



**Macro-Risk Assessment and Stabilization Policies
with New Early Warning Signals
SSH.2012.1.3-1**

[Deliverable 6.16](#)
[Annual Report](#)

Author(s)	M. Villa, A. Villafranca (with substantial contributions from all RAstaNEWS partners)
Keywords	EU economic governance, Monetary policy, Fiscal policy
Abstract	<p>The RAstaNEWS project is based upon the premise that rethinking the future of macroeconomic and monetary integration in Europe requires a substantial revision and integration of underlying macroeconomic models, and a new vision about what markets and policymakers can accomplish.</p> <p>In this Annual report, we will focus on proposals on the design of macro-prudential regulation within the EMU, and on the identification of Early Warning Signals and their inclusion in EWS mechanisms at the euro area level. In particular, we argue that macro-prudential regulation should be centralized at the central bank level, in order to maximize synergies between monetary policy and macro-prudential regulation while minimizing negative externalities. The current institutional architecture, in which macro-prudential supervisory decisions are delegated to national authorities, with the ESRB and ECB playing a limited role, is inefficient.</p>

Distribution level	Public	Status	Final	Version	01
Contractual delivery date	25	Actual delivery date		36	

This project has received funding from the European Union’s Seventh Framework Programme for research, technological development and demonstration under grant agreement no. 320278.



2nd Annual Report

Monetary Policy and Prudential Regulation: In Search of a New Normal

M. Villa, A. Villafranca
ISPI

1. Introduction¹

The RASTANEWS project is based upon the premise that rethinking the future of macroeconomic and monetary integration in Europe requires a substantial revision and integration of underlying macroeconomic models, and a new vision about what markets and policymakers can accomplish. In a nutshell, since its inception the project has aimed at providing different but interrelated policy outputs to EU and Eurozone policymakers:

- 1) proposals to reform EMU macroeconomic policies in a way that would contribute to decrease the likelihood of the occurrence of future crises, while at the same time supporting overall growth in the currency union. The project aims at addressing EMU design and policy weaknesses that only emerged after the onset of the Great financial crisis, particularly those that: (a) hamper the proper functioning and the uniform transmission of monetary policy throughout the euro area; and (b) limit the coordination of fiscal policies, prevent their use as countercyclical buffers, and impede the emergence of a political

¹ The research leading to these results has received funding from the European Union, Seventh Framework Programme FP7/2007-2013 Socio-economic Sciences and Humanities under Grant Agreement No. 320278 –RASTANEWS.

consensus over the design of redistributive mechanisms at EMU level;

- 2) proposals to reform EMU macro-prudential policies, improving the functioning of the Banking Union as a way to enhance convergence of economic conditions and a smoothing of the business cycle, all the while serving as prudential tools at the EMU level that shelter the monetary union from a renewed negative feedback loop of financial crises and inter-country contagion;
- 3) proposals to devise Early Warning Signals (EWS) that could serve as improved and timely indicators of problematic disequilibria at the macro level, with the aim to allow European and national policymakers, regulators and supervisors to act as early as possible in order to rebalance national economies or the EMU as a whole before a full-fledged crisis can develop.

Point 1 of this list has been thoroughly addressed in the First RAstaNEWS Annual Report. This Second Annual Report will aim at shedding some insights and offer policy recommendations as to a feasible way to address points 2 and 3, i.e. how to strengthen macro-prudential regulation and supervision at the EMU level, and how to develop EWS indicators that could help highlight economic disequilibria that have the potential to destabilise national countries within the EMU or the euro area as a whole.

2. Monetary policy and macro-prudential regulation

How should monetary policy and prudential regulation be managed? Should they be independent or somehow coordinated? Before the Global Financial Crisis (GFC) the “separation principle” (Issing, 2011) provided the standard answer to this question, assigning a single goal to monetary policy – i.e., “monetary stability” (low and stable inflation) – or prescribing a dual mandate whereby monetary stability is coupled to “real stability”, i.e., output stabilization around the long-run potential growth path.² Supervision and regulation, on the other hand, aimed essentially at protecting individual financial institutions from excessive distress (micro-prudential policy). Economy-wide financial stability, i.e. the mitigation of systemic risk by means of macro-prudential policy, albeit not completely absent in the policy debate, was not on the authorities’ radar.³

Eight years after the outbreak of the GFC, the pre-crisis consensus is in shatters. First of all, it is now abundantly clear that financial supervision has to be upgraded to a systemic dimension, expanding the role of macro-prudential policies (IMF, 2014). Second, an increasing number of economists and policy makers advocate a new, tripartite mandate whereby financial stability should be added to price and output stability as an explicit goal of monetary policy (Reis, 2013; Antipa and Matheron, 2014; Peek, Rosengren, Tootell, 2015). In order to fulfill this mandate the central bank could adopt, for example, an augmented Taylor rule which dictates a change of the policy rate in response to departures from target not only of inflation and output (the inflation gap and the output gap respectively) but also of a measure of financial stability (see Section 3).⁴

The rationale for augmenting the Taylor rule with a financial target,

² In the former case, monetary policy is characterized by strict inflation targeting, in the latter by flexible inflation targeting.

³ Moreover, prudential policies were assigned to different agencies across countries, spanning from national central banks, to the Ministries of Finance, to specific regulatory and supervisory authorities.

⁴ The inflation (output) gap is the difference between current inflation (output) and target inflation (output). Analogously, the financial gap can be defined as the difference between a measure of the current level of financial instability and the target level of financial stability: Blanchard (2000) and Cecchetti et al. (2000) were among the first to suggest an augmented Taylor rule along these lines.

however, is built on shaky foundations, as we will show in sections 3 – which is devoted to an operational definition of financial stability – and 4, which presents the reciprocal spillovers between monetary policy and prudential regulation. Therefore many economists and policy makers are still in favor of a separation between monetary policy (aiming essentially at monetary stability), on the one hand, and macro-prudential policy (aiming at financial stability), on the other. We put ourselves in this camp, arguing in favour of an operational separation between monetary policy and prudential policy.

Section 5 is devoted to the assignment problem, i.e. who does what in monetary and prudential policies. As regards policy objectives, the principle of separation, which we adopt, allows to assign instruments to objectives: interest rate setting should be in charge of monetary (and real) stability while the regulation of financial intermediaries (capital and liquidity requirements) should be in charge of financial stability.

Once the separation principle is established, it is necessary to assign the proper tools to monetary and macro-prudential authorities. We advocate the centralization of monetary and prudential policies in the hands of the same authority, namely the central bank.

In sections 6 and 7, we dig deeper into the rationale and architecture of prudential regulation. Section 6 discusses the current institutional arrangement of prudential policies in Europe, detects defects and proposes remedies. Section 7 presents RASTANEWS insights on Early Warning Signals (EWS).

3. The case for, and against, a new tripartite mandate for monetary policy

The institutional architecture of monetary and macro-prudential policies prevailing before the GFC was based on a simple, clear-cut dichotomy:

- monetary policy - in charge of setting interest rates - is assigned a single goal (monetary stability) or a dual mandate (monetary and real stability);
- prudential policy – in charge of regulating and supervising financial institutions – has the responsibility of mitigating financial distress essentially at the level of individual institutions (micro-prudential policy).

In this policy framework, “financial stability [is] generally viewed as a dangerous distraction, risking the central bank’scredibility in achieving its price stability mandate”(Williams, 2015).

For the sake of clarity, it is important to point out that there are (at least) two notions of financial instability. According to the first – which we will label FI1 – financial instability essentially means excessive volatility of financial prices, especially of stock prices. The second notion (FI2), on the other hand, emphasizes the risk of a financial crisis due to excessive financial fragility of banks, firms or households.

According to the pre-GFC consensus, monetary stability was “the best guarantee for financial stability” (Toniolo and White, 2015). In fact, a central bank credibly committed to monetary stability should be able to anchor inflation expectations, reducing interest rate volatility and contributing to the attainment of system-wide financial stability, narrowly defined as low asset price volatility (FI1). Monetary policy should aim at mitigating asset price changes only inasmuch as they are sizable and impact on monetary stability (Bernanke and Gertler, 2001).⁵

⁵ A hotly debated issue – even before the GFC – is whether or not the central bank should act to prevent “excessive” stock price dynamics – i.e. mitigate FI1 – by raising interest rates to halt a stock market boom or lower them to correct a crash. On this issue, there are two contrasting views. Bernanke and Gertler (2001) have argued that a positive shock to asset prices boosts aggregate demand and consequently the price level. The central bank therefore does not need to respond directly to asset price fluctuations because it is already indirectly reacting to asset price movements when it keeps in check price inflation. On the other hand Cecchetti et al. (2000) have argued that the central bank is likely to achieve a higher performance by adjusting its policy instrument not only in response to its forecast of future

According to Issing (2011) the pre-crisis conventional wisdom – the so called “Jackson Hole consensus” – prescribed the following to central banks:

- do not target asset prices,
- do not prick an asset bubble,
- “clean up” the consequences of a financial crash.⁶

However, the GFC has abundantly shown that the premises of the pre-crisis consensus are incorrect.

First of all, low inflation does not imply financial stability. Keeping interest rates “too low for too long” – in response to inflation aligned with the target – might create a sense of tranquillity that will ultimately lead to excessive risk taking and macro-financial imbalances (Rajan, 2006; Olsen, 2015).⁷ Monetary policy cleaning-up has also been heavily criticized (Peek, Rosengren and Tootell, 2015).

Second, micro-prudential regulation and supervision has been shown to be insufficient to guarantee the stability of the financial system as a whole: financial institutions may appear safe on a standalone basis, while the financial system as a whole could be on a dangerous disequilibrium path (Borio, 2009).⁸ According to Cecchetti (2011, 2012) economy-wide financial instability is due to (i) externalities that lead to systemic risk⁹ and (ii) pro-cyclicality of financial imbalances due to the interaction of the real economy

inflation and the output gap, but to asset price dynamics as well. Assenza, Berardi and Delli Gatti (2015) show that an augmented Taylor rule which incorporates the response of the policy rate to the growth of asset prices is not welfare enhancing.

⁶ In other words, the Central Bank should intervene ex-post providing liquidity to the market, acting as a Lender Of Last Resort (LOLR).

⁷ It is almost a commonplace that the Great Moderation has generated complacency and led to over-confidence about the smooth working of the economy (Kashyap, 2015).

⁸ The regulatory framework before the outbreak of the GFC was largely micro-prudential and therefore inadequate to deal with the systemic component of the financial crisis (Hanson, Kashyap and Stein, 2011).

⁹ In a network of borrowing/lending relationships, the insolvency of a financially fragile borrower hurts the lender and the other agents linked to the bankrupt borrower and to the lender. In the worst-case scenario, further bankruptcies will ensue (bankruptcy avalanche). This is clearly a negative externality due to bilateral credit interlinkages. If the lender reacts by raising the interest rate charged to all the borrowers she is lending to, also financially robust borrowers will suffer. This is clearly a negative pecuniary externality, i.e. an external effect which works its way from the specific borrower and lender to the rest of the economy through the price of credit. The bankruptcy of a borrower is absorbed initially by a reduction of the lender’s net worth, which will push leverage up. If the lender sells assets under distress to de-leverage, the price of these assets will fall reverberating on the market value of other agents’ portfolio due to common exposure. This is a pecuniary externality due to asset fire sales.

and the financial system.¹⁰ The recent crisis showed that it is very difficult to control both externalities and pro-cyclicality, also due to the fact that it is not easy to define appropriate capital requirements that would increase the resilience of the financial system while minimising the impact on credit supply to the wider economy. Therefore, systemic risk is much more than just the sum of individual risks: the interactions among financial institutions and between institutions and the market environment generate risk correlation and amplify the macroeconomic consequences of financial distress (Battiston et al. 2012; Allen and Carletti, 2013; Aldasoro et al. 2015).¹¹

These criticism of the pre-GFC consensus spurred a debate on the design of the monetary policy framework (IMF, 2013). There are essentially two camps in this debate. On one side, some influential economists and policy makers (Reis, 2013; Peek, Rosengren, Tootell, 2015) propose to assign a new tripartite mandate to central banks in which financial stability becomes an explicit goal of monetary policy. The central bank, for instance, could adopt an augmented Taylor rule which suggests a change of the policy rate in response to departures from target of a measure of financial stability, in addition to the usual ingredients (inflation and output gap). In other words, these scholars propose a super-flexible inflation targeting scheme for monetary policy. On the other side, prominent economists and commentators defend the basic tenet of the pre-crisis consensus, advocating the separation principle. Svensson (2015), for instance, claims that monetary policy is unable to systematically affect banks' capital and liquidity buffers. Therefore, it would be pointless to address financial imbalances by means of a standard monetary policy instrument (the policy rate).¹²

Paradoxically, if monetary policy aims at financial stability the risk of financial instability might even increase, as shown recently by the Swedish experience. In order to limit the excessive accumulation of household debt, the Sverige Riksbank decided to increase interest rates in 2010-11 even if inflation was well below target and the unemployment rate was above the "natural" level. Hence, the Swedish monetary stance became tighter than in a flexible inflation targeting regime, with significantly higher unemployment rate and lower inflation. Moreover, inflation expectations fell below target, pushing the real interest rate up and leading to higher debt-to-income ratio for

¹⁰ Pro-cyclicality is the core of Minsky's Financial Instability Hypothesis (Minsky, 1982).

¹¹ Of recent, these problems have been exacerbated by the increasing presence of Systemically Important Financial Institutions (SIFIs). The large scale of activity and/or interconnectedness of these complex institutions made them too big to fail *par excellence* and – at the same time – too big to bail out.

¹² Svensson is clearly thinking in terms of financial stability of the second type (FI2 in our taxonomy). There are good reasons, however, to be sceptical of a tripartite mandate also in case financial instability is of type 1 (FI1), as shown in footnote 5.

households: the pre-emptive action undertaken by the Swedish central bank ended up with higher financial instability.

Along the same lines, Yellen (2014) has claimed that the consequences of monetary policy actions on financial stability (changes of leverage and maturity transformation) are not well understood and (at best) severely limited.¹³

Shin (2015) provides a balanced interpretation of the relationship between macro-prudential and monetary policies. Both policies can influence the demand and the supply of credit.¹⁴ Given the sizable spillovers induced by each policy on the other policy's objective, therefore, a sharp separation of these two policies is (almost) impossible. For instance, tighter prudential regulation (e.g. an increase of capital requirements) might lead to a contraction of banks' balance sheets resulting in a deflationary tendency, which in turn may provide an incentive for an expansionary monetary policy. In 2014, for instance, the large majority of macro-prudential measures taken by euro area Member States were restrictive, with the explicit objective of "mitigation and prevention of excessive credit growth and leverage."¹⁵ At the same time, the ECB introduced the Targeted Long Term Refinancing Operations (T-LTROs) and in early 2015 started debating Quantitative Easing with the aim of boosting the supply of credit and contrasting the risk of deflation. The trade-off between the two policies is indeed striking.

In order to take sides in this debate we have to evaluate the following issues:

- Specification of a measurable notion of financial stability (section 4).
- Analysis of the interactions and trade-offs between monetary and financial stability (section 5).
- Solution of the assignment problems: which instrument should be assigned to which objective? Which agency should be in charge of which objectives? (section 6)

¹³ According to Yellen (2014), monetary policy cannot fill the gap in the regulatory set-up that allowed some financial intermediaries to avoid an effective supervision, and cannot reduce the degree of opacity of several complex financial instruments: two elements – among several others – that played a major role in the build-up of financial imbalances that led to the GFC.

¹⁴ Monetary policy affects risk taking uniformly, however, while macro-prudential policy is sector-specific and sometimes agent-specific. See also Brunnermeier and Sannikov (2014) on this point.

¹⁵ See ESRB (2015), page 11.

4. How do we measure financial instability?

Any institution willing to tackle financial instability has to solve two fundamental problems: the definition and measurement of financial instability, and the choice of the time horizon.

First, an operational definition of financial instability is required. While the objective of monetary stability can be easily quantified — for example, an inflation rate (measured by the rate of change of CPI) close to 2% — financial stability cannot be defined in a rigorous and unambiguous way.¹⁶ The most obvious problem, therefore, is to measure the degree of financial instability in order to operationally define a financial stability target (Reis, 2013).

In the literature, financial instability has been defined in terms of financial sector leverage (Woodford, 2012), spread between borrowing and lending rates, funding of financial intermediaries, credit to the private (non-financial) sector, risk premia in the bond market, and growth rate of asset prices.¹⁷ It appears clear that financial stability is a multi-dimensional concept that, to the very least, requires stability of (i) financial markets (by means of liquidity provisions), (ii) financial institutions (setting proper micro-prudential rules) and (iii) the financial system as a whole (imposing adequate macro-prudential requirements) (Geerats, 2010).

Second, a proper policy horizon should be chosen. This is a far from easy task. In order to stabilize inflation, central banks usually define a medium-term policy horizon that is longer than the average interval between the policy move and the deployment of the effects of such a move (which has been estimated of being around 2 years, ECB 2015). In so doing, central banks gain some flexibility in order to aim at a secondary objective such as output stabilization. However, when financial stability is added to the set of monetary policy goals, the situation gets complicated. One of the main ensuing problems is that the financial cycle is generally much longer than the economic cycle (Borio, 2014).¹⁸ Hence the policy horizon to achieve price stability is not necessarily consistent with the (longer) horizon needed to target financial

¹⁶ The ECB (2015) defines financial stability as “a condition in which the financial system — comprising financial intermediaries, markets and market infrastructures — is capable of withstanding shocks and the unravelling of financial imbalances, thereby mitigating the likelihood of disruptions in the financial intermediation process which are severe enough to significantly impair the allocation of savings to profitable investment opportunities”.

¹⁷ All the indicators listed in the test concern FI2, with the exception of the last one.

¹⁸ Moreover, the financial cycle can easily go out of sync with the business cycle, and this can be precisely a consequence of financial imbalances building up.

stability. Conflicts between different policy objectives are perfectly possible: they are indeed very likely to occur.

5. The interactions between monetary and financial stability

Given the interactions between financial and monetary stability, we turn here to evaluate the sign and the size of the side effects that monetary policy can have on the objective targeted by macro-prudential policy, and vice versa. The sign of these side effects is important also in order to define the feasible degree of coordination that can be achieved between monetary and macro-prudential policies, as well as the appropriate institutional framework.

5.1 Monetary policy and financial instability

Monetary policy can affect financial stability through three main channels (Antipa and Matheron, 2014). For illustration purposes, suppose that the monetary authority adopts an expansionary monetary policy.

In such a case, low interest rates:

- soften borrowing constraints, allowing agents to take on more debt and increase leverage, therefore affecting – through the selection effect on the quality of borrowers – the probability of default;
- provide incentives to take on more risk (for instance to obtain a predetermined level of nominal returns before interest rates are lowered: Rajan, 2006), to expand the size of balance sheets, and to reduce screening efforts (Borio and Zhu, 2008);
- magnify externalities, contributing to a spiral of higher asset prices and higher leverage.

If the central bank targeted financial stability explicitly – i.e. if it pursued the stability of asset prices and/or leverage – interest rates would not be kept too low for too long, i.e. an interest rate hike would occur much sooner than in the absence of such a goal.

This generates three problems that complicate the conduct and credibility of monetary policy. First of all, the use of monetary policy to target financial stability might endanger the credibility of the central bank in fighting inflation – as underlined by Williams (2015) – and risk de-anchoring inflation expectations. The ensuing increasing uncertainty and volatility might

strengthen financial risks.¹⁹

Second, the time dimension may hinder the efficacy of monetary policy in targeting financial stability (IMF 2015). In the short run, when portfolios are *de facto* impossible to change, higher interest rates may foster financial instability by reducing household earnings, firms' profitability and asset prices. In the medium term, when rebalancing of portfolios is possible, higher interest rates might strengthen financial stability by inducing households and firms to de-leverage.

Third, interest rate hikes needed to target monetary stability are much smaller than the ones necessary to tame the building up of financial imbalances. It follows that it is difficult to compare the effects on monetary and financial stability of an interest rate change that, if implemented to target primarily inflation, will be (almost) negligible in terms of financial stability while, if implemented to target primarily financial stability, will be too severe to secure price stability.

Summing up, we can state the following:

***Remark 1** While a change in the policy rate will certainly affect financial stability, the precise sign and size of the transmission mechanism is too uncertain and insufficient to justify the assignment of a financial stability objective to monetary policy. We advocate instead an operational separation between the monetary policy sphere and the prudential regulation sphere in managing the overall financial conditions of the economy.*

5.2 Macro-prudential policy and monetary stability

Macro-prudential policies, though very useful in order to bolster financial stability,²⁰ can affect monetary stability. In order to appreciate this point, note first that financial instability can induce important negative effects on inflation (Geerats, 2010; Smets, 2014). During upturns, the magnification of an asset price bubble might lead to increasing inflationary pressures (via

¹⁹ See Svensson (2015) on the Swedish experience mentioned above.

²⁰ Macro-prudential tools – such as countercyclical capital buffers – should be able to influence financial stability: (i) along the time dimension, to limit the accumulation of financial vulnerabilities during booms, and provide a buffer to contain the negative consequences of financial excesses during busts; (ii) across sectors/agents, to increase the resiliency of systematically important institutions (such as SIFIs) in order to contain systemic risk (Cecchetti, 2011).

wealth effects on aggregate demand).²¹ Symmetrically, when a bubble bursts and financial crisis ensues, this might trigger deflationary pressures. Therefore, prudential policies that aim at limiting pro-cyclicality in financial markets – i.e. at mitigating FI1 – make the attainment of price stability easier.

Prudential policies aiming at offsetting externalities and strengthening agents' financial conditions – i.e. at mitigating FI2 – can make the conduct of monetary policy easier as well. For instance, the imposition of limits on debt-to-income ratios can reduce default rates during a monetary tightening cycle (Igan and Kang, 2011). Moreover, capital requirements on banks can limit leverage and reduce risk-taking even when interest rates are low (Fahri and Tirole, 2012).

There are, however, cases in which prudential policies can complicate the attainment of monetary stability. As already mentioned above, for instance, increasing capital requirements might lead to a deflationary spiral.

We can therefore state the following:

Remark 2 *Adequate macro-prudential policies can often (but not always) improve the conduct of monetary policy, making the attainment of its dual mandate easier.*

²¹ In this case, monetary policy can target asset prices because of the latter's effect on monetary stability as prescribed by Bernanke and Gertler, 2001.

6. After separation: Who does what?

6.1 Assigning instruments to objectives

Conventional wisdom suggests that policy makers should assign policy instruments to objectives using Mundell's principle of effective market classification: an instrument should be assigned to the objective on which its relative effect is higher.

While the costs of using monetary policy to target financial stability seems to be larger than the benefits, the use of macro-prudential tools to tame financial instability has proven fruitful. Goodhart et al. (2009) and, to some extent, Adrian et al. (2015) showed that in order to attain financial stability, the regulation of financial institutions is more effective than monetary policy action, i.e. macro-prudential tools are relatively more efficient than interest rates in targeting financial stability. We can therefore conclude that:

***Remark 3** Interest rate setting should be assigned to monetary stability while prudential measures (both at the micro and the macro level²²) should be assigned to financial stability.*

6.2. Assigning instruments to authorities

We have adopted the principle of operational separation between the goals and tools of monetary policy and the goals and tools of prudential regulation. Now we have to assess the degree of coordination between these policies. In fact, they might be managed either by separate authorities or – under the same roof – by the same authority.

In our view, the assignment of monetary and prudential policies to independent agencies is likely to be inefficient, given the spillovers among the two spheres (discussed in section 5). A strong coordination between two different agencies may take these spillovers somehow into account. However, the best solution is, in our opinion, full centralization.

²² For instance countercyclical capital buffers (Drehmann et al., 2010, 2011 ; Behn et al., 2013; Drehmann and Juselius, 2013 ; Detken et al., 2014) and macroprudential instruments targeting real estate related risks (ESRB, 2014).

Remark 4 *It is efficient to centralize both monetary and prudential policy at the central bank level, in order to maximize the synergies of closer integration between prudential and monetary policies (Antipa and Matheron, 2014; Lossani, 1998).*

Centralization, in fact:

- exploits the complementarity²³ and the overlapping components of the transmission mechanisms of the two policies,
- provides incentives for the central bank to rigorously supervise the financial system in order to limit the probability of a crisis and the size of clean-up (i.e. LOLR) interventions,
- eliminates at the root the delay in policy response due to lack of coordination and risk of conflicts among different authorities in the heat of a financial crisis.²⁴

However, we recognize that centralization can also have disadvantages. In particular, centralization (i) may impose an excessive burden on the central bank (Orphanides, 2013), and (ii) increase the risk of fiscal or financial dominance over monetary policy (Antipa and Math-eron, 2014). For instance, a central bank under financial dominance might be willing to keep lending to defaulting banks that may spread financial distress through their interconnectedness. While aware of these disadvantages, we conjecture that the benefits more than offset the costs of centralization, provided conflicts of interest are adequately contained.

The current architecture of prudential policy in the European Union is only partially in line with the remark above. The ECB, national central banks, and other agencies are in charge of different aspects of prudential regulation, and this multiplication of agencies in charge of the same policy aim opens up an important space for coordination problems. In the next section, we will delve deeper in the way in which macro-prudential policy is carried out, both in the euro area and in the European Union as a whole.

²³ For instance, Antipa and Matheron (2014) claim that gathering and analysing data on financial intermediaries – while the central bank carries out supervision tasks – provides additional information to assess the state of both the financial and the economic system, which may prove to be useful in order to carry out the monetary policy task.

²⁴ See Goodhart and Shoenmaker (1995) for an interesting discussion of the pros and cons of centralization.

7. Prudential policy in action

7.1. Who does what in the EMU prudential sphere

Since November 2014, the Single Supervisory Mechanism (SSM) is responsible for micro-prudential supervision only, while macro-prudential supervision is to a large extent delegated to national authorities.

The fundamental difference between these two policies lies in their targets. Micro-prudential supervision aims at monitoring and preserving the stability of individual financial institutions, ensuring their compliance with the relevant prudential regulation. Macro-prudential supervision should instead monitor aggregate financial risks by carrying out two basic tasks: (i) limit the pro-cyclical behaviour of the financial sector (e.g. the increase of leverage during booms and sudden de-leveraging during downturns); (ii) limit the likelihood that difficulties faced by some institutions spill over to other intermediaries and markets. Despite different targets, the tools employed are essentially the same: capital requirements, liquidity ratios, leverage limits, and other specific measures like the Loan-to-Value (LtV) and Loan-to-Income (LtI) caps applied to mortgage loans.

More specifically, in 2013 the Directive CRD IV (art. 128-140) introduced a set of capital buffers that will be effective as of January 2016: a counter-cyclical buffer, a systemic buffer, and a buffer for Systemically Important Institutions (either Global or Other, G-SII and O-SII respectively). They can be added to the minimum CET1 ratio, extended by the capital conservation buffer which amounts to 7% of the Risk Weighted Assets (RWA), as of January 2019.

The national authorities in charge of macro-prudential supervision are responsible for: (i) setting the counter-cyclical buffer rates (in a range between 0 and 2.5% of RWA), (ii) identifying the G-SIIs (which are subject to a buffer ranging from 1% to 3.5%) and the O-SII (which are subject to a buffer up to 2%), and (iii) deciding which institutions (if any) should be subject to a systemic risk buffer. Other tools, like the LtV and LtI caps, may be introduced through national law.

In the EU as a whole, the architecture of macro-prudential supervision includes two supra-national bodies, namely the European Systemic Risk Board (ESRB) and the ECB, but with a limited role. The ESRB is responsible, at the EU level, for monitoring systemic risk and providing warnings and

(non-binding) recommendations to the national authorities, which bear the final responsibility to take action.

Within the euro area, supranational coordination is somewhat more stringent, but not by much. National authorities have to notify the ECB before taking a macro-prudential decision: in case of objections by the ECB, the national authority has to consider the ECB's reasons prior to proceeding with its decision. A symmetrical procedure applies to the case where the ECB wants to take a macro-prudential action; however, the ECB can only take restrictive actions, by imposing requirements for capital buffers higher than those imposed by the national authorities.²⁵

This institutional design raises three coordination issues:

1. the implementation of macro-prudential policy can differ widely across countries, i.e. the coordination of national macro-prudential policies can (and, in practice, is) inadequate;
2. the coordination of macro-prudential authorities at different levels (national and supra-national) appears to be inadequate;
3. macro-prudential and micro-prudential policies may be in conflict.

As to the first issue, systemic risk has a strong cross-country dimension: the amplification of the financial and economic cycle, due to the procyclicality of financial intermediation, and the propagation of liquidity and solvency shocks, have significant spillovers from one country to the others. It may become all the more so, if policy makers were successful in further synchronizing the EMU's business cycle.

At the same time, it is unlikely that national authorities would take into due consideration these externalities, given they are ultimately accountable to national actors and may even lack adequate information on such externalities. The ESRB itself, in its report on macro-prudential policy implemented in the EU in 2014, has acknowledged that "national authorities do not analyse the potential cross-border effects of national macro-prudential measures in great detail". The same report states that "wide differences exist across Member States in the number and type of measures taken."²⁶

This heterogeneity may be hardly justified by idiosyncratic macro-economic shocks. To the contrary, it hints at a lack of coordination among the national authorities. The emergence of significant cross-country differences in the use of macro-prudential tools can leave the European regulatory framework too segmented, risking to jeopardize the objective of achieving a

²⁵ Art. 5 of the SSM Regulation.

²⁶ See ESRB (2015), pages 3 and 10 respectively.

level playing field.

As to the second issue, conferring macro-prudential supervision tasks to national authorities, which then have to communicate their actions to two supra-national authorities (the ECB and the ESRB), all the while taking their opinion into account to some extent, raises some obvious issues of a potential lack of coordination (particularly between the ECB and the National Competent Authorities, or NCAs) and duplication of actions (particularly between the ECB and the ESRB, also because of a large overlap between their governing bodies).²⁷

As to the third issue, the picture becomes even more complex when noting that micro-prudential supervision within the SSM is shared between the ECB and the NCAs, and that the monetary policy is attributed to the ECB under a separation regime between the two tasks: supervision and monetary policy.²⁸

This fragmented framework raises the risk of conflicts between different policies. Consider the macro- and micro-prudential policies, which use the same tools to achieve different goals. In a downturn, the macro-prudential authority might prefer to take an expansionary action by lowering the counter-cyclical capital buffer; but this action might be offset by the micro-prudential authority, which might prefer to increase the individual capital ratios of several banks for stability concerns, making use of its discretionary powers under Pillar II.²⁹

Remark 5 *The current institutional architecture, in which macro-prudential supervisory decisions are delegated to the national authorities, with the ESRB and the ECB playing a quite limited (mainly advisory) role, is not satisfactory. The institutional design should be streamlined and centralized. As far as the euro area is concerned, it seems reasonable to attribute the responsibility of macro-prudential supervision to the SSM. This issue needs to be further analysed and discussed by policy makers.*

²⁷ The composition of the General Board of the ESRB has a large overlap with that of the Governing Council of the ECB, since it includes its President and Vice-President, together with the Governors of the national central banks of the Member States (plus the chairmen of other European financial authorities, like EBA, EIOPA, ESMA). See Angelini (2015) for an interesting discussion of the institutional framework of macro-prudential supervision in the EU.

²⁸ See Baglioni (2016) for a discussion of the organization of the SSM.

²⁹ Conflicting stances may also arise between macro-prudential and monetary policies, as shown above.

7.2. Stress tests and systemic risk

The first action by the ECB, as responsible for banking supervision, has been the examination of the balance sheets of the most significant banks in the euro area (“comprehensive assessment”).³⁰ The ECB directly assessed 130 banks, i.e. “significant” financial institutions subject to the direct oversight of the ECB, chosen following five sufficient criteria:

1. The value of the bank’s assets exceeds €30 billion;
2. The value of the bank’s assets exceeds both €5 billion and 20% of the GDP of the Member State in which it is located;
3. The bank is among the three most significant banks of the country in which it is located;
4. The bank has large cross-border activities;
5. The bank receives, or has applied for, assistance from euro area bailout funds (the ESM or the EFSF).

The 130 institutions thus singled out are a small fraction in number compared to the over 6,000 euro area banks, but they account for 82% of the total assets of the banks located in the SSM area.

The comprehensive assessment is composed of two parts: (i) an asset quality review (AQR), (ii) a stress test. The capital shortfalls emerging from the AQR and from the stress test, concerning 25 institutions out of 130 and amounting to €25 billion on 31 December 2013,³¹ have been the starting point for the SSM supervisory activity over the most significant banks. Banks characterized by a shortfall have been asked to submit a list of remedial actions to restore their capital position. Such actions had to rely on private resources and on national public backstops as a last resort.

Though important to improve confidence in the health of EU-based financial institutions and to restore a euro-area level playing field, the micro-prudential approach adopted in carrying out the comprehensive assessment has been a severe limitation of the exercise. The analysis performed by the ECB, through both the AQR and the stress test, has focused on the risk profile of each financial institution in isolation, without considering potential

³⁰ The comprehensive assessment was carried out during 2014 and its results were made public on 26 October 2014. This action therefore took place before the ECB was formally attributed its supervisory role on 4 November 2014.

³¹ During 2014, most undercapitalized banks managed to raise capital, bringing capitalization needs at end 2014 down from €25 billion to just over €9 billion.

spillover effects³² – i.e. the systemic dimension of risk – which have played a crucial role in amplifying initial shocks during the GFC.

The failure of the comprehensive assessment to consider systemic risk can be traced back to the architecture of the SSM, which does not assign the responsibility for macro-prudential supervision to the ECB.

***Remark 6** Lack of responsibility in macro-prudential supervision might explain why the ECB decided to overlook the systemic component of credit and liquidity risks. Whatever the reason, this limitation should be avoided in future stress test exercises.*

Another drawback of the comprehensive assessment derives from its focus on the CET1 ratio as the only indicator of bank solvency. Actually, concerns about the CET1 ratio have a more general relevance, since they point to pitfalls in the Basel III regulatory approach. The CET1 ratio turns out to be penalizing for financial systems focused on commercial banking, as opposed to investment banking. Moreover, it suffers from the potential manipulation of the risk weights used to compute the RWAs. This approach overlooks the possibility that some financial intermediaries accumulate high leverage, despite the fact that they are able to report a satisfactory CET1 ratio. In the future, a way to improve the stress test methodology would be to complement the CET1 ratio with a simple leverage index, which is less prone to manipulations and country bias.

³² See footnote 9.

8. Early warning signals

Given that the macroeconomic consequences of financial disruption can be painful and long lasting, it is of the utmost importance to constantly improve models that allow us to foresee the onset of a financial crisis as early as possible. This requires the identification and careful refinement of Early Warning Signals (EWSs), quantifiable indicators of an approaching financial storm that may trigger an economic recession. In this section we will briefly review RAsTaNEWS research concerning (i) EWS of an approaching financial crisis (financial EWS) that could serve as a basis for the timely activation of macro-prudential policies, and (ii) EWS of an incoming recession (real EWS), which may be used to activate macro-stabilization policies.

8.1. EWS of a financial crisis

Financial EWS are quantifiable indicators of increasing or “excessive” credit growth, leverage, financial imbalances and systemic risk in the run-up to a financial crisis.

A large body of literature has been devoted to the identification of financial EWS, starting from the development of leading indicators of currency crises in emerging economies (Frankel and Rose, 1996; Kaminsky et al., 1998). The focus has then shifted to develop indicators to foresee a wider spectrum of events, including banking crises and boom/bust cycles of asset prices in developing as well as developed countries.³³

Recently, applications of network theory to the financial system have allowed to capture the systemic nature of the financial crisis and the role played by interconnectedness among financial institutions in spreading the crisis (Kambhu et al., 2007, May et al., 2008). This view has led to the development of network-based measures that have the potential to be employed as EWSs of crisis events (Squartini et al., 2013, Rovira Kaltwasser and Spelta 2015, Spelta 2015).

³³ The development of financial EWS has been advocated by the Financial Stability Board (FSB, 2011), the International Monetary Fund and the Bank for International Settlements (see Rhu, 2011). In this respect, the literature is huge. See, for example, Babecky et al., 2012; Behn et al., 2013; Demirguc-Kunt and Detragiache, 1997; Detken et al., 2014; Drehmann et al., 2010, 2011; Drehmann and Juselius, 2013.

In particular, Spelta (2015) proposes a method to develop a financial EWS – the so-called “time score” – that simultaneously addresses the two dimensions of the build-up of financial imbalances: (i) the cross-sectional dimension, due to financial institutions’ interlinked exposures; and (ii) the time dimension, due to the financial cycle. These two dimensions are indeed closely related. On the one hand, the build-up of risk concentration among institutions drives the financial cycle. On the other hand, economy-wide credit growth tends to lead to higher interconnectedness, as financial institutions increase leverage and non-core funding exposures with other intermediaries.

The time score may therefore account for both the evolution over time of the volume of transactions, and for the cross-sectional distribution of transactions among institutions in each period.

Figure 1 (upper panel) shows the behaviour of the actual traded volume (blue) in the interbank market (from e-MID data) together with the actual time score (red) and the time score produced by a network model of the interbank market. The volume of transactions smoothly increases until the peak of the first quarter of 2007 – which can be considered the beginning of the financial crisis – and decreases afterwards, levelling off at end-2009. The time score reaches its maximum before the beginning of the crisis: it starts decreasing in 2006. This pattern allows to conceive it as a leading indicator or EWS of the crisis.

Spelta investigates the role of the change in network interconnectedness (see the central and lower panels of Figure 1) in leading to the subsequent fall of transactions at the beginning of the financial crisis. He conjectures that an abrupt shift in banks’ confidence in the risk profile of their peers may have changed the topological structure of the network (i.e., how banks are interconnected with each other), which in turn may have contributed to the abrupt decline of transactions in the interbank market.

The Basel Committee on Banking Supervision (2013) has proposed to measure interconnectedness as the weighted sum of intra-financial system assets, intra-financial system liabilities, and outstanding securities. Intra-financial assets and liabilities are aggregate bilateral interbank exposures and try to capture how strongly each bank is “dependent” on another bank. Along similar lines, Minoiu et al. (2015) have proposed to employ “average strength” (another network-based measure) as a financial EWS.

Rovira Kaltwasser and Spelta (2015) compare their proposed “time score” measure to the “average strength” measure. Results show that the time score reaches its peak before the beginning of the crisis, while average strength peaks considerably later. This is evidence that the time score provides a better EWS than average strength, as it anticipates the dynamics of future crisis

event.

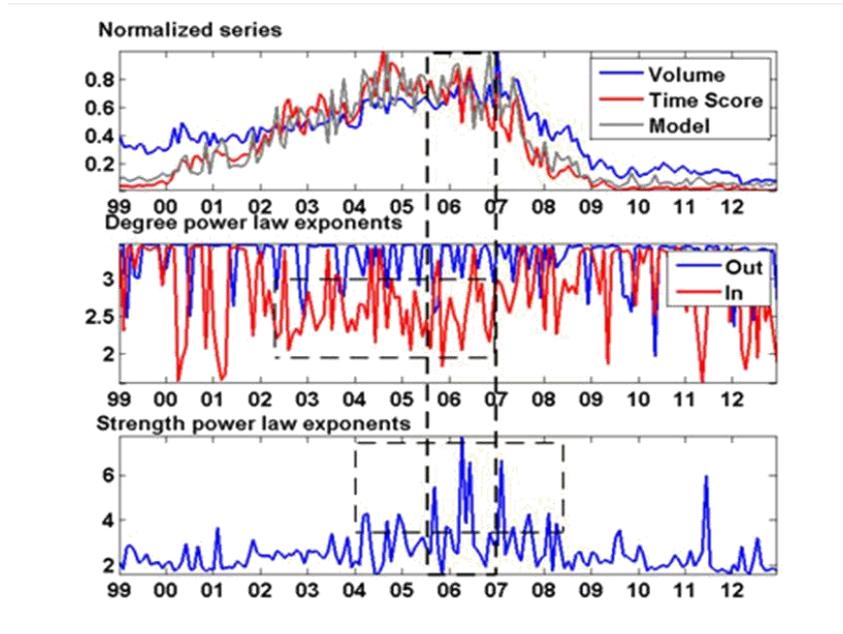


Figure 1: Upper panel: total volume of transactions (blue), actual time score (red), average time score generated by 500 repetitions of the interbank model (gray). Central panel: power law exponents of the in- (red) and out- (blue) degree distributions. Lower panel: power law exponent of the strength distribution. The vertical rectangles identify the periods in which the change of the topological structure of the network drives the transition to the financial crisis.

Summing up:

Remark 7 *Useful financial EWSs could be developed looking simultaneously at the interconnectedness among agents in a financial network and at the state of the financial cycle. A change in direction of these indicators may be used for the timely identification of critical transitions in complex systems – such as the interbank market – due to ongoing or upcoming crisis events.*

8.2. EWS of a recession

A recent strand of macroeconomic literature has drawn attention to the role of abrupt changes in expectations in driving business cycle fluctuations (Beaudry and Portier, 2013). Morana (2014, 2015) and Bagliano and Morana

(2015) have provided an empirical finance framework – grounded in intertemporal asset pricing theory (ICAPM, Merton, 1973) – to make the “news-driven” business cycle insight operational.

As shown by Merton (1973), once shifts in the macroeconomic outlook are allowed for, the equity premium (the fact that observed returns on stocks are much higher than returns on government bonds) is determined by a model that is able to capture unfavourable changes in the macroeconomic scenario. The most widely employed risk factors are size (SMB) and value (HML) factors (Fama and French, 1993), momentum (MOM; Charart, 1997), stock market liquidity (PSL; Pastor and Stambaugh, 2003), financial leverage (LEV; Adrian et al., 2014), and risk aversion (VOL). They are capable of explaining the equity premium by mimicking state variables related to firms’ distress. In practical terms this means that the said risk factors, taken together, have a good chance at predicting impending economic crises.

Morana (2014) shows that macro-financial shocks account for the bulk of risk factors fluctuations³⁴ Positive innovations to size and value factors reveal expectations of favourable changes in macroeconomic prospects. The opposite holds true for a positive shock to momentum, which tends to be followed by a contraction in real activity. A positive shock to stock market liquidity leads to a short-term expansion in real activity. A positive leverage shock determines a contraction in real activity and liquidity conditions. Finally, higher stock market volatility may signal worsening expectations of future economic scenarios, leading to a short-run contraction in global real activity. Overall, a combination of these risk factors may be employed as EWS of an incoming recession.

Bagliano and Morana (2015) and Morana (2015) assess the forward looking properties of risk factor shocks in order to predict real activity (and the US\$/€ exchange rate) during the subprime financial crisis, the Great Recession and the sovereign debt crisis. Models that include risk factors denote a much higher forecasting accuracy than pure autoregressive models.³⁵ In particular, the value and momentum factors are relevant predictors in all cases. The improvement in forecasting performance of augmented models stems from the capability of risk factor innovations to accurately signal both the beginning and the end of the economic downturn, a property that standard

³⁴ Macroeconomic shocks contribute to risk-factor fluctuations in the very short-term, financial shocks in the short-term, and oil market disturbances in the medium- to long-term. Different shocks affect different risk factors: productivity and monetary policy shocks impact on size; labor market and term structure shocks affect value; aggregate demand and US terms of trade shocks translate into changes in momentum.

³⁵ Risk-factor augmented macrodynamic models generate forecasting errors 50-90% lower than autoregressive models.

models do not have. Moreover, sizable improvements are obtained also with reference to the predictability of (i) the depth of the Great Recession and (ii) the transition to the new recessionary episode for the euro area and the sovereign debt crisis.

In the upper panel of Figure 4 we plot an indicator of real economic activity for the Euro Area (EA) based on the Conditional Correlation of the Euro/dollar exchange rate with MOM (we will label this indicator CCEM) for the period 2006-2015; in the lower panel we plot the US\$/e exchange rate for the same period.

9. Policy recommendations

While recognizing that monetary policy and prudential regulation are characterized by intertwined transmission mechanisms and reciprocal spillovers, we advocate an operational separation between the two.

The rationale for this separation is essentially the fact that the sign, size and time dimension of the effects of changes in monetary policy (e.g. a change in the policy rate) on financial institutions are too uncertain to justify the assignment of a financial stability objective to monetary policy.

The assessment is more nuanced as to the effects of prudential policies on the output and inflation gaps. Adequate macro-prudential policies can often (but not always) improve the trade-off faced by monetary policy, enlarging its policy space. However, the goal of macro-stabilization cannot be reasonably assigned to prudential policy. In the end, therefore, we would (i) stick to the dual mandate for monetary policy, and (ii) assign a financial stability objective to prudential policies.

Operational separation implies that interest rate setting should be employed to preserve monetary stability, while capital and liquidity requirements should be used to preserve financial stability.

We also advocate the centralization of both monetary and prudential policy to a single institution: the central bank. In this way, the central bank can exploit the obvious synergies between the two spheres mentioned above.

Going deeper into the institutional arrangement of prudential policy, we emphasize the limits of the current situation where macro-prudential supervisory decisions are delegated to the national authorities, with the ESRB and the ECB playing a quite limited (mainly advisory) role.

The institutional design should be streamlined and centralized. As far as the euro area is concerned, it seems reasonable to attribute the responsibility of macro-prudential supervision to the SSM. This is an issue that needs to be further analysed and discussed by policy-makers.

References

- [1] Acharya V. (2009), A theory of systemic risk and design of prudential bank regulation, *Journal of Financial Stability*, 5, 224 –255.
- [2] Adrian, T., Etula, E., Muir, T. (2014), Financial intermediaries and the cross-section of asset returns. *Journal of Finance* 69, 2557-2596.
- [3] Adrian, T., de Fontnouvelle, P., Yang. E. and Zlate, A. (2015), Macroprudential Policy: Case Study from a Tabletop Exercise, W.P. RPA 15-1.
- [4] Aldasoro I., Delli Gatti, D., Faia, E. (2015), Bank Networks: Contagion, Systemic Risk and Prudential Policy, CEPR Discussion Papers No 10540
- [5] Allen, F. and Carletti, E. (2013), What Is Systemic Risk?, *Journal of Money, Credit and Banking*, Supplement to Vol.45, No.1.
- [6] Angelini P. (2015), Le politiche macroprudenziali: una discussione dei principali temi, *Bank of Italy Occasional Papers*, No. 271.
- [7] Antipa, P. and Matheron, J.(2014), Interactions Between Monetary and Macro-prudentials Policies, *Banque de France, Financial Stability Review*, No.18.
- [8] Assenza, T., Berardi, M. and Delli Gatti, D. (2014), Was Bernanke right? Targeting asset prices may not be a good idea after all, *CESIFO WP No 3641*
- [9] Babecký, J. et al.(2012), Banking, debt and currency crises: early warning indicators for developed countries. *IES Working Paper 20/2012*.
- [10] Bagliano, F.C., Morana, C. (2015), It ain't over till it's over: A global perspective on the Great Moderation-Great Recession interconnection. *DEMS Working Paper Series no.303*.
- [11] Baglioni A. (2016), *The European Banking Union. A Critical Assessment*, Palgrave Macmillan, forthcoming.
- [12] Baglioni A. and Cherubini, U. (2013 a), *Marking-to-market government*

guarantees to financial systems: theory and evidence for Europe, *Journal of International Money and Finance*, vol. 32, 990 - 1007.

- [13] Baglioni A. and Cherubini, U. (2013 b), Within and between systemic country risk. Theory and evidence from the sovereign crisis in Europe, *Journal of Economic Dynamics and Control*, vol.37, 1581 - 1597.
- [14] Basel Committee on Banking Supervision (2013), *Global Systemically Important Banks: Updated Assessment Methodology and the Higher Loss Absorbency Requirement.*, Technical Report, Bank for International Settlements.
- [15] Battiston, S., Delli Gatti, D., Gallegati, M., Greenwald, B., J. Stiglitz (2012), *Liaisons Dangereuses: Increasing Connectivity, Risk Sharing and Systemic Risk*, *Journal of Economic Dynamics and Control*, vol. 36, pp. 1121–1141
- [16] Beaudry, P., Portier, F. (2014), News driven business cycles: Insights and Challenges. *Journal of Economic Literature*, 52, 4, 993-1074.
- [17] Behn, M. et al. (2013) *Setting countercyclical capital buffers based on early warning models: would it work?* European Central Bank WP 1604.
- [18] Bernanke, B. and Gertler, M. (2001), *Should Central Banks Respond to Movements in Asset Prices?* *American Economic Review*.
- [19] Blanchard, O. (2000), *Bubbles, Liquidity Traps and Monetary Policy*, in Mikitani, R. and Posen, A. (eds.), *Japan's Financial Crisis and Its Parallels to the US Experience*, Washington, Institute for International Economics, Special Report No 13.
- [20] Borio, C. (2006), *Monetary and Financial stability. Here to Stay?*, *Journal of Banking and Finance*.
- [21] Borio, C. (2009), *Implementing the Macroprudential Approach to Financial Regulation and Supervision*, Banque de France, *Financial Stability Review*, No 13.
- [22] Borio, C. (2014), *Monetary Policy and Financial Stability: What Role in Prevention and Recovery?* BIS W.P. 440.

- [23] Borio, C. and Zhu, H. (2008), Capital Regulation, Risk-taking and Monetary policy: a Missing Link in the Transmission Mechanism? BIS W.P. 268.
- [24] Brockmeijer, J. et al. (2011)"Macro prudential policy: An organizing framework." IMF, March 14.
- [25] Brunnermeier, M., and Sannikov, I. (2014), Monetary Policy: Price and Financial Stability, ECB Forum on Central Banking, May 2014
- [26] Cecchetti, S. (2011), Monetary policy lessons learned from the crisis and the post-crisis landscape, remarks at SEACEN-CEMLA Conference Kuala Lumpur, October 2011.
- [27] Cecchetti, S. (2012), The future of financial intermediation and regulation, Remarks prepared for the Second Conference of the European System of Central Banks Macro-prudential Research Network, Frankfurt, 30 October.
- [28] Cecchetti, S. et al . (2000), Asset Prices and Central Bank Policy, Geneva Reports on the World Economy, No.2. ICMB and CEPR.
- [29] Cecchetti, S., Domanski, D. and Von Goetz, P. (2011), New Regulation and the New World of Global Banking, National Institute Economic Review, April
- [30] Chinazzi, Matteo, et al. (2013), Post-mortem examination of the international financial network, Journal of Economic Dynamics and Control 37.8 : 1692-1713.
- [31] Carhart, M.(1997), On persistence in mutual fund performance, The Journal of Finance 52, 57-82.
- [32] Demirguc-Kunt, A., and Detragiache, E. (1997), The determinants of banking crises: evidence from industrial and developing countries. The World Bank, WP No 1828. .
- [33] Detken, C. et al. (2014) Operationalising the countercyclical capital buffer: indicator selection, threshold identification and calibration op-

tions. European Systemic Risk Board.

- [34] Drehmann, M. et al.(2010), Countercyclical capital buffers: exploring options, BIS WP No 317.
- [35] Drehmann, M., Borio, C. and Tsatsaronis, K. (2011), Anchoring countercyclical capital buffers: the role of credit aggregates, *International Journal of Central Banking* 7.4: 189-240.
- [36] Drehmann, M. and Juselius, M. (2014), Evaluating early warning indicators of banking crises: Satisfying policy requirements, *International Journal of Forecasting* 30.3: 759-780.
- [37] ECB (2015), *Financial Stability, Glossary definition*.
- [38] ESRB (2014), *The ESRB Handbook on Operationalising Macroprudential Policy in the Banking Sector*.
- [39] ESRB (2015), *A review of macro-prudential policy in the EU one year after the introduction of the CRD/CRR*, European Systemic Risk Board, June.
- [40] Fahri, E. and Tirole, J. (2012) *Collective Moral Hazard, Maturity Mismatch, and Systemic Bailouts*, *American Economic Review*, Vol.102, No.1.
- [41] Fama, E.F., French, K.R. (1993). *Common risk factors in the returns on stocks and bonds*. *Journal of Financial Economics* 33, 3-56.
- [42] *Financial Stability Board (2011) Macroprudential policy tools and frameworks. Progress report to the G-20*.
- [43] *Financial Stability Board (2013), Global systemically important banks—updated assessment methodology and the higher loss absorbency requirement, revised version*.
- [44] Frankel, J. A., and Rose, A.K. (1996), *Currency crashes in emerging markets: An empirical treatment*. *Journal of international Economics* 41.3: 351-366.

- [45] Geerats,P. (2010), Price and Financial Stability: Dual or Duelling Mandates, in Oesterreichische Nationalbank , Central Banking after the Crisis, Proceedings of the 38th Economics Conference of the Oesterreichische Nationalbank “Central Banking after the Crisis: Responsibilities, Strategies, Instruments”, pp. 56-63.
- [46] Goodhart, C. and Shoenmaker, D. (1995), Should the Functions of Monetary Policy and Banking Supervision Be Separated, Oxford Economic Papers.
- [47] Goodhart, C., Osorio, C. and Tsomocos, D. (2009); The Optimal Monetary Policy Instrument. Inflation vs. Asset Price Targeting and Financial Stability, mimeo.
- [48] Hall, R. and Reis, R. (2013),The Mystique Surrounding the Central Bank’s Balance Sheet, Applied to the European Crisis.
- [49] Hanson, S., Kashyap, A. and Stein, J (2011), A Macroprudential Approach to Financial regulation, Journal Of Economic Perspectives, Vol.25, No.1.
- [50] Huang X., Zhou,H. and Zhu,H. (2009), A framework for assessing the systemic risk of major financial institutions, Journal of Banking and Finance, 33, 2036 –2049.
- [51] Huang X., Zhou,H. and Zhu,H. (2012), Systemic risk contributions, Journal of Financial Services Research, 42, 55 –83.
- [52] Igan and Kang (2011), Do Loan-to-Value and Debt-to-Income Limits Work? Evidence from Korea, IMF WP/11/297.
- [53] IMF (2013), Rethinking Macro Policy II: Getting Granular, IMF SDN/13/03.
- [54] IMF (2014), Monetary Policy in the New Normal, IMF SDN/14/03.
- [55] IMF (2015), Monetary Policy and Financial Stability, Staff Report.
- [56] Issing, O. (2011), Lessons for Monetary Policy. What Should the Consensus Be?, IMF W.P. No.11/97. Kambhu, J., Schuermann, T., & Stroh,

- K. J. (2007). Hedge funds, financial intermediation, and systemic risk. *Economic Policy Review*, 13(3).
- [57] Kaminsky, G., Lizondo, S. and Reinhart, C.M. (1998), Leading indicators of currency crises, *Staff Papers-International Monetary Fund* : 1-48.
- [58] Kashyap, A. (2015), Should U.S. Monetary Policy Have a Ternary Mandate?. Discussion, Federal Reserve Bank of Boston Conference “Macroprudential Monetary Policy”, October 2015.
- [59] Krishnan, N., Weidman, S. and Kambhu, J. (eds.) (2007) *New Directions for Understanding Systemic Risk:: A Report on a Conference Cosponsored by the Federal Reserve Bank of New York and the National Academy of Sciences*. National Academies Press, 2007.
- [60] Lossani, M. (1998), The European Central Bank and the Objective of Financial Stability: a Review of the Issues, *Economia Internazionale*.
- [61] May, R. M., Levin, S. A. and Sugihara, G. (2008), Complex systems: Ecology for bankers. *Nature* 451.7181: 893-895.
- [62] Merton, R. (1973). An Intertemporal Capital Asset Pricing Model. *Econometrica* 41, 867-887.
- [63] Minoiu, C. et al. (2013) Does financial connectedness predict crises?. *International Monetary Fund*, No. 13-267.
- [64] Minsky, H.P. (1982), *Can It Happen Again? Essays on Instability and Finance*, M.E. Sharpe, NYC
- [65] Morana, C. (2014), Insights on the global macro-finance interface: Structural sources of risk factor fluctuations and the cross-section of expected stock returns. *Journal of Empirical Finance* 29, 64-79.
- [66] Morana, C. (2015), The US\$/e exchange rate: structural modeling and forecasting during the financial crisis. Università di Milano-Bicocca, mimeo.
- [67] Olsen, O. (2015), *Integrating Financial Stability and Monetary Policy*

Analysis, Systemic Risk Centre Public Lecture, SRC- LSE.

- [69] Orphanides, A. (2013), Is Monetary Policy Overburdened?, BIS W.P. No.435.
- [70] Pastor, L., Stambaugh, R.F.(2003), Liquidity risk and expected stock returns. *Journal of Political Economy* 11, 642-685.
- [71] Peek, Rosengreen, Tootell, (2015), Should U.S. Monetary Policy Have a Ternary Mandate?, paper presented at the Federal Reserve Bank of Boston Conference “Macroprudential Monetary Policy”, October 2015.
- [72] Rajan, R. (2006), Monetary Policy and Incentives, address at the Bank of Spain Conference on Central Banks in the 21st Century.
- [73] Reis, R. (2013), Central Bank Design, *Journal of Economic Perspectives*.
- [74] Rose, A. K., and Spiegel, M.M. (2013), Cross-country causes and consequences of the crisis: An update." *European Economic Review* 55.3 (2011): 309-324.
- [75] Rhu, H. (2011), Macroprudential policy framework, BIS Papers chapters 60: 120-123.
- [76] Rovira Kaltwasser, P. and Spelta, A. (2015) Identifying Systemically Important Banks, a temporal complex approach. Mimeo.
- [77] Shin,H.S. (2015), Macroprudential Tools, Their Limits and Their Connection with Monetary Policy, Panel remarks at IMF Spring Meeting event: “Rethinking macro policy III: progress or confusion?” 15 April 2015, Washington, DC.
- [78] Smets, F. (2014), Financial Stability and Monetary Policy: How Closely Interlinked?, *International Journal of Central Banking*.
- [79] Spelta, A.(2015), A unified view of systemic risk: detecting SIFIs and forecasting the financial cycle via EWSs. Mimeo.
- [80] Squartini, T., van Lelyveld,I. and Garlaschelli,D. (2013), Early-warning

signals of topological collapse in interbank networks. Scientific reports 3.

- [81] Stein, J., (2014), Incorporating Financial Stability Considerations into a Monetary Policy Framework, remarks at the International Research Forum on Monetary Policy, Washington, March.
- [82] Svensson, L. (2015), Monetary Policy and Macro-prudential Policy: Different and Separate, paper presented at the Federal Reserve Bank of Boston Conference “Macro-prudential Monetary Policy”, October 2015.
- [83] Tabellini, G. (2008), Why Did Bank Supervision Fail?, in Reinhart, C. and Felton, A, (eds.), The First Global Financial Crisis of the 21st century, VOXEu.org.
- [84] Toniolo, G. and White, E. (2015), The Evolution of the Financial Stability Mandate: From Its Origins to the Present Day, NBER W.P. 20844.
- [85] Ubide, A. (2015), The Interaction between Monetary Policy and Macro-prudential Policies and the Challenges Faced by the ECB Monetary Policy in the Current Governance Framework for Financial Regulation, Brussels, Directorate-General for Internal Policies Economic Governance Support Unit, In-depth analysis.
- [86] Yellen, J. (2014), Monetary Policy and Financial Stability, The 1014 Michel Camdessus Central Banking Lecture, IMF Washington, July.
- [87] Williams, J. (2015), Macro-prudential Policy in a Micro-prudential World, FRBSF Economic Letter, June1.
- [88] Woodford, M. (2012), Inflation Targeting and Financial Stability, NBER W.P. 17967.