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 outlines the most important policy lessons for governance and coordination of macro-prudential policies aimed at systemic risk. The policy implications and recommendations are summarized in six takeaways for policy makers.

February 2016

INTRODUCTION

The financial crisis of 2008/2009 and ensuing Euro crisis of 2010/2011 have shown that new thinking on EU-wide policies for systemic risk are necessary. The main challenge is about the governance and coordination of macro-prudential policies for preventing, mitigating the systemic risk, also suggesting how to restore the financial system when shocks materialize.

This Policy Brief summarize the policy implications and recommendations for the measurement and management of systemic risk contained in the SYRTO Code, which is one of the main deliverable we realized from a wide body of academic research on systemic risk, such as has been done under the SYRTO project, but not limited to it.

Financial firms and financial markets can be triggers and transmitters of systemic risk. Both outside and inside financial institutions we have to know how to detect them early on. The first group of recommendations is on how to improve the governance and coordination of policies aimed at preventing systemic risk.

In exploring the transmission of systemic shocks (low probability/high impact events) through the financial system, we find an important role for the financial cycle, and a low-risk anomaly that can be indicative of an impending crisis. The second group of recommendations is on how to improve the governance and coordination of policies aimed at the transmission of systemic risk.

Assuming we can never completely prevent systemic events, limiting the damage and breaking transmission chains are however possible. The third and final group of recommendations is on how to improve the governance and coordination of policies aimed at the stabilization of the financial system after a crisis.

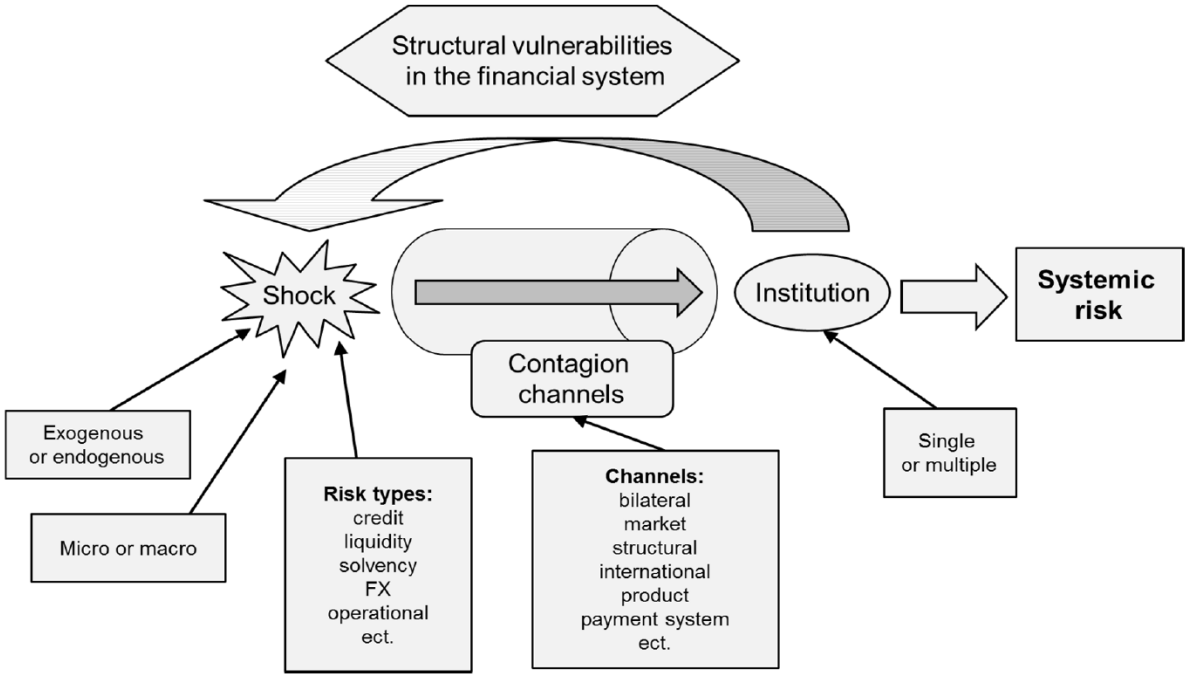
After discussing the policy challenges regarding governance and coordination of systemic risk we next focus on prevention, mitigation and stabilization by summarizing the main recommendations in six takeaways.

Evidence and Analysis

I. The Governance and Coordination of systemic risk

The financial crisis changed the consensus on the adequacy of traditional bank regulation, which focused on the solvency of a single institution. The basic insight is that the banking system can 'run on itself', because of a lack of trust between financial institutions. The old system assumed that the health of banks was adequately captured with risk-based regulation, which turned out to be false. When the losses mounted, it turned out that potential losses were severely underestimated. Moreover, it became quite hard to assess which bank was solvent and which was not. The financial position of multiple banks was threatened at the same time: a systemic crisis.

Systemic risk is the risk of the breakdown in the financial system, by the default of two or more institutions in the same time period. Systemic risks are characterized by (i) initial shocks of modest magnitude, and (ii) the transmission of those shocks between financial institutions that threatens their existence. Figure 1 visualizes the concept of systemic risk.



Source: Smaga (2014)

For the financial system we can identify two dependency chains in the "Black box" of contagion channels (the cylinder in Figure 1). First, a common shock can affect all institutions, caused by the collapse of an asset price bubble funded by debt. For example, a real estate boom and subsequent bust affects all the banks who have lent to real estate developers. This is a shock to all banks, caused by the common exposure. As such, it is a dependency chain that might not be observable *ex ante*, when regulators only focus on the health of individual banks.

The second source of dependency is contagion: a shock to just one or a few institutions spills over to other institutions and markets through the networked structure of the financial system. The classic example is in Schnabel and Shin (2004), who document an usually high contagion between the grain and sugar price during the crisis of 1763. The contagion had no fundamental reason, but was caused

by the distressed selling of sugar by a bank that had speculated with grain. In that way, the two market prices started to move together, and the problem of one bank spilled over to other banks, leading to multiple bank failures. A modern-day example is the credit crisis of 2007/2008 which was initially confined to a problem in real estate and CDOs. The losses that ensued led to the selling of other assets so that comovement arose between assets that were otherwise not related

The essence of systemic risk and the focus of this Policy Brief is the dependency links and contagion between institutions in the financial system. The failure, or near-failure, of multiple banks in the 2007-2010 period have shown that new measurement techniques, policies and institutional structures are necessary to prevent or mitigate systemic risks in the futures. Below we introduce the systemic risk instruments that have been introduced after 2007, and the issues in terms of governance structures and the coordination between micro- and macro-prudential policies.

II. Systemic risk instruments

The regulatory reform initiated by the G20 in the aftermath of the crisis is close to finalization. In the EU, the new rules on capital and liquidity represent the first defense for preventing the accumulation of systemic risk. They have incentivized banks to move towards safer business models and required more robust capital and liquidity buffers to those institutions willing to operate in riskier markets. Better capitalized banks are also better positioned for supporting lending and economic growth. There is indeed increasing evidence suggesting a positive correlation between strong capital ratios and banks capacity to sustainably lend into the real economy.

The repair process of the European banking system since 2011 has led to a major strengthening of banks' capital base. EU banks increased their common equity tier 1 (CET1) ratio between 2011 and 2014 from 9.2% to 12.1%, see European Banking Authority (2015). While banks have further reduced exposures in certain areas or business lines, for instance, in investment banking, total asset volumes increased by about 6% as of December 2014.

New regulations have focused on the following aspects:

A. *Mitigating liquidity risk*
   Liquidity risk has been, if not the source, the main driver of the financial crisis. The combination of poor liquidity management and a reliance on short-term funding led to multiple failures and near-failures when liquidity disappeared. Earlier regulation operated on the assumption that robust capital cushions would shield banks against major shocks.

   Already in 2008, the Basel Committee published the Principles for Sound Liquidity Risk Management and Supervision. These provided guidance on the risk management and supervision of funding liquidity risk in order to foster better risk management practices. In addition, the Committee introduced two minimum standards (the liquidity coverage ratio (LCR) and the net stable funding ratio (NSFR)) for liquidity and funding, which pursue the objectives of promoting short-term resilience of a bank's liquidity positions as well as longer-term funding stability.

   Stricter requirements and supervision have also been introduced on banks' funding plans. Banks are now explicitly requested to develop a funding strategy that provides effective diversification in the sources of funding. While banks should plan their funding strategy under business-as-usual circumstances, they are also required to consider contingency plans to be activated in case of emergency situations, both idiosyncratic and systemic. This mitigates the transmission of systemic shocks through the banking system that could arise from the forced liquidation of (illiquid) assets to cover a funding shortfall.

B. *Higher capital ratios*
   Higher capital requirements have come into force, which mitigates the transmission of shocks. Contingent capital and bail-in capital serve the same purpose. Counter-cyclical capital buffers

(CCB) for systemically important financial institutions (SIFIs) lean against the build-up of debt-driven asset price bubbles that are known for triggering systemic problems. The CCB can vary between 0% and 2.5% of risk-weighted assets (RWA) and is switched on by national authorities when deemed necessary.

C. *Reducing asset volatility.*
For US-banks, the Dodd Frank act limits proprietary trading, which reduces the vulnerability of individual banks to shocks. Ring fencing ensures that consumer banking activities are shielded from more risky banking activities. For the remaining financial market activities of banks, central clearing (CCP) for swaps and credit value adjustments (CVA) reduce the counterparty risk from derivative transactions, which limits the fall-out of a defaulting counterparty to the financial system.

D. *Improving supervision and resolution*
In the European context the problem of resolution was made harder by the system of national supervision for cross-border banks, which made it hard to assess solvency, liquidity and to estimate the externalities of bank failures. To improve the supervision of large European banks, the banking union has been formed. The single supervisory mechanism (SSM) and the single resolution mechanism (SRM) are designed to ensure a fair and orderly supervision process and increase the objectivity of the decision to close down a troubled bank. The SRM reduces the uncertainty and disruption in case of a looming default, mitigating the transmission of initial shocks through the financial system.

III. Governance structures for systemic risk

The introduction of systemic risk instruments has gone hand in hand with the development of governance structures, such as changes in the ECB's responsibility, the European Banking Union, the SSM and the SRM. The SYRTO research on systemic risk has consequences for these institutions and the governance of systemic risk.

From the early warning research (Siegmann, 2016, Section 2.1) comes a clear need for a governance mechanism to set the threshold for false warnings. The early warning models produce forecasts on the probability of an impending crisis, but they come with a band of uncertainty. The uncertainty gives rise to two problems, namely that of false warnings (act, but there is no crisis) and that of missed crisis (not acting, but a crisis still occurs). Policy makers need to understand this choice and decide on thresholds for acting. In this dilemma, a clear governance structure is important.

A problem for researchers is that of the missing counterfactual[1]: successful interventions will appear in the data as "no crisis". It makes statistical inference on crisis-signals harder, and complicates the communication of an institution that is responsible for systemic risk mitigation. The public might argue that the enacted policies have been unproductive, since a crisis did not materialize and the immediate costs were quite visible. For example, higher lending standards have affected the spending power of consumers. The low volatility paradox gives rise to such problems, where a systemic risk supervisor might want to intervene right at the time when market-implied risks are at their lowest.

Two international institutions that have been involved in systemic risk are the Basel Committee on Banking Supervision, and the Financial Stability Board. They have no official jurisdiction, but they have been instrumental in proposing measures to determine which institutions are systemically important. Research in SYRTO has looked at the same issue, i.e., which institutions contribute most to systemic risk, from a more econometric angle (Siegmann, 2016, Section 3.2).

Note that the effective governance of systemic risk could involve a large role for international institutions. For example, researchers from both the IMF and the BIS have warned for the problems of excessive credit growth, financial innovation and the potential for systemic risk. These institutions are

[1] This was pointed out by Charles Goodhart at the SYRTO conference held in Amsterdam, June 4-5, 2015.

less susceptible to national interests or industry lobbying and can act more independently. To some, this is their biggest weakness, but for systemic risk it could be exactly the right thing to have.

The effectiveness of the single resolution mechanism will become clear in the coming years. Schoenmaker and Siegmann (2014) describes how coordination in case of a bank default between countries could work. A voting mechanism based on the asset shares or loan shares of banks in each country leads to outcomes that are close to what a supranational supervisor would achieve. One implication is that decisions made by a supranational supervisor, such as the ECB in the European Banking Union, are quite close to that of an optimal voting scheme.

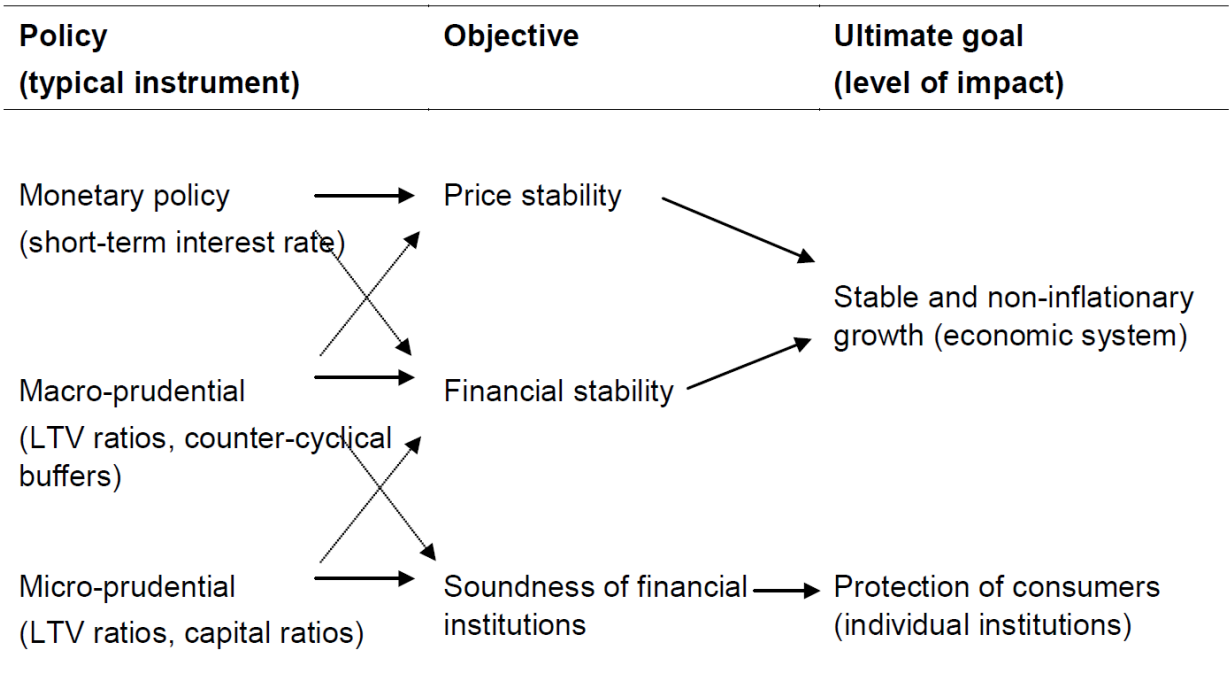
An important governance issue is the role of the ECB in stabilizing European financial markets. It seems that its interventions were mostly successful, and, in terms of results, the ECB as institution serves the purposes of mitigating systemic risk well.

IV. Coordination of macro and micro-prudential responsibilities

SYRTO research holds lessons for the best mechanisms to coordinate macro- and micro-prudential supervision.

In the traditional view, prudential supervision at the level of a single institution is enough to mitigate the potential moral hazard problems that arise from deposit insurance. As such, in the EU, national supervisors were responsible for the micro-prudential supervision tasks. The EU-passporting agreements arranged for home-country supervisors to take the lead in supervising cross-border banks.

From the perspective on systemic risk it is clear that the micro-prudential approach is not enough. The reason is that the interventions or regulations that are necessary to make the system more resilient depend on the interplay between institutions. Policymakers have dubbed this the "macroprudential" approach to supervision, where the word "macro" refers to the perspective of the system-as-a-whole. The figure below illustrates the policy framework for the financial and economic system:



Source: Schoenmaker (2013)

Macro and micro-prudential policies overlap in that they are both aimed at the stability of financial institutions. They deviate in the area where micro-prudential interests are the protection of consumers of a single bank and macro-prudential interests are the stability of the system as a whole.

On the supervisory structure, Schoenmaker (2014) recommends to assign macroprudential powers to a single body. This facilitates ownership and designates clear responsibilities. To prevent gridlock when micro and macro-prudential concerns do not coincide, it may be appropriate to define a hierarchy of objectives, where the macroprudential objective takes precedence. This could be a procedure to agree upon for the ECB and ESRB.

Micro- and macroprudential perspectives can collide in the case of low market-implied risks. Low volatility can be a warning signal for systemic crises. But low volatility is a good thing from a microprudential perspective: buffers appear to be high, and risk appetite appears to be low, because the measured riskiness of the assets is low. For the interplay of the two responsibilities, it is important for microprudential supervisors to incorporate the systemic risk assessment in their appraisal of the soundness of institutions.

Central clearing has a positive influence on the stability of a single institution, because the uncertainty and unpredictable contagion effect caused by the default of one counterparty is mitigated. All transactions are cleared centrally and the default of one clearing member is borne by the default fund of the clearing, and, ultimately, the clearing members. However, in the case of a large systemic event, there is a risk that the system-wide impact is larger than in the de-centralized setup. For the effective interplay microprudential and macroprudential responsibilities, it is therefore of key importance that the size of the default fund reflects macroprudential concerns.

Contingent convertibles contribute to the loss-absorbing capital for a bank and are admitted by microprudential supervisors to fulfill capital requirements. However, their widespread use could lead to new channels of contagion. Micro and macroprudential supervisors will need to coordinate on mitigating potential channels for systemic risks to propagate through the system by subsequent triggers of contingent convertible bonds.

In the mitigation of systemic risk, the interplay between micro- and macroprudential authorities becomes a concern in terms of the financial cycle. The research in SYRTO finds that a financial cycle can be identified as a separate cyclical component in time series of credit growth and house prices. However, the cycle is different per country and per asset class. This creates the need for information sharing between country-level experts and a macroprudential supervisor. The guidelines from the ESRB incorporate this intuition, by proposing countercyclical capital buffers in capital regulations for banks, which are switched on and off on a country-by-country basis.

Coordination between micro- and macroprudential tasks is important for stabilization, in the areas of stress-testing, complexity and the policy maker's loss function. In stress-testing, microprudential supervisors need to coordinate with macroprudential authorities on the appropriate stress scenarios that not only stress a single institution, but include system-wide shocks and take potential channels of contagion into account. Done properly, stress tests are a good crisis management tool that benefits stabilization.

The complexity of the financial system might not always be clear from the microprudential view. The complexity of financial products and business practices of banks deserves specific attention from the microprudential supervisor. The complexity of interactions and causality chains should be on the radar of the macroprudential supervisor. The coordination between the two types of supervisors is necessary to obtain a comprehensive assessment of where the largest downside risks related to complexity are.

The policy maker's loss function defines the trade-off between missed crises and false warnings. These are the typical type-I and type-II errors in statistical inference and, in the policy space, pose a specific challenge to the communication and interventions of the supervisor and regulator. At the one end is a missed crisis, which is obviously of great concern. But at the other end is the fall-out from too many false warning. Systemic risk instruments will be used frequently, and an actual crisis will seldom

materialize. This could hurt the reputation of regulators. This is both a matter for the governance of systemic risk in general, as for the coordination between micro- and macroprudential responsibilities.

POLICY IMPLICATIONS AND RECOMMENDATIONS – SIX TAKEAWAYS

I. Models do give early warning signals of systemic crises

Crises are unpredictable, almost by definition. However, many research findings point to the fact that signals on an impending crisis are available. Financial imbalances such as high and increasing leverage of the banking system, a debt-driven boom in asset prices are consistently found to have predictive power for a banking crisis.

Some models are more elaborate and technical than others, but each has its own merit. Simple models give imprecise signals, but provide understanding of which economic forces are important. Elaborate models, such as those using machine learning techniques (data mining) are much better at predicting, but are more difficult to interpret.

One specific model, namely regression trees, seems very promising in offering good predictions. The data-driven decision tree provides a natural "menu" of questions that policy makers can ask, resulting in a systemic risk score and intuition on which economic variables are most important in the current regime.

II. Low financial stress levels are not synonymous to high financial stability

In contrast to financial imbalances, which are predictive of crises, market-based financial stress measures are not forward looking. These are measures such as volatility, or the probability of default, which only shoot up when a crisis actually occurs. They are consistent with existing notions of the timing of historical crises, but are not easily used to gauge the probability of an impending crisis.

A case in point is the 2008-2009 financial crisis. At the start of 2007, most statistical stress indicators were at their lowest, sometimes the lowest point in decades. This seems contradictory, until we realize that the safety before the crisis was actually one of the driving forces that led to the crisis: many financial products had seemingly low risk, but turned out to harbor neglected risks that drove the panic when they materialized.

An important lesson for policy makers is that, in normal times, financial stress indicators reflect the apparent calm as priced in the markets and could be misleading. Such measures need to be complemented by information on the actual behavior of banks, a topic should be high on the agenda of policy makers.

III. The challenge is to make hard decisions based on soft information.

The reigning paradigm concerning asset-price bubbles before 2008 was that of non-intervention. Having seen the fall-out of the financial crisis, the consensus view has shifted towards intervention. Some of this is reflected in formal regulations, such as counter-cyclical capital buffers and new rules on the liquidity position of banks.

Another example is the change in policy stance of regulators and governments, who want to become more pro-active in intervening in institutions to avoid new systemic crises. From the above it is clear that models provide a useful signal of potential crises, but a large margin of error remains. Moreover, different models can give different signals about whether financial stability is threatened. This

creates a problem for intervening, as false alarms need to be balanced against the potential for crises missed.
One possibility to improve decision making is to invest in communication with the financial sector and the public, putting focus on the potential dangers if no action is taken. This effectively lowers the barrier to intervene and make early-warning signals more useful. It remains the tough job of the regulator to "take away the punch bowl when the party get going", i.e., the regulator is most effective in booming markets, when the forces against intervention are strongest.
Successful intervention and interventions that were not necessary after all are almost impossible to distinguish. Therefore, a process of trial and error is inevitable, and the danger of a 'cry wolf' effect needs to be managed by effective communication.

IV. Manage the complexity of the financial system

Ongoing financial innovation and institutional developments have led the financial sector to resemble a complex dynamic system. Such systems have been analyzed in engineering, where it is well known that they suffer from several problems. A key one is that a single malfunction can have unpredictable effects. Large scale failures can occur in a random fashion. Intervening in the system is hard. The problems amount to the phenomenon of "normal accidents", i.e., the occurrence of crashes in dynamic and complex systems is the norm rather than the exception.

The literature offers suggestions on how to deal with complex systems. First of all, the complexity itself might be reduced by striving for modularity, so that different parts of the financial system can easily be distinguished and have well-defined relations. Second, the monitoring of the financial system should improve by investing in data collection and analysis. Thirdly, there is a need for continuous improvement in the modeling and analysis of financial risks in the financial network. The improvements in data collection and modeling should be used to develop more sophisticated stress tests that guide policy makers on where the potential breakdowns are located.

V. There is evidence for a country-specific financial cycle

The financial crisis of 2008/2009 was preceded by at least a decade of very high credit growth. Looking back, this is suggestive of a 'financial cycle' with persistent growth of credit and asset prices. Such growth rates trend according to a cyclical pattern with a duration of 15 years, and are country-specific. However, due to data limitations it is too early to draw any definitive conclusions regarding the behavior of financial cycles.

The concept of the financial cycle is now firmly embedded in the approaches developed by national supervisors and the ESRB to mitigate financial instability. It should be noted, however, that macroprudential policies cannot replace monetary policy, fiscal policy and, even less, industrial policy. The knowledge of the interlinkages between financial stability, banks, and growth is too limited for attempting to use macroprudential policy for fine-tuning the credit cycles.

VI. Systemically important institutions are correctly identified

Compared to sophisticated statistical techniques, the common-sense approach to identifying systemically relevant institutions (SIFIs), by using the size, interconnectedness, leverage and liquidity is adequate. Also, simple measures based on the risk of one institution in isolation (such as value-at-risk) work surprisingly well in measuring its systemic importance. The fact that an institution such as AIG was not identified as systemically important before the crisis was due to the absence of data rather than using incorrect measures.

In that respect, the common standards for supervisory reporting developed by the European Banking Authority for EU banks, with harmonized templates and definitions, represent a major step in the right direction. Comparable, consistent and comprehensive data from supervised entities help

supervisors to make informed decisions on preventative measures, on use of micro- and macro-prudential tools and to promptly react on idiosyncratic problems or system-wide build-up of systemic risks.

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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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
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WEBSITE

www.syrtoproject.eu.

FOR MORE INFORMATION

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