demand-based components (i.e., consumption and investment decisions) are of course important. Understanding the behavior of TFP is crucial for macroeconomists and policy makers as well. Indeed, technological shocks affect directly the TFP and its variations produce volatility on GDP growth dynamics. In general, a rise in the cost of funding may induce the firms to slow down the R&D intensity with a negative impact on innovation and TFP growth. A similar argument occurs if we observe the financial disease of the banking system: huge losses of the banking sector translate into severe reduction of credit supply in the economy with negative effect on funding firms' productivity enhancing projects.

4. Any possible Early Warning System to be used for signalling potential abnormalities within the financial system should also consider economic impacts. Financial turbulences and macroeconomic instabilities usually are moving differently, but are strongly interlinked. As a result, an effective tool should include both financial and macroeconomic leading indicators elucidating on the relationship between systemic risks and potential predictors. The relationship is extremely complex, non-linear, exhibiting multiple regimes. We should be able to identify the more relevant risk zones, indicating how macroeconomic fundamentals should be read together with contagion-based measures.

RESEARCH PARAMETERS

The goal of the project is the study of the systemic risk arising from the relationships between sovereigns – banks and other financial intermediaries (BFIs) – corporations of the European Union. Specifically, the aim of SYRTO is twofold:

1. Assemble an Early Warnings System (EWS) to be used as risk barometer for each sector and countries alike, identifying potential threats to financial stability;
2. Realize a "SYRTO Code" in order to detect a series of recommendations, also expressed in terms of EWS prescriptions, on: (a) the appropriate governance structures for EU to prevent and minimise systemic risks; (b) the best mechanisms for ensuring an effective interplay between, and coordination of, macro and micro-prudential responsibilities.

The realization of the previous main targets has been conceived in a step-by-step process in which:

- First, we inspect idiosyncratic risks within the financial system thereby making clear the main risk predictors and how these are related to: (a) sovereign risk, (b) banks and other financial intermediaries risk; (c) non-financial corporates risk;
- Second, we inspect both the two-way and multi-way risk connections among macro-sectors (sovereign, bank and other financial intermediaries, corporates), by elucidating the main risk linkages and related transmission channels;
- Third, we assemble an overall EWS and suggest possible normative superstructure for a better EU economic governance including monetary and policy coordination as well as financial market supervision.

In relation to these objectives the project:

- Provide a comprehensive risk analysis covering countries and sectors aggregating the individual risk dimensions based on the following methodologies: Dynamic Conditional Correlations; Copula functions and copula-based models; Granger causality tests; Principal Component Analysis; Multiple Indicators Multiple Causes (MIMIC); Frailty models; Dynamic latent component analysis; Regime-switching models; Shrinkage-based regressions; Contingent Claim Analysis (CCA); Dynamic Factor Models of Tail Risks; Agent-based modelling.
- Focus on EU policy and regulatory responses to financial markets tensions, discuss how econometric tools in modelling and managing systemic risk can be linked with policy advices for stabilize the EU eco-financial system.

PROJECT IDENTITY

PROJECT NAME

SYRTO: Systemic Risk Tomography: Signals, Measurements, Transmission Channels, and Policy Interventions.

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CONSORTIUM

Participant no.	Participant organisation name	Country
1	University of Brescia (UNIBS)	Italy
2	Centre National De La Recherche Scientifique (CNRS)	France
3	Athens University of Economics and Business – Research Centre (AUEB-RC)	Greece
4	Cà Foscari – University of Venice (UNIVE)	Italy
5	Stichting VU-VUMC (VUA)	The Netherlands
ADVISORY BOARD		
Scientific Division	Economists from top academic institutions	
Policy Division	Staff Members of ECB, IMF, OECD, national central banks	

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WEBSITE

www.syrtoproject.eu.

FOR MORE INFORMATION

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FURTHER READING

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