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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 first policy relevant findings from the initial stage of the project, and presents initial policy recommendations for macroprudential policy and financial stability in the EU.

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INTRODUCTION

Financial crises and in particular the Global Financial Crisis (GFC) have increased the awareness of the potential dangers of financial instabilities across the developed economies included in the European Union. The severity and speed of the downturn over the recent crisis was largely unpredicted by policy makers. There is a strong need among policy makers to disentangle causality effects in order to design effective policy. The purpose of the SYRTO project is to provide policy makers with better tools to obtain early warning signals for systemic risk and insights as to how these instruments may be linked effectively to policy instruments. In this Policy Brief we provide some first policy relevant findings from the initial stage of the project.

Analyzing and managing macrofinancial risk have become increasingly important over time as global markets have become increasingly more connected. Specifically, analyzing and managing sovereign risk, the risks of financial institutions, and the interactions among sovereigns and financial institutions are important for investors and those responsible for financial stability. This topic is also important for those who are responsible for the traditional areas of monetary and fiscal policies because, as we see in a number of cases, monetary and fiscal policies designed to deal with things like stimulus or consumption demand can actually have unintended consequences of some magnitude for financial stability and markets.

After having studied the impact of the financial crisis on the aggregate demand side, our analysis focuses mainly on the development of warning signals useful for policy makers. Our study suggests that, while forward looking analysis remains very complex, EU policy makers might do well by relying

on a relatively simple few artificial indicators. Starting from financial data, sophisticated statistical methods are employed to measure the risk magnitude of the financial institutions connections.

EVIDENCE AND ANALYSIS

The most important policy-relevant findings of our analysis obtained during the first year project relate to the following main issues:

1. Financial and real economy connections;
2. Linkages between different financial sectors (i.e. insurances, hedge funds, banks) and Government bonds (Sovereigns);
3. Linkages among financial, liquidity risks and bank balance sheets structure;
4. Sovereign risk and market perceptions;
5. Joint dynamics of liquidity and asset prices;
6. Snow-ball effects generated by the increasing complexity of the economic-financial system.

1. Financial and real economy connections

The recent financial crisis has underscored the need of the deep understanding of the key drivers of financial risks and its relationship with real activity. *Three fundamental points* are investigated.

I. *First*, we measure the effect of financial variables on consumer credit spending in the USA, i.e. where the financial turmoil originated. Using linear and nonlinear cointegrating estimation techniques, we show that consumer credit responds more significantly to the medium and long-term interest rates than the short-term interest rate. This finding is valuable to the Central Bank to pursue an effective monetary policy.

II. *Second*, we study the linear or nonlinear nature of the housing supply adjustment process in USA, i.e. the market where the housing bubble propagated to the rest of the world. Empirical investigation shows that housing builders react linearly to deviation from equilibrium. This result supports the view that the housing market boom and bust is mainly due to (irrational) changes in expectations about future appreciations in housing. This finding is crucial to recognize that policy maker has to promptly intervene to the agents expectations in the economy. This emphasizes the needs to provide policy maker a complete set of instruments to understand the situation it faces.

III. Our *third* investigated point relates to Regression Trees approach which seems to be very promising as shown in our analyses on sovereign debt crises in emerging markets and Greece, Ireland, Portugal and Spain (GIPS) over the period 1975–2010. We show that by using such a methodology we are able to detect the main risk signals of impending sovereign debt crises whenever pre-selected indicators exceed specific thresholds. In more depth, our results indicate that sovereign debt crises are mainly driven by liquidity concerns together with the worsening of macroeconomic conditions. Focusing on the Greek and Irish crises of 2010, the strong contraction in GDP growth together with low interest rates and a bad default history have been the major drivers. Both crises are clustered together with other defaults, such as Turkey 2002, Ukraine 1998 and Venezuela 1995, proving that the root of the recent Greek and Irish sovereign debt crises has been the same as that of other emerging market crises that occurred in the past. This point is of particular interest, as it complements evidence on high debt/GDP levels which are associated with notably lower growth outcomes. Putting together the two things, we may

thus conjecture that the risk threshold we found for real growth of GDP may encompass excessive indebtedness.

2. Linkages between different financial sectors and Government bonds

Analyzing and managing macrofinancial risk have become increasingly important over time as global markets have become increasingly more connected. Sovereign risk, the risks of financial institutions, and the interactions among sovereigns and financial institutions are important for investors and those responsible for financial stability. The basic lesson is that when a shock to the corporate or housing sector occurs, risk changes and the shock propagates to the banking sector and then to the government sector. The shocks can take place in any sector or simultaneously in different sectors and then propagate to the other sectors. For instance, if the shock begins in the banking sector, it flows to corporations and then to governments.

We also point out another class of government liabilities that do not appear on balance sheets but are real liabilities—government guarantees. These guarantees are significant and it is important to note that these guarantees are insurance policies that have value and are real liabilities of the government, yet they are not on the balance sheet. The risks generated by these explicit or implicit guarantees, or structures that look like guarantees, can cause risk to propagate across the various sectors of the economy in nonlinear ways that are rather substantial. Specifically, we refer to interactions among the household sector, the corporate sector, the financial sector (banks), and the government sector, both domestically and across geopolitical borders. The ambition of the SYRTO Project is to understand the nature of these interaction to be able to measure and monitor the macrofinancial risks associated with them.

3. Linkages among financial, liquidity risks and bank balance sheets structure

In this point we analyze a model of multiple banks to study how interbank market participation affects the incentives to hold bank capital for risk-sharing purposes. It is investigated under which conditions a negative relationship exists between bank participation in the interbank market and bank capital. The model also predicts a negative relationship between changes in bank capital and interbank participation as well as changes in dividend and interbank market participation. A positive relationship between the level of dividends and interbank participation is found.

4. Sovereign risk and market perceptions

Here, we study the joint evolution of credit premia (CDS) for sovereign risk. The time series behaviour of these premia in times of turmoil is highly non-linear, and the dependence among them strongly time-varying. Accounting for these effects in the methodology, we investigate what were the effects on *joint* and *conditional* probabilities of credit events in the Eurozone during the sovereign debt crisis. In particular, we find that the announcements of non-standard monetary policy issued by the ECB had substantial effects on probabilities of credit events of individual countries (typically lowering them), while the effect on conditional probabilities (i.e., one country suffering a credit event given another country suffers a credit event already) was negligible. This held also over a longer period of several months, for example, during the period of OMT transactions. The implication is that policy makers succeed in conveying to the public and markets that their policy measures help prevent credit events for individual countries. They are less successful in conveying a similar message for the system of euro countries as a whole. Markets perceive that systemic risk has remained unchangeably high. Additional policy measures or means of communication need to be sought therefore to accomplish lower market perceptions of systemic risk.

5. Joint dynamics of liquidity and asset prices

A reduced form model for the joint dynamics of liquidity and asset prices is proposed. We focus on the macro-dynamic implications of the self-reinforcing feedback between credit creation and the market value of the financial assets employed as collateral in the bank loans (the so called financial accelerator) modeled as a coupled non-linear stochastic process. In the context of our stylized Minskian-type macroeconomic model, we compare two different types of monetary policies: (i) a first monetary intervention is a liquidity injection in the financial sector approximating the Quantitative Easing policies followed after the 2008 crisis by several Central Banks around the world (Federal Reserve, European Central Bank, Bank of England, Bank of Japan); (ii) the second intervention is an injection of an equal amount of liquidity in the real sector approximating (only very partially) the policy followed by the Australian Government and the Swiss Federal Government.

6. Snow-ball effects generated by the increasing complexity of the economic-financial system

Econometric measures of systemic risk to capture the interconnectedness among the monthly returns of hedge funds, banks, brokers, and insurance are implemented. It is found that all four sectors have become highly interrelated over the past decade, increasing the level of systemic risk in the finance and insurance industries. These measures can also identify and quantify financial crisis periods, and seem to contain predictive power for the current financial crisis. The results suggest that hedge funds can provide early indications of market dislocation, and systemic risk arises from a complex and dynamic network of relationships among hedge funds, banks, insurance companies, and brokers. Furthermore, we also looked inside the hedge fund industry risk dynamics finding that correlations in returns, crowded trades, their leverage dynamics, and market liquidity shocks are the main systemic risk drivers in the hedge fund industry.

POLICY IMPLICATIONS AND RECOMMENDATIONS

Policy implications from our initial results regard how policy makers should deal with the increased interconnectedness in financial markets and the whole economy and the need of an integration of monetary, fiscal, and financial stability policies rather than thinking to manage them in isolation.

The data suggest that the degree of connectedness across different types of entities changes over time—hence the need for models that capture these dynamics in order to monitor the connectedness of the system. At this early stage of our research, we suggest caution in taking these measures of connectedness as actual paths of causality among different entities (sovereigns and institutions) on which revised investment decisions or corrective policy might be considered. Instead, these maps of connectedness should be viewed as raising questions about what is going on in the system that may not otherwise be transparent. Subsequent investigation using other information sources and models would then inform what, if any, steps should be taken.

Also, from the analysis of the results of our simulations, a monetary intervention injecting liquidity in the real sector seems able to stabilize the decline of the GDP and the increase of the default rate, while the same intervention in the financial sector seems to have only transitory impacts on the financial market but limited effects on the real sector.

Based on all our preliminary findings, and ongoing research, our main suggestion is about the path towards a macroprudential policy and financial stability in the EU, we propose to articulate in three main parts:

1) *Financial Stability Surveillance* (risk identification). What is needed is the identification of financial stability indicators and early warning models for macro-financial models that

incorporate financial instability, and models of bank and sovereign connectedness and contagion dynamics.

2) *Financial Stability Assessment* (risk assessment). Assessment should involve quantifying the impact on the financial system in case an identified risk materializes. What is currently needed is further insight into the behavior which leads to amplification loops and second-round feedback effects (and also to interactions of financial conditions with the macroeconomy). The idea is that extreme risks are almost always of an endogenous nature, and indeed only become extreme through market participants' behavioral responses to an unexpected and possibly small initial shock. Progress regarding the transmission of initial shocks, and thus regarding the two-way interaction between risk conditions and market participants' behavior, needs to be developed further.

3) *Financial Stability Policy* (policy response and evaluation). Identified and significant (in terms of assessed impact) vulnerabilities to financial stability need to be mapped to an appropriate policy response. A policy response involves available policy instruments.[1] For every available policy instrument, policy makers require conceptual quantitative frameworks that inform the respective decisions. Moreover, tools and frameworks for a comprehensive *ex post* impact assessment of policies should be available. As an example, the systemic risk surcharges foreseen within the Basel III/CRDIV framework require reliable methods which help determine which banks are relatively more systemic (large, leveraged, illiquid, interconnected, opaque, hard to substitute away from) than others.

RESEARCH PARAMETERS

The main objectives of the SYRTO project are:

a) The EU economic governance including monetary and policy coordination as well as financial market supervision, taking into account the complex institutional and economic integration in the European Union. It is needed an holistic approach that includes in policy regulations financial and nonfinancial institutions as well given the growing interconnections among financial and nonfinancial sectors. Our aim is to condense all suggestions and recommendations into a *SYRTO Code* articulated in three main chapters regarding:

   I. *Prevention*: identification of a series of rules of thumb in order to limit the triggers of systemic risk.
   II. *Mitigation*: limiting of systemic shocks transmission and prevent conflicts of interest and ineffective policy interventions.
   III. *Stabilization*: ex post policy interventions to stabilize the Euro system.

b) The prediction, prevention and mitigation of systemic risks providing an *Early Warning System* (EWS) to be next used as the trait d'union between institutional and quantitative features of systemic risk. Governments are playing a key role with sovereign instruments and their related risk. We suggest to monitor the networks of market and institutions.

As it is clear that the project assigns a "pivotal" role to the systemic risk, being the main focus of the research to be inspected in terms of measurements, transmission channels, and policy intervention.

[1] For a discussion of macro-prudential instruments, see e.g. http://www.imf.org/external/pubs/ft/wp/2011/wp11238.pdf

We are convinced the SYRTO project it is contributing in weighting the risks belonging in each network node.

In relation to these objectives the project will:

i. Proceed to apply and combine enhanced qualitative and quantitative methods mastered by the project partners in a coherent framework: Linear and nonlinear cointegration estimation techniques; Linear and nonlinear Granger causality; Principal component analysis; Univariate MT-STAR Model; Correlation methods; Panel Regression; Kalman Filter, Regression tree; Simple networks; Bayesian networks; Bayesian Model Averaging; Copula-based correlations; Agent-based modelling.

ii. Focus further on EU policy and regulatory responses to financial markets tensions.

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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