

“Macroeconomics and systemic risk: must central bankers go back to their future?”

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Macroeconomics and systemic risk: must central bankers go back to their future?

Abstract

This paper applies to the recent financial crisis and from the viewpoint of the euro area two stylized models with two agents, money, no banks but important financial frictions formerly described in Moutot (2011). As the two models are able to generate high price and premia volatility and respectively illustrate systemic risk through a break-up of the zone and by the impairment of a financial market, the broad lessons they offer help explain the playing out of the crisis globally and in the euro area. As a consequence, it is argued that the consideration of systemic risk is essential to macroeconomics and hence broadens the set of tasks that central bankers must carry out in order to fulfil their price stability mandate.

Keywords: macroeconomic models, systemic risk, financial development, monetary policy, heterogeneous agents, supervision, financial frictions, financial crisis, secular stagnation.

JEL Classification: C5-6, E, G, H7, K2, N1-2-4, O2.

Introduction

Over the past two years, the volatility of markets has gradually subsided and markets have stabilized at levels increasingly close to their level at the beginning of the financial crisis. This happened first around the world and later within Europe. This is, hopefully, marking a return to “normality” after the crisis started with the crashes of the US “sub-primes” in mid-2007, and went on with the fall of Lehman Brothers and many other banks at the end-2008 and early 2009. Thereafter, the measures taken to contain the spread of the crisis led to a rebound in many countries, including the US, emerging countries, and even some parts of Europe. However, at the time when its end appeared close, the crisis flared up again in mid-2010, reached Greece, then Europe, and especially, the eurozone. For some time it threatened the world globally again. In the end, it abated again once the euro area agreed on substantial reforms and a set of measures were taken by the European Central bank.

This crisis does not compare with many other crises however. Some draw parallels to the 1929 crisis. Yet it differs in that it has not led to durable negative growth or durable deflation. Simultaneously, the rebound of growth has been disappointingly slow and modest, especially in Europe but also in other developed countries. Also, the identity of countries under pressure, starting with the US but concentrating on the euro area later, has changed across the crisis.

This raised a number of issues. Some of which had already been identified and were acted upon early in the crisis, as evidenced by the adoption at end 2008 at the Pittsburgh summit of a set of measures to avoid the development of imbalances in the financial sectors and to curtail the likely contagion. In this context, agreeing on measures concerning the overall functioning of finance in the world and the need for a coordination of countries and policies rather than “beggar my neigh-

bour” policies was certainly a success later illustrated by the G20 action. Also, almost all summit participants agreed that the euro area needed an adequate mix of economic, financial, monetary, and structural policies and therefore, an appropriate combination of institutions.

However, the later discussion on the policy mix also led many to the feeling that monetary policy was too tight while fiscal policy was weakened by an increasing fiscal multiplier. For some, the hottest issue was structural and with regard to the euro area, reflected a low level of competitiveness as well as the inability of its financial sector to finance the investment necessary to sustain a recovery and its governance. For others, it was the systemic risk created by a limited development of federal institutions and the weak implementation of the growth and stability pact that made the policy mix insufficient.

This led to many questions on the nature and impact of systemic risk and on its link to macroeconomics and to the institutional challenges faced by policy-making actors in such context. Did central banks and other financial institutions react adequately to the crisis? Were their tools sufficient? Concerning the euro area, are the role, responsibilities and instruments of the European Central Bank (ECB) well defined by the Maastricht Treaty and are its strategies appropriate? Would the ECB be within its remit when intervening through Outright Monetary Transactions (OMTs)? Is there a risk of what some describe as “secular stagnation” wherein the economy simply does not grow for a prolonged period? Such discussion is ongoing and particularly addresses the role of central bankers at various levels: in terms of policy target, of standard and non-standard measures and of market interventions.

Obviously, answering each of these questions in detail, although desirable, would be too time- and space-consuming. Also, models that describe systemic risks in realistic and applied manner are not available yet or

concentrate on banks and neglect other sectors. Thus, I will be taking these limitations into account in this article and proceed in the following ways:

First, using two much stylised models of systemic risk arising from the use of money in the absence of banks, I discuss how such risks may be and have been managed across history and when the need for such risk management arises in a federal context. Second, I shall concentrate on the broad inferences suggested by such models to explain as manifestations of systemic risk specific developments observed globally and in the euro area. The aim is to better identify the role of systemic risk in shaping the main economic and financial developments globally and in this zone. Hence, this article is a complement and an illustration of a more theoretical and still ongoing research project of which first results were made available in the ECB working papers series¹. By so doing, it also allows some comparison with a few other articles or recent books dealing with the creation and assessment of the euro and the euro area and with the secular stagnation issue. In other words, I believe new insights can already be drawn from the latest evidence created by the financial crisis.

Furthermore, lessons for central bankers can be drawn from such insights. They lead to the conclusion that macroeconomics cannot be separated from systemic risk and hence to a wider conception of a central bank's role than one of simply inflation targeting. It is all these elements combined – stylized models, histori-

cal references and impacts of regulation on financial development and systemic risk – that led me to the title of this article: macroeconomics cannot be separated from systemic risk and consequently, *central bankers have to go back to their future*. In other words, created to help States better influence and understand the functioning of monetary economies, central banks need to keep this sometimes forgotten role and continuously adjust their theoretical and applied knowledge of monetary economies so as to play at best the macroeconomic role they have lately acquired, i.e. the maintenance of price stability, as well as their more traditional roles in promoting financial stability and financial development.

I will first describe my view of systemic risk and explain the most basic features of the suite of stylized models that I refer to in this article. I will also examine in this context which elements are essential to the good functioning of a monetary union (Section 1). I will then consider why this crisis happened and lasted at the global level (Section 2). Then I will raise the same question at euro area level and show why interpretations which do not take into account systemic risk cannot be satisfactory. On the contrary, identifying the various factors which potentially or historically combined together and played a role, allows illustrating the particular playing out of the crisis in the euro area (Section 3). Lastly, I will conclude with a more detailed explanation of what I mean by *central bankers have to go back to their future*². The final section includes the acknowledgement.

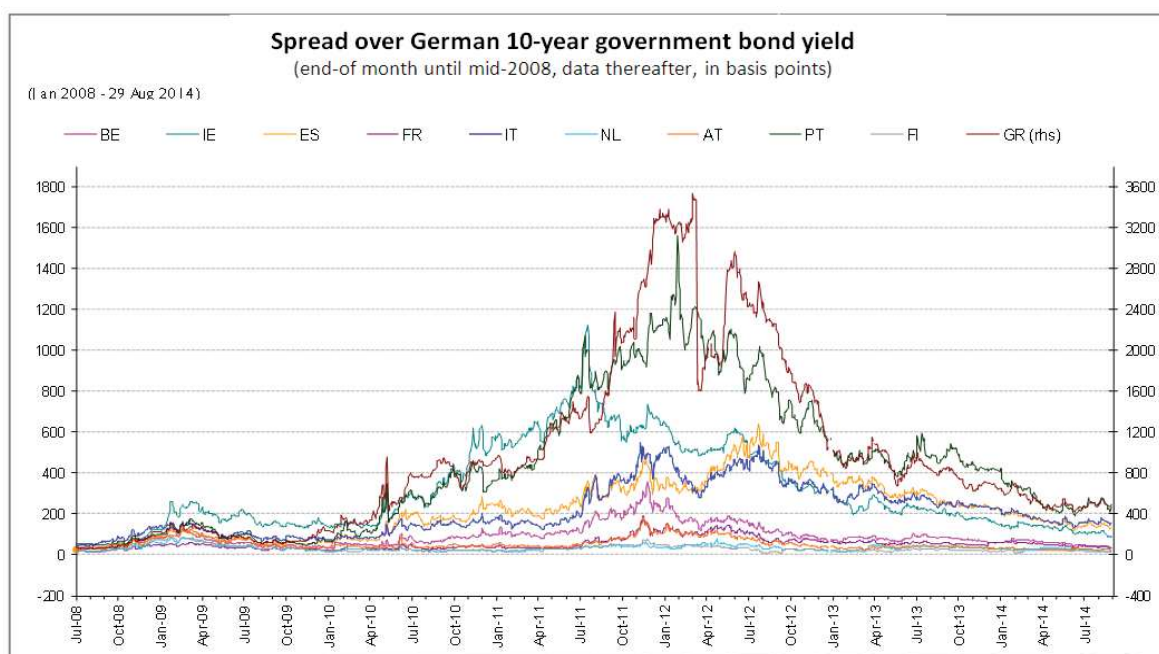


Fig 1. Sovereign bond yields in the euro area

Source: Bloomberg, Thomson, Reuters Datastream and ECB calculations.

¹ Moutot (2011). "Systemic risk and financial development in a monetary model", ECB Working Paper Series No. 1352.

² Of course, the views presented are mine and they do not represent the view of the ECB, although I use them to support the positions it has taken. I am also responsible for any mistake. I am grateful to the ECB for the support given to my research project on the modelling of money.

1. Systemic risk and stylized models of systemic risk: are they relevant to monetary union?

1.1. What is systemic risk? Making sense of events over the past few years and assessing the relevance and effectiveness of the response made by authorities to the related risks, is much easier when taking into account not only the risks that materialized and affected the banks and their sovereigns, but also those that are or were present in adjacent segments of the economy but were not or not fully realized. The latter include in particular, the risk that some countries may exit the Eurozone and the risk that financial markets close or see their activity decrease. The rationale for it is that these segments often play a major role in propagating or in helping contain the financial risks at the source of a systemic crisis. Thus, it is important to complement what comes from the banking sector with a necessarily theoretical and stylized knowledge of systemic risk.

This is also in line with a more general definition of systemic risk than usually encountered in the most recent papers on the financial crisis. According to such definition, systemic risk is the risk that an economy in apparent equilibrium suddenly reaches a less efficient equilibrium as a result of an endogenous phenomenon responding possibly with delay to an exogenous one. This definition is both similar to a large set of definitions put forward by academics and central bankers (see Aglietta and Moutot, 1993; or CGFS, 2010 and many intermediary sources).

This definition does neither include nor exclude or even grant any special role to banks as the specific source of systemic risk. This is not to deny such role. Rather, banks and credit are one source and, in this crisis, was precisely the main source of systemic risk. Studied in detail by academics, from Diamond and Dybvig (1983) to Tirole and Rochet (1996), this type of risk which results from moral hazard, contagion, imperfect information and “too big to fail” considerations is now well understood and monitored by authorities such as the ESRB. It is what I call the systemic risk originating from “inside money”. But, much less considered and perhaps just as fundamental are the systemic risks coming from markets themselves, be they financial or goods and service markets, and from the fiscal and financial governance. Independently or in addition to the “inside money” systemic risk, the functioning of markets and the type of payment habits and constraints which are associated to them and shape the efficiency of market-making, do play a major role. This is what I call the “outside money” systemic risks, given that the existence of and the role of money itself in payments are essential to their influence.

1.2. Stylized models to illustrate the systemic risk originating from “outside money”. I will use the

simplest model that I could develop¹ to deal with such issues. As a financial crisis can only come when some lose a lot more than others, it has two, rather than one, type of agents and these are trading only one good or service with money as their single asset to transact and to save. Moreover, as financial crises are inevitably connected to financial frictions and hence, to binding financial constraints, the use of money is constrained in the following manners: In a first variant, the constraint is a cash-in advance constraint; in a second variant, the constraint is applied in net terms and only at the end of period, thereby taking into account the sales of endowments. Finally, agents are allowed to compare and choose autarky rather than participation in this economy. Also, they may create new financial markets if they jointly agree about it and move to a so-called Arrow-Debreu economy.

Hence, the model illustrates some of the inter-relations between money, systemic risk and financial development as well as the need for regulation which accompanies the use of money in variant 1. As it also allows a shift to autarky, it also illustrates the functioning of a very basic monetary union between two countries. Finally, its second variant can also be interpreted as a reflection of a securities market with two market makers endowed with capital but forbidden to borrow or to invest cash in other securities. It can therefore illustrate the issues arising in illiquid securities markets. This allows us to consider some of the many governance elements that have to be present for a monetary union to be successful and sustainable. Finally, as it allows financial development, it also offers lessons on the way to best foster financial development.

Overall, the two variants may bring relevant information to the extent that they reproduce features of financial asset markets like their volatility, they are in line with historical developments and suggest relevant elements of response to systemic risk.

Indeed, suppose 10 units of good or service are received from the sky each period and that each agent receives either 3 or 7 units of good, the uncertainty bearing only on the partition of these 10 units among the two types of agents, a “3-7” partition being as likely as a “7-3” one. In variant 1, agents sell all their endowments before consuming and can only consume as much as the amount of cash they keep from the preceding period. In variant 2, they can consume even if they keep little or no cash from the preceding period given that the constraint is only to keep a non-negative amount of cash after selling their endowment and purchasing their consumption. Hence, if they wish, they can always consume their endowment. Moreover,

¹ Please see Moutot (2011): “Systemic risk and financial development in a monetary model”, ECB Working Paper Series No. 1352.

it is assumed that full transparency exists concerning information on prices and quantities, that agents buy at a competitive market price and that the legal system is

able and has the power to ensure the existence of sustainable equilibria. It is also assumed that utility functions are logarithmic.

No macro
uncertainly
But prices vary
strong
and
Prices are
higher in
Variant 2 than
in Variant 1

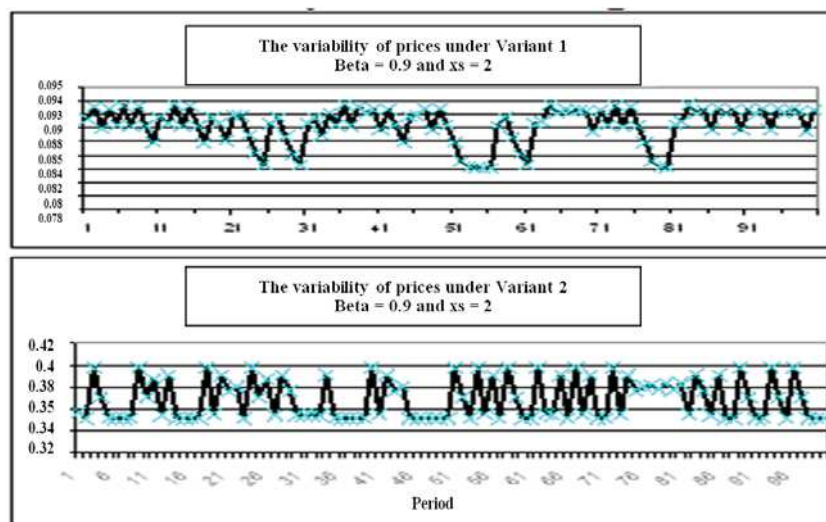


Fig. 2. Price variability in two models with cash constraints

In such case, the two variants have in common that they create substantial variability of prices, even though the total endowment of agents is constant (Figure 2). Hence, rational expectations models are able to reflect much more market volatility than usually expected. In fact, this shows that the various results of rational expectations models insufficiencies accumulated by many authors in the 1980's and 1990's (Meese and Rogoff, or Schiller for example) owe more to the absence of multiple agents and of financial constraints than to rational expectations. Moreover, this shows that it is not impossible for neo-classical models to generate the variability hoped for by Farmer and Geanakoplos (2008). It also helps answer the following question.

1.3. Are currency unions always associated with a systemic risk? Let us concentrate first on variant 1, the cash-in-advance world. What Figure 3 shows

is how the distribution of money across agents evolves through time in variant 1. Whenever the prior ownership of cash conditions purchases, the prices and the distribution across agents of money or wealth rebound at each period within a box with some accumulation at its two extremes, Mmin and Mmax.

Figure 4 shows however the comparison that each agent can make between its current level of welfare and his/her welfare in autarky. It is easy to identify systemic risk: at Mmin as well as at Mmax, one of the agents finds its welfare lower than in autarky. Hence, if the fine or punishment resulting from non-participation that should have normally made welfare in autarky lower is badly calculated or not implemented, this agent will stop participating into the market. This would be an episode of systemic risk through market break-up.

How does money partition evolve
in Variant 1?
Inside a box and within a
segment [Mmin, Mmax]

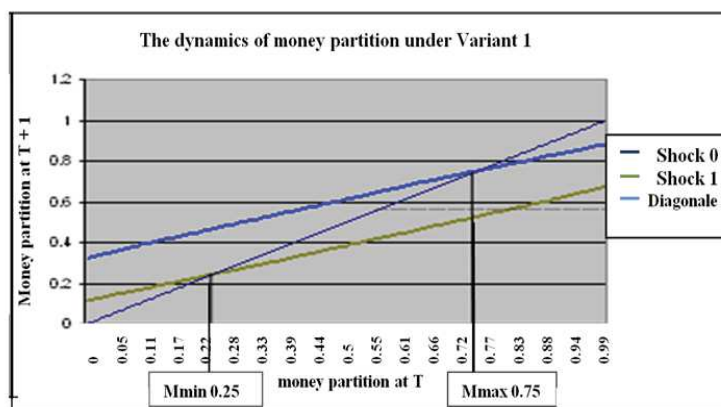


Fig. 3. Money/wealth partition across time

Notably, for a monetary union to be sustainable there must be, at a minimum, a fine to discourage

the members of a monetary union who do not follow its basic rule (s) and endanger its sustainability.

ty. The need for a fine in such a simple setting shows that without a central and sovereign authority able to impose some supplementary cost to the

offending agent, the monetary union is unsustainable: the unique market of this economy can only break up.

Variant 1 is Pareto –superior to autarky on $[0.28 \ 0.72]$

Whenever Money/wealth in $[0.25, 0.28]$ or $[0.72, 0.75]$ a fine is necessary to prevent a move toward autarky.

→
A CIA model implies substantial enforcement

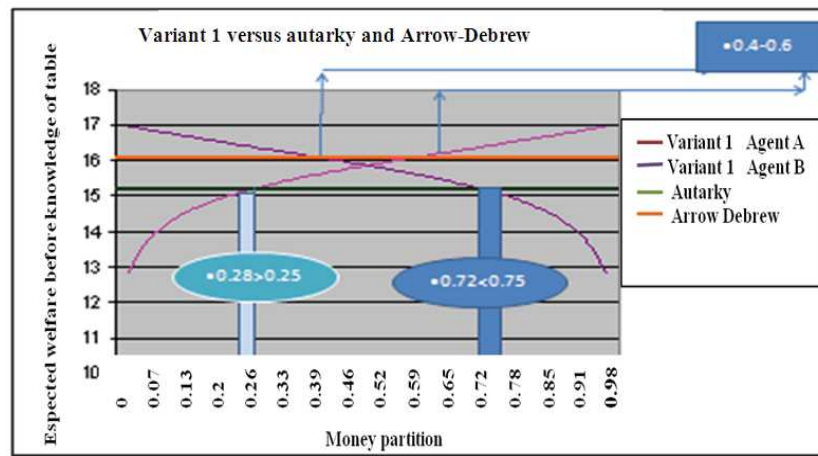


Fig. 4. Money/wealth partition and the choice between financial development or regression

Did History know about this? Yes. Croesus as well as the Romans were aware of it, at least for the case of one sovereign per monetary zone: as fiscal policy was in both cases already unique, both simply refused the payment of taxes with goods and demanded their payment in their currency (see V. Lannoye, 2011).

Is it still relevant today? Yes, at least in the case of the euro area. The implementation of such a fine is precisely what the 2005 change of rules in the Growth and Stability Pact demanded jointly by France and Germany made impossible. This non-implementation was therefore a serious argument behind the idea that, at some point, the euro may break up, as argued by some economists in 2010-11. The need for some central decision-making is what the 2012 agreements on the two-pack and the fiscal compact has strived to establish in response. The EU Commission can now propose such a fine to the Council and the Council can oppose it only by an extended majority. This is one reason why the “break-up” argument is not as pertinent as it was between 2005 and 2012.

The need for a fine also implies that it may be necessary to change the fine if the process determining the endowments of agents unexpectedly changes. Suppose for instance that the productivity of one of the countries and their endowment increase: M_{min} and M_{max} are modified, as the wealthier agent may find autarky attractive. Consequently, the fine will need to be adjusted in due time. This certainly needs to be supported by a streamlined legal process in order to avoid a prolonged debate on the size of an appropriate fine. The changes undertaken since 2008 by the European Union in order to strengthen fiscal policies are therefore fully relevant and justified.

But Variant 2 shows that markets do not always break-up, at least as a consequence of a desire to shift to autarky. In such context, it is easy to show that autarky is Pareto inferior in all situations. So agents never go back to autarky.

Two other elements, however, are worth noting. First the solution of Variant 2 may disappear if the discount rate of utility decreases, i.e the degree of impatience increases. The market is still functioning in terms of ability to determine prices. However, the turnover of such markets decreases very much and prices increase even though transactions decrease (see a graph of the ranges where solutions exist in Moutot, 2011).

Second, with minimal adjustment, the model can be used to simulate the pricing of sovereign bonds when their markets come under stress. Indeed, sovereign markets often give roles of market-makers or of issuers to a few banks or within these banks to a few specialized staff (see Etan Cole-Cohen and others, 2013). These staffs are, in part, paid through bonuses and cannot be replaced in the short term. Like the agents of Variant 2, they face clear constraints on the amount of capital they can use, i.e. on their net position at the end of the day. Within the day, however, they can make any amount of transactions to the extent that their net result remains within constraints. Also, like the agents of my simple model, they are faced by an uncertainty in the very short term, on the share of the issuance or of the market making deals that will be obtained.

Normally, the way such staffs are remunerated does not have much importance. However, when global uncertainty increases, when the lengths of net positions taken by such staff are strictly limited, and their own position becomes precarious, the bonuses such staff demand in the short term to make the market or

to support the issuance of new debt may increase strongly. As their own horizon decreases, the marginal cost of increasing the debt of a sovereign under stress may then get very large, in line with a strong increase in the premia paid to these staff. Although the market itself does not break up, its price determination breaks up and the premia applied make a clear dependence on fundamentals difficult to observe. Even more clearly than in Variant 1, Variant 2 shows that systemic risk from “outside money” can accompany systemic risk from “inside money”.

2. Why did this crisis happen and why has it lasted so long, globally?

My simple answer to this complicated question is this: systemic risk and macroeconomic disequilibria have reinforced each other more than anticipated by markets, policy makers, supervisors and academics.

2.1. An excessive reliance on the power of the “invisible hand” and on the impact of technological progress on productivity. Before the crisis, an acceleration of financial development with instruments such as asset-backed securities, CDOs, and high-frequency trading led to their widespread use. These innovations, if misused, had the potential to create havoc. But, the general wisdom was that the new hedging and insurance abilities provided by these financial products were the output of an “invisible hand” and, hence, would support the stability and

soundness of the financial sector in the US as well as in the euro area. Expanding financial markets could only make the economy closer to the perfect economies described by Arrow and Debreu. Moreover, it was true that volatility abated markedly at the beginning of the millennium, thereby supporting the use of these new financial products.

However, several elements prevented a good outcome and led macroeconomics and systemic risk to reinforce the likelihood of a bad outcome in the shorter term. The belief that markets were always right and if well monitored, would allow the economy to find its equilibrium with minimal policy efforts, as advocated by President Greenspan, had two practical consequences.

First, supporting demand with low interest rates, to the extent that it would push up real estate prices and the apparent financial wealth of agents, became popular. Both the IMF and the OECD encouraged central banks, including the ECB, to imitate the US and to delay any increase of interest rates in 2004-2005.

This was accompanied by the belief that technological progress had accelerated in a very lasting manner. On that ground also, it became particularly difficult to convince markets that interest rate increases were needed. This certainly participated in the development of bubbles, at global and regional levels. Hence, macroeconomic and systemic risks reinforced each other beyond the US.

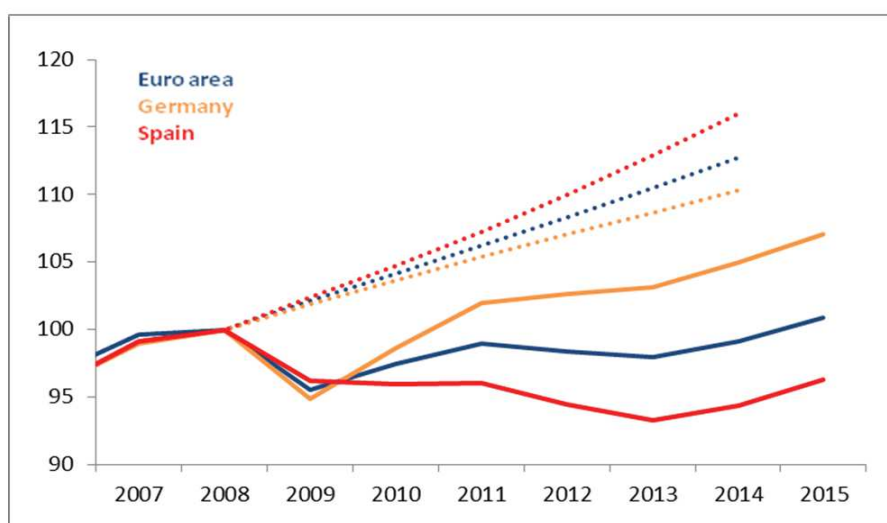


Fig. 5. Growth: impact of the crisis on real GDP – expected growth in 2007 and realization

Source: European Commission, Consensus, and calculations by ECB staff.

While the acceleration of growth at the end of the 90's and its resilience thereafter was seen as the delayed consequence of the internet age, it was also viewed as a long-term phenomenon still affecting a limited number of sectors but due to generalise. As shown by Figure 5, in hindsight, these views were not supported by reality, at least not in the euro area case. Even the

situation in the US, although more favorable than in the euro area, does not guarantee the stability of productivity growth. If, as argued by Brender and Pisani (2004), one third of this productivity increase came from the IT sector itself, another third from the retail sector as a consequence of IT use, and the last third from the banking sector, at least the last third of it

should have disappeared or decreased. Hence, a major element of response to the crisis is the ability to increase productivity.

Second, the functioning of markets and more generally of the financial sector as well as its representation and modelling went long unquestioned. We, economists and forecasters, happy with the sophistication and success of our new DSGE models, gave great weight to the view that general equilibrium and almost-complete markets would allow the economy to systematically return to trend in the medium term. Such return to “normalcy” could be optimised by moving interest rates up or down without considering, in detail, the financial frictions affecting the economy.

Consequently, insufficient attention was given to the detailed paths of transmission taken by systemic risk. This had both long-term and short term effects, the latter one reinforcing the former. For instance, an important and almost accidental factor in the crisis was the run on money market mutual funds in the US after Lehman failed and the fact that MMMFs had large deposits with foreign bank branches in New York, on which they heavily drew (see Allen and Moessner, 2010).

These frictions were not completely ignored. Some, such as then Professor Bernanke, had written seminal papers on them. This awareness and the ability to take action that it implies were certainly helpful. But it is only recently that financial frictions took a more serious role in central bank models and forecasts. In the ECB, the monetary analysis conducted with a view towards monitoring such frictions was first used from 2003 on, and was made more systematic after the review of monetary analysis, which started in 2007 and was completed in 2009, (see Moutot, Drudi and Musso, 2010). This allowed a regular use of the Christiano, Motto and Rostagno (2007) model for supplementary scenarios illustrating the likely impact of specific financial developments. Nevertheless, the ECB approach was strongly criticized by prominent academics in 2006 and only recently, the tides have changed and some economists have taken notice.

2.2. The lack of adequate multi-agent models. Finally, even in academia, the desire to face the technical issues resulting from the multiplicity of agents and their financial constraints was low. This applied particularly to the rarely considered role of non-banks, with the notable but recent exceptions, of Professor Shin’s (2009) and of Professors Brunnermeier and Salikovy (2011) articles. Furthermore, at a time when technological progress is largely based on IT and on the use of IT to spread knowledge across people, firms and countries, the impact of such sharing of knowledge is more naturally achieved by small and often relatively young firms able to gather at a fast pace equity funding. This also implies the consideration of

several types of agents, some making the right investment and some not. Of course, the ability of small and young firms to obtain finance also matters as well as the incentives and regulation of corresponding financial markets. Finally, this lack of interest also includes the specific dynamics that market makers in OTC markets and arbitrageurs in organized markets have to face when volatility becomes high. In particular, the changes in the efficiency of market-making in a context of high volatility were rarely analyzed and, consequently, the need for action from authorities was rarely discussed.

As a result, a deep analysis of non-conventional monetary policy measures or of regulatory constraints and their impact on the distribution of wealth was unavailable. Somehow, choosing to use models with one representative agent to face one policy-maker was a logical choice in a situation where the main challenge was supposed to be, like it was in the 70’s and 80’s, the mastering of inflation. Unfortunately, this was not the most logical choice when facing issues of wealth distribution and of possible default as encountered in a financial crisis. By contrast, overlapping generations models are better adjusted to the theoretical analysis of regulatory measures. However, as explained by Goodhart (2014) they cannot lead to estimate over short periods of regulatory measures and impact.

Let us recognise however, that the techniques to deal with multiple agents models in an environment that includes systemic risk have not been sufficiently developed and are mathematically challenging. Indeed, the techniques developed in the 90’s (see Sargent and Lyung, 2004), when systemic risk was not viewed as substantial, were often shortcuts. Such shortcuts included the use of value functions with one price regime and the guess of starting points for the distribution of wealth. They were useful for many environments but difficult to reconcile with financial crises. Particularly, they missed the mark in addressing the issues raised in financial markets as well as in the political debate when dealing with non-standard measures, actual or potential defaults as well as “stress-tests” and the impact across time of macroprudential measures and of their announcement.

Such techniques may be appropriate for modelling normal slowdown and recoveries. One may in such case argue that the distribution of wealth across agents remains stable, if not constant. However, the notion of a unique steady state is inconsistent with the notion of systemic risk and with fat tails. Price regimes have to depend on whether constraints are binding or non-binding to ensure that systemic risk is endogenous. Moreover, imposing the Bellman equation and linearizing it is inconsistent with the view that not all cash or credit constraints are continuously binding. It is inconsistent also with reproducing the variability of prices observed in many financial markets. If the no-

tion of systemic risk has some sense, the focus has to be on identifying when some paths become unsustainable, and not on a finite set of starting points that make the distribution of wealth sustainable.

2.3. Financial development, financial stability, and growth. This lack of questioning on the functioning of financial markets and on their models also had some echo in the field of supervision and macro-prudential issues and on growth expectations beyond what the excessive belief in the ability of markets to be right directly implies.

In the context of Basle II, banks were authorised and encouraged to develop their own internal models and thereby gained some ability to affect the measurement of their internal ratios. Pressures to modify the functioning of some markets in favor of specific traders, for instance to modify the order of transactions in favor of funds proposing higher transaction fees, were tolerated, if not accommodated. The notion of competitive markets became fairly fuzzy and inconsistent with the idea (I) of equal opportunity.

No wonder under such conditions that attempts to rig the prices of commodities or to affect the measurement of interest rates also happened and that ABS and OTC transactions on CDOs, combined to complacent ratings from ratings agencies, led several US banks toward bankruptcy, igniting the financial crisis. It is not surprising, therefore, that states like Greece used swap techniques to beautify their debt ratios.

While the new operations were often vaunted as allowing clever protection thanks to their highly mathematical constructs and sometimes high frequency execution, it was increasingly admitted and/or ac-

cepted by some managers and supervisors that their control was difficult and that traders could take by themselves and under their own responsibility very large positions. Clearly, the relationships between capital owners and specialised staff and between such staff and supervisors begged for examination. This became fully clear at the Pittsburgh summit of 2008, which launched a series of reforms at the international level.

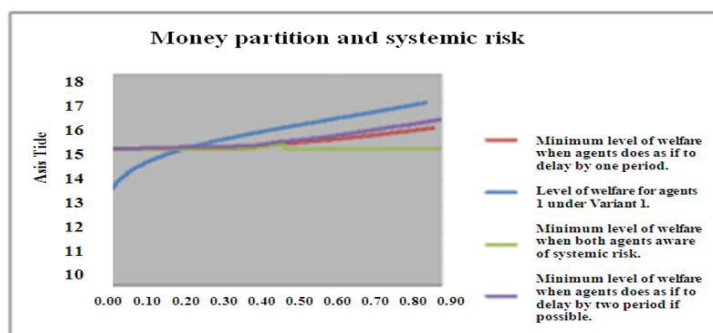
As more decisions based on the belief that “markets are always right” were gradually diminishing the credibility of supervisors and regulators, it also created the conditions for the materialisation of systemic risk. However, the timing could not be predicted. Also, to the extent that authorities were uncertain on the practical measures to be taken for the transformation of an OTC market into a centralized one, the likelihood of any full consensus with market participants was very low. Why?

It may, even in a rational expectations environment (see Figure 6), happen that rumours on the implementation of fines or on their actual amounts develop. Depending on the identity of the agent who learns and believes such rumours, manifestations of systemic risk may happen earlier or later depending on how and when agents share information on the rumour. Agents may act “as if”, should it be advantageous to them. This happened during the last financial crisis. Chuck Prince explained it, saying that one needs to “dance as long as the music is playing”. Goldman Sachs probably did something similar if, as accused by some, they actually took advantage of the uncertainty of their own customers in July 2007 to liquidate some of their losing positions.

Suppose authorities do not intend to implement the tax for break-aways

Systemic risk may occur if authorities do not implement and adjust their policies.

The timing of this break is uncertain given that “doing as if” will be preferable for those with sufficient wealth: “dancing as long as the music is playing”



This is consistent with a conception of systemic risk where the surprise created by the systemic event is limited if the “fragilities” which amplify its impact are monitored and channels of transmission are well understood (Bernanke, 2013)

Fig. 6. Money/wealth partition and the timing of systemic occurrence

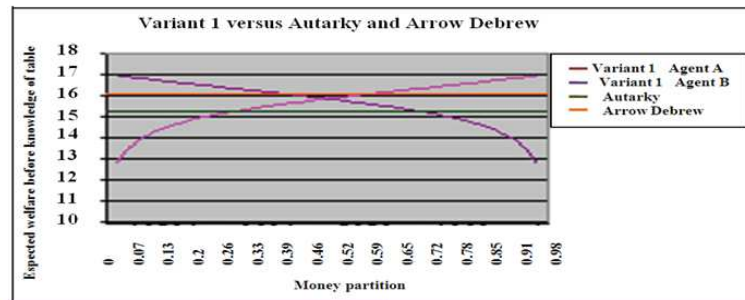
Indeed, policy makers often find that fostering financial development is not as easy as expected. An interesting example of such difficulties is when attempts are made to go from Variant 1 to the Arrow-Debreu model. Although always desirable in principle, this happens only when the partition of money is with-

in a range: this range is $[0.4, 0.6]$ in the example illustrated by Figure 4. However, this partition varies a lot across time. Hence, waiting for a durable consensus to make the change from one regime to the other is hazardous. While it is easy to add financial markets if their creation can be agreed

over one period, it is almost impossible to reach it if a succession of 6 periods within the range [0.4, 0.6] is necessary (see Figure 7). On that basis, one should not be surprised that transforming OTC

operations into cleared operations, through discussions and agreement with professionals, as agreed in Pittsburgh, has been more challenging than expected.

Variant 1 is Pareto interior to Arrow-Debreu only on [0.4, 0.6]
Financial development needs time and support
How likely is it that “the invisible hand” will foster financial development?



How likely is it that money partition stays N periods in a row between 0.4 and 0.6

N = 1	N = 2	N = 3	N = 4	N = 5	N = 6
39.70%	8.30%	3.60%	1.70%	0.90%	0.40%

Fig. 7. Price dynamics and the practicality of financial development

3. Why did this crisis rebound and last so long in the euro area?

My broad answer to this question is that the weaknesses originating in the US markets revealed and resonated with a number of governance weaknesses specific to the euro area. As their solution was dependant both on their particular nature and on financial and electoral cycles, this leads to an amplification of otherwise more innocuous shocks.

3.1. From a US-originating to a US and Eurozone originating crisis. Indeed, what had started as a US story rapidly transformed into a global one in which the euro area, after a couple of years, played a leading role. It took from February 2007 to August 2007 for markets to understand that a US real estate crisis had a global impact on the financial sector. It then took another year (Fall, 2008) to realize that the banking crisis had an impact on growth all over the world and particularly on the euro area. This led to a drop in

confidence and to the appearance of spreads within the euro area where there had been none since the start of monetary union. But the two next drops in confidence (Mid-2010 and Mid-2011) were actually caused by euro area developments and in particular by Greek ones.

This transmission indeed had several specific features. At its start, it was not a monetary crisis but rather a fiscal and a financial one, which became the source of significant turmoil in the euro area and beyond. Only after the situation of Greece worsened seriously, were we provided with an illustration of the particular dynamics of such turmoil in the Eurozone and its links to European Governance or lack thereof. This allowed an identification of the reforms to be undertaken in order to adjust the factors that were specific to the euro area. Finally such adjustment had to be followed by measures reactivating the national sovereign bond markets of countries under pressure.



Source: markit, Eurostat and ECB calculations.

Fig. 8. Drop in confidence (Global PMI output, monthly, data, dissuasion index, seasonality adjusted)

Indeed, the reaction of the ECB in August 2007 to the increasing illiquidity of markets had positively surprised markets. Liquidity was extended very fast to the whole banking sector. Simultaneously, due to the ECB credibility and to the resilience of prices in the euro area, inflation expectations remained stable. On such basis the provision of credit by banks was for quite some time largely unaffected. Moreover, from October 2008 on, the stance of monetary policy in the euro area was made strongly supportive by the rapid fall in official interest rates.

Moreover, a variety of non-conventional measures were used. The measures undertaken by the various central banks have covered almost the full set of assets and liabilities of central banks. The ECB inaugurated FRFA (fixed rate full allotment) and lending up to a three year term. This allowed banks to trade with the ECB rather than in the market and ensured liquidity. The ECB also bought covered bonds issued by banks. It intervened in the sovereign bond market with its SMP program. This was however limited by the prohibition of monetary financing which imposed to link the purchase of sovereign bonds on the secondary markets to the quality of fiscal policy and in particular

to the existence of a substantial program supported by both the IMF and the Commission. Finally, the list of acceptable collateral was enlarged. In the US, measures on liquidity were complemented by the purchase of private assets and public bonds, leading to three programs of quantitative easing.

The impact of such measures on markets and spreads was initially substantial. One could have thought, by the spring of 2010 that the crisis was close to ending as spreads were decreasing again. It seemed that both the fiscal and monetary policy reactions had weathered the storm. Such thinking was misguided as it failed to take into account other important euro area factors as set forth below.

3.2. The specific factors of the Eurozone crisis.

Fiscal factors manifested themselves first in terms of ability to take losses emanating from the need to recapitalise banks and finance them. A natural link between the size of national banking sectors and the size and fiscal positions of countries had always existed. Even though financial markets, in principle, benefit from free financial flows and competition among financial centres, the soundness of financial centres depends a lot on the size and fiscal position of the country in charge of the financial centre.

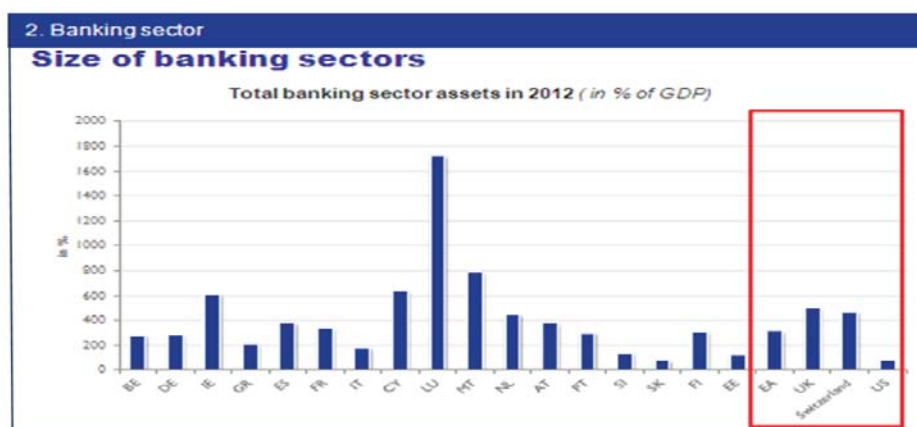


Fig. 9. Size of banking sectors

Source: ECB and BIS consolidated data. Calculations in respective national currencies. Latest observation 2012.

This relation, although obvious, had not received so much attention in the past. On this occasion, it was severely tested but, at least at the start, did not concern the euro area especially. Stark policy choices were therefore made by several countries, with Iceland and Ireland leading the list later followed by the UK and Switzerland. But, for some time it remained more a global issue for second - size financial centres rather than for the euro area. The size of the banking sector at euro area level remained smaller, in terms of GDP, than those of the UK and Switzerland.

Nevertheless, it started affecting the euro area in a specific way once the Greek example had made clear to markets that the euro area resilience could be

equated with the resilience of its weakest countries. Undoubtedly, the fiscal degradation in the EU as a whole was substantial but not worse than in several major developed economies, as shown by Figure 10. It was, however, evaluated in a much more negative manner due to the risk of contagion across countries, banks and credit sectors that was the consequence of the desired integration of financial markets. This is why the fear of a systemic event increased when tensions reached Portugal and later Spain and Italy, then Cyprus.

In such context, the term “disintegration of financial markets” was probably a misnomer. What we observed is rather the consequence of an insufficient integration of supervision and financial stability au-

thorities in an otherwise integrated market. This is the reason why one also observed divergences across

bank access to financial markets within the same country.

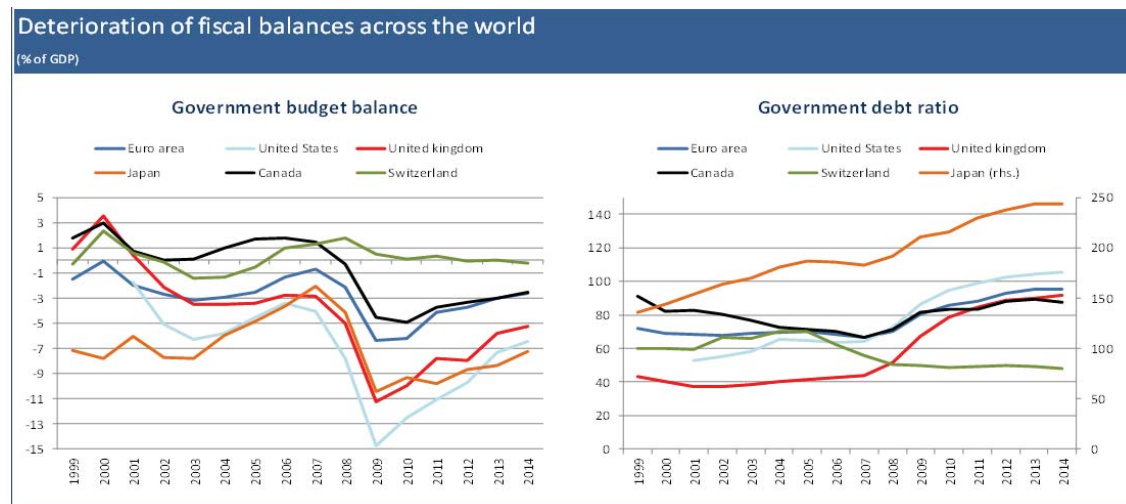


Fig. 10. Deterioration of fiscal balances across the world (% of GDP)

What was hence, specific to the euro area, was its multi-national nature and therefore, the potential for contagion across banking sectors and Treasuries. This was due on one hand, to the absence of an effective banking union, and on the other hand, to the low degree of enforcement of European fiscal agreements included in the Maastricht Treaty and the Growth and Stability Pact. In particular, these fiscal agreements implied originally, that fiscal dominance in the euro area could be avoided as monetary financing of public entities was forbidden. Moreover, the increase of a deficit beyond 3% was supposed to be corrected with the shortest delay possible. However, instead of applying the fiscal agreements, it was decided under the joint pressures of France and Germany in 2004, to renegotiate and loosen the Growth and Stability Pact, as explained in Section 2. Hence, since 2005, the Maastricht Treaty, whose negotiators were fully aware of the need for low deficits and limits on debt, has only been partially implemented.

In such context, the Greek case was the factor which most clearly transformed the global financial crisis into a euro area one. It worked like the “rumour” I described under Figure 6. Undoubtedly the Greek case forced markets to consider what would happen if Greece would not pay back its sovereign bonds. What impact might this have on other banks and budget positions in euro area countries? Would this gradually create tensions for Greek banks and companies and devalue their status? It also made clear the low desire of countries to undertake reforms, the mechanical links between the fiscal deterioration and the stability of banks, as well as the lack of enforcement powers of the Commission and the Council. This gradually transformed the view of markets and economic agents, amplifying the risks and supporting the view that the Euro blueprint had some faults.

Markets also noted the lack of competitiveness of many countries under pressure. What was unimportant in an environment of financial stability became an important issue in a situation where the lack of enforcement made the ability of countries to adjust in the short term less credible, and where the slowdown of productivity also made doubtful the ability of countries to accept durable constraints. Thus, the emphasis on the process of coordination in the euro area and the need to enforce a higher degree of convergence: the very low level of TFP growth created the possibility that the adjustment would be slow and difficult.

This situation had two consequences. The criticism in the media and in markets encouraged large flows out of peripheral countries and into German banks clearly recorded by Target balances. Second, the institutions created to support the functioning of the Eurozone were increasingly seen as insufficient or flawed and this implied that the ability of the euro area to evolve and defend itself was particularly weak.

The media and market reaction, in this case was exaggerated. The idea of a deep flaw and particularly the accusation of unawareness were unfair. The lack of a banking union was not a discovery for those who had negotiated the Maastricht Treaty. The possibility to create a banking union, to centralise the lender of last resort function had been discussed. But it had been clearly impossible to reach any consensus on such issue. Nevertheless, the possibility to give a larger role to the ECB had been left open, as it was clear that a change of view would certainly have to occur in case a crisis would result. (see Aglietta and Moutot, 1993). Also, the view that progress in the EU has almost always been a last minute response to serious tensions was widely shared among professionals close to such

discussions. High-level national representatives are unlikely to take responsibility for a major EU setback. Federalism is only invoked as a solution at EU level in periods of deep uncertainty. But in such situations, there is no alternative.

3.3. The reaction of authorities to the crisis. A last-minute response to serious tensions was exactly what happened. Faced with a challenge deemed as extremely serious, the European Council reacted. Over a short period of time, and in response to proposals and views put forward by the

Commission and the ECB, a number of agreements were reached. One had to accept that some of the policy choices made before the crisis was only partly consistent with reality and with what the negotiators of the Maastricht Treaty had intended. Clearly, the lack of banking union and the 2005 weakening of the Growth and Stability Pact were harming the whole construction. The euro area could not afford to let its credibility decrease and perpetuate the belief that its break-up was a possibility. At the same time, they could not deny the relevance of these issues either.

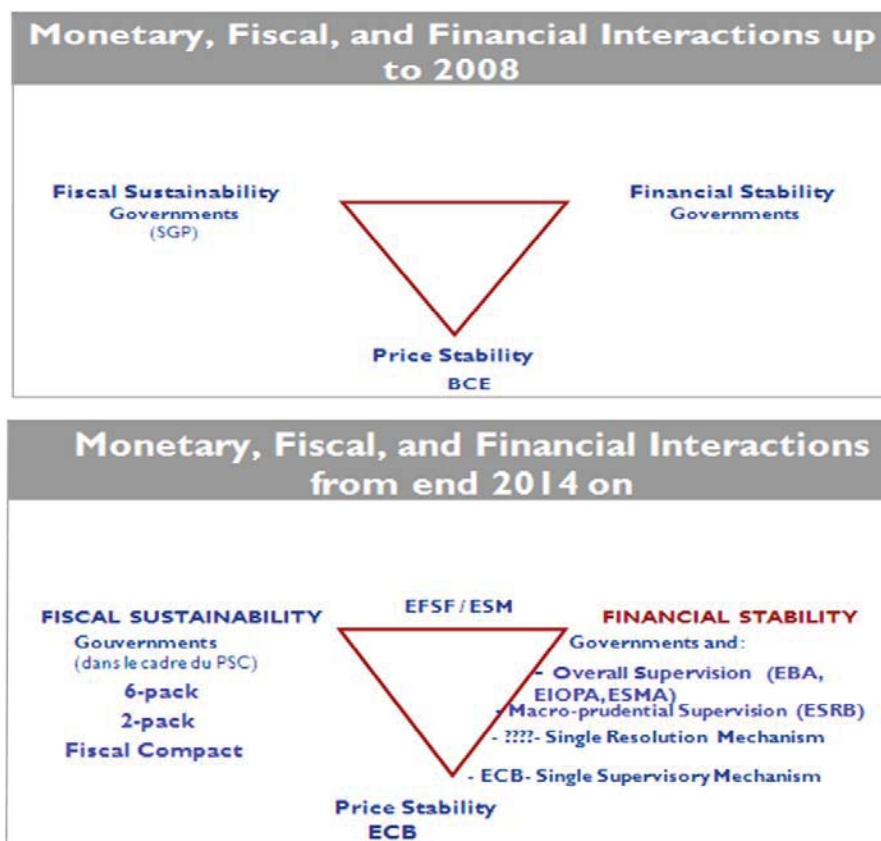


Fig. 11. Monetary, fiscal and financial interactions up to 2008

There is no point in further debating the steps ahead and behind this reaction. It is better to simply compare the map of such governance before and after the crisis (see Figure 11). In a short period of time, remarkable progress has been achieved by keeping in mind that missing occasions for reforms, a failure to act, would be extremely costly.

The reforms dealt with the process of convergence within a monetary union and its monitoring. It dealt also with the organization of the support to be received by countries in case of excessive market pressures. It improved coordination of economic policies by giving increased importance to national competitiveness and structural reforms. Recently it dealt with the deepest issue, i.e. the banking union, the Single Resolution System and the issue of guaranteed deposits which are necessary to take care of the consequences of an integrated financial market in a mone-

tary union. Finally, these reforms have rekindled discussions on the need for a more cohesive and stronger political union. However, all these changes could only be convincing if the good functioning of the markets would allow for a more normal functioning of the economy. It was particularly essential to improve the functioning of sovereign bonds markets and ensure that risk premia beyond those determined by fundamentals were avoided.

In other words, the dynamics of the crisis cannot be explained by traditional macroeconomics as a reaction to bad monetary, fiscal policies, or financial policies at the level of the euro area. It comes from the interaction of various types of systemic risk originating from "outside money" with the systemic risk originating from banks in the Eurozone context. Moreover, the correction of these systemic risks by adequate reforms could not suffice without the successful re-

launch of some of the markets most stricken by crisis and most essential to the functioning of the transmis-

sion mechanism, the sovereign bond markets. Macroeconomics cannot be separated from systemic risk!

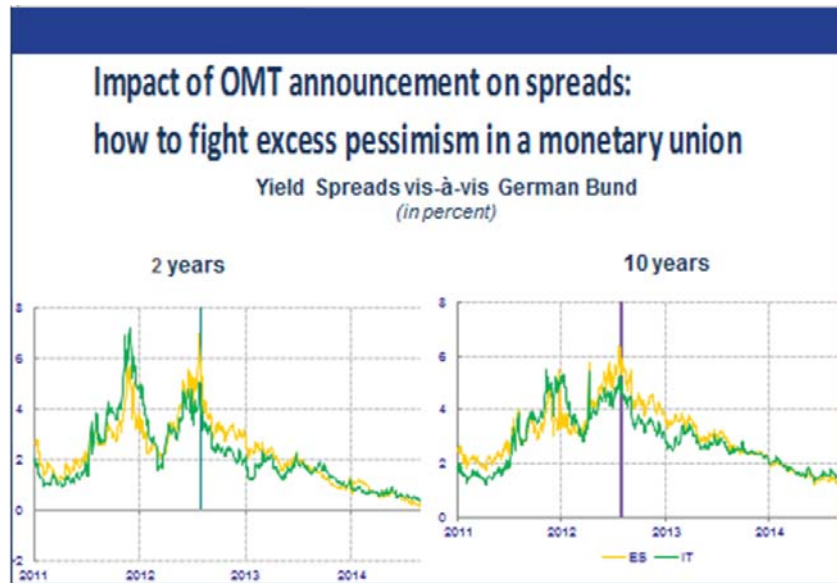


Fig. 12. Spreads for Spanish and Italian government bonds vis-à-vis German bunds

3.4. The adjustment of sovereign bond markets of countries under pressure. Indeed, a major factor in the successful reduction of uncertainty was the decision of the ECB to put forward a better tool than SMP for stabilising bond markets and deal with the associated conditionality, the controversial Outright Monetary Transactions (OMTs). As explained in Section 2, the impatience of traders and specifically of market makers in a sovereign bond market may grow (or the discount rate of utility may decrease) under the influence of new regulation, for instance due to new capital or liquidity ratios for banks or other financial institutions, or under the influence of supervisors and/or of internal risk managers. In such case, the market turnover decreases fast as shown under the second graph of Figure 13, while the apparent risk premia increase. This may in turn make the situation of the sovereign unsustainable or close to unsustainability.

Can authorities respond to these issues? Yes, if they intervene to “make the market” without trying to prevent price movements resulting from fundamentals. They have to ensure that at least one of the market-makers does not remunerate its staff in the same way and/or considers a longer horizon for bonuses. This may be done by identifying, *ex ante*, one of the market makers as the prime broker. But the support of such market-

makers may not last. A more direct solution is for the state to avail a bank which will not remunerate its staff with bonuses but will nevertheless be able to make the market and hence, support the issuance of sovereign bonds. Such control of the sovereign bond market was originally the reason why central banks, such as the Bank of England and the Banque de France, were created at a time when banknotes did not exist yet. This is consistent with the first graph of Figure 14 which shows that the turnover of the sovereign bond market in this case remains substantial and risk premia are more limited.

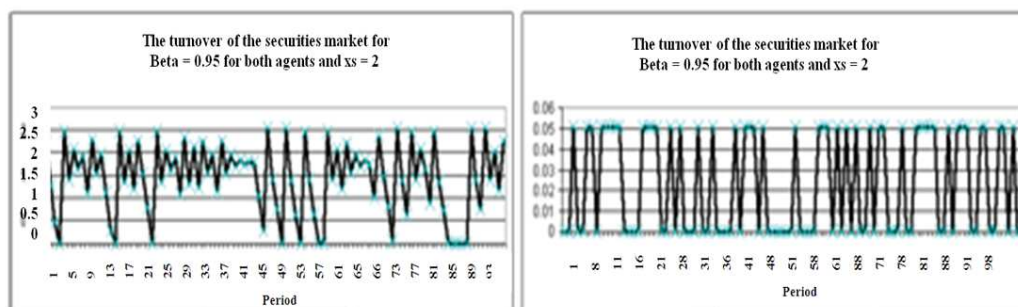
Today, this is a function that either a central bank or a Treasury may organize. Of course, such organization has to respect the functions of other institutions. In a multi-national setting like the euro area, national Treasuries are unlikely to convince markets. However, the ESFS and thereafter the ESM were created. The possibility for the ECB to purchase sovereign bonds through OMTs strengthens this set-up formidably due to the closeness of the ECB to markets. Technically, the participation of central banks to such function is easily accommodated since their staffs continually monitors such markets, if only to price the value of the sovereign bonds that they receive as collateral.

Money/wealth partition and the choice between financial development or regression

So, is variant 2 the perfect world?

No. when markets cannot break up, they may close!

Suppose that “uncertainty” is very high and leads to downward moves in the discount rate of utility from 0.95 to 0.61 as a result of a random walk.



Interpret variant 2 as reflecting the interaction of the few major trading desks supporting the issuance of securities. They are under cash constraints and their staff is largely paid with bonuses indexed on premia.

Fig. 13. Money/wealth partition and the choice between financial development or regression

The difficulty of such re-launch comes from the need of the ECB to avoid both the progressive creation of fiscal dominance and the monetary financing which could lead to it. A central bank such as the ECB has to bear in mind that its primary goal is price stability and consequently needs to limit, as much as possible, the risk of fiscal dominance.

History can however bring some degree of wisdom concerning such situations. Romans, at least those from the time of the Republic or of the first emperors, disdained any financing of the state by bankers as they dreaded their political influence, (see V. Lannoye, 2012). However, the Western part of this empire, which kept this rule, lasted until the 5th century AC only. By contrast, the Eastern Empire which did not

keep to it and issued debt, lasted until the 15th century. Although its survival cannot be definitively linked to such an issue, we must recognize that such a factor played a role. The ability to keep financial markets open, facilitates the functioning of the economy.

German history also offers interesting examples. The 1924 example of hyper-inflation generated by monetary financing certainly must be avoided at all costs. But the German history also records the dismal consequences of 1931, when the refusal by the Chancellor to save the banking system due the fear of a new hyper-inflation, had serious deflationary consequences, not to mention political consequences as well. Clearly, both these extreme policies must be avoided.

Money/wealth partition and the choice between financial development or regression

So, can any policy improve the situation?

Yes:

Change the dynamics by introducing an agent whose discount rate of utility is stable! In other words, intervene

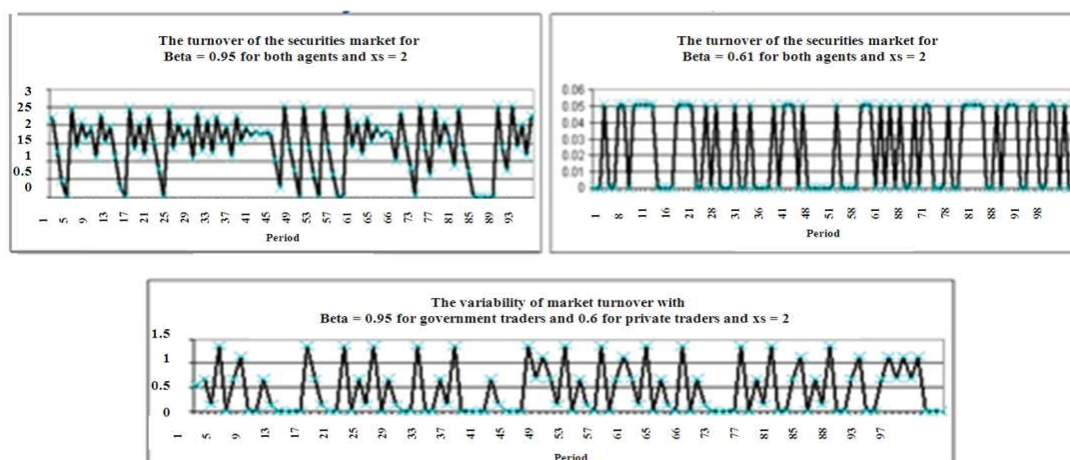


Fig. 13. Money/wealth partition and the choice between financial development or regression

Overall, these elements support the logic underlying the announcement by the ECB of OMTs. On the

one hand, a tool like OMTs is needed in order to keep bond markets functioning when excessive

impatience may harm the ability of policy-makers to support the economy. On the other hand, such operations should take place only in cases where the improvement of economic fundamentals in the context of a program supported by the IMF and the Commission is clear. Moreover, OMTs should take place only if the ESM, i.e. the body representing national Treasuries, has already supported the funding of such country through purchases of sovereign bonds on the primary market. Also, any suspension of progress in programs should lead to a stop of such operations. But this is no reason to deprive all sovereigns from availing efficient sovereign bond markets when their fundamentals allow it.

4. Lessons for central bankers: back to their future?

So, what is meant by this title? You may already have guessed that this does not imply that central bankers need function again the way they did in the 19th or in the 20th century. What I mean, however, is that the financial crisis has clarified a set of issues which, without being ignored, were assumed-away or considered less relevant for policy-making, over the last twenty years. Indeed, before inflation targeting and the independence of central banks became standard, these issues had often been more directly addressed by our profession. In other words, central banks have to utilise both historical lessons and most advanced research in order to find solutions to new challenges.

4.1. Central bankers need to integrate the financial frictions, the impact of inequality and redistribution in their analysis of the economy and their monetary policy strategy. Contrary to the general view of only a few years ago, the central banker cannot simply consider the determination of the short term money market interest rate as his/her dominating task and hope that one specific type of model would reveal the optimal result on a continuous basis. The transmission of that short rate varies depending on the structure and the degree of confidence in the economy. This transmission may happen through banks and/or through financial markets. Moreover, the respective importance of each of these channels is likely to vary across time and situations. Also, the nature of the current technological challenges and their impact on future trend growth is always difficult to ascertain. Furthermore, interactions with the insurance sector can only grow as the global population gets older. Overall, as financial and technological innovation proceeds and systemic risks materialize, markets and banks as well as their interaction with supervisors, will have to change accordingly.

For this purpose, three elements are essential: central banks need appropriate models that are able to reflect the reactions of each type of intermediaries; they must

avail the practical experience necessary to understand the evolving short term dynamics of their particular trades and in particular, the short and long-term impact of new regulation and of variations in their implementation; and they need the historical knowledge that will utilize the lessons of old challenges for the solution of new ones. Indeed, just as macroeconomics cannot be separated from systemic risk anymore, so too must the central banker integrate such systemic risk considerations in his/her decisions. The central banker must make sure that the financial system, through its development and through its oversight, allows the economy to benefit from new technological developments as fast as possible as well as stop financing unworthy projects as soon as possible.

This has bearings on the coordination of monetary and fiscal policies today. Fiscal consolidation is needed all the more in the euro area where the weakening of procedures in 2005 was one of the sources of the crisis. Moreover, their countervailing strengthening in 2012 needs to be implemented in order to restore credibility. However, its actual impact, once the ability to impose fines at federal level is re-established and OMTs have succeeded in re-launching sovereign bond markets, depends not only on the usual fiscal multipliers but also on the impact systemic risk is having on each of their determinants. The presence of systemic risk explains that fiscal multipliers may evolve depending on the nature of the crisis (see Blanchard and Leigh, 2013) and on the types of policies which are followed to counter it. However, in the absence of models able to reflect endogenously the change and the dynamics of multipliers, and as recognized by Blanchard and Leigh, the consequences of alternative policies are difficult to assess.

This link between macroeconomics and systemic risk has consequences also for the type of financing that the economy needs. At a time when the role of internet and globalization is essential to reaping the benefits of any specific breakthrough, any increase in productivity is likely to accrue to first movers at global level. However, financing the small innovative firms who pioneer specific technologies to reach a global status quickly is often risky and difficult to evaluate. Also, encouraging such firms also means allowing their owners to profit from their innovations and ensuring that their capital share is not excessively diluted. Thus, the financing of such investment by markets through shares and marketable securities is not always sufficient. Henceforth, bank financing of such innovations should be encouraged and the combined effect of bank regulations, fiscal and monetary policies needs to be assessed or re-assessed.

In the Eurozone, the rebound of bank credit to non-financial corporations has been weak or absent. Consequently, and as recently explained by President Draghi, supporting demand may go through the en-

couragement of non-securitized bank loans, and in particular through the purchase of such loans by central banks. Keeping markets liquid is one of the tasks of central banks. But encouraging a stable and growth-oriented supply of credit to the economy is also another of its secondary objectives.

Thus, central bankers will need to accompany their forecasts with detailed analysis of the changes that they see occurring in the technological and financial sphere and their impact. In such context, central banks will not only need to test new scenarios inspired by monetary or financial stability analysis. They will also have to learn how markets have developed, how to interpret their short term evolutions, and how to revive them or even replace them if needed.

The hope of a return to a more stable situation where one model would suffice is therefore, much less compelling than in the recent past. As shown by my two variants, payment and settlement techniques are relevant for the dynamics of the economy and for the way systemic risk materializes. Moreover, as telecommunication techniques improve, what we call liquidity issues can be quite different depending on the nature of underlying financial frictions. As high frequency trading develops, central banks will have to understand its impact on the economy. Consequently, central banks will need to combine staff with an up-to-date knowledge of markets including market-making with other types of staff. Staff also needs to be able to help restructure banks and to know when and how to liquidate assets. Central bankers need not only to be good economists, they also need to be good bankers and financial intermediaries.

4.2. Central Banks must better interact with academia and develop deeper knowledge of financial intermediaries in order to identify relevant issues and policies earlier. For this purpose, central bankers need models able to take into account the diversity and the heterogeneity of agents as well as the various types of financial frictions which influence the economy. They need models which ensure a clear jump beyond the DSGE literature. In particular, wealth needs to play its role and its distribution has to be considered as a relevant variable. Moreover, the completeness of markets is an excessive assumption for those who are interested in preventing and responding to systemic risk as well as monitoring and when necessary encouraging financial development.

Hence, the collaboration of central banks with academia and the detailed knowledge of the banking system is and will remain essential, if only because models complex enough to illustrate and guide central banks decisions are hard to develop. On the one hand, a major effort is needed to develop the mathematical proofs that guarantee the quality and consistency of such models. On the other hand, economics like physics or engineering needs to accept that numerical calculus

offer useful and legitimate ways to solve models. Somehow, the mutation of physics in the 19-th century needs to inspire the central bankers, supervisors and economists in the 21-st century if their discipline is to face future challenges in due time. Banks attracted many mathematicians in order to foster the spread of high frequency trading during the last 10 years. It is now time for central banks and supervisors to employ the mathematical techniques that will allow them to assume all their responsibilities.

Of course, taking actions which have an impact on the distribution of wealth requires that central banks have both the independence needed to ensure that the right decisions are made in due time and that they can exercise the right degree of responsibility vis-à-vis their people. How to ensure this? I will not analyze it here. But I would certainly stress two points. First, price stability remains a valid primary objective under which to organize many other tasks if the horizon at which it is considered is long enough. Second, it is important to find processes which guarantee the quality, good timing and the legitimacy of their decisions. The experience of this financial crisis confirms what has often been verified: it is the delay in making hard-to-make decisions that cost the most.

Accordingly, the central banker must, to the extent possible, prepare and then use the measures best fitting the current economic and financial situation. In particular, he/she needs to the extent possible, to finance the banks and the economy in a way consistent with price stability and, as a consequence, medium term growth. However, this can be durably successful only if the banking sector itself is sound as well as profitable. Central banks also need to be prepared to temporarily finance the private sector, whenever the banking system or the financial markets cannot. For this purpose, it should avail itself, the knowledge and staff able to design and occasionally implement new operations.

Emergency liquidity, the provision of which has been decided at national level up till now, will need to be consistent with supervision. Indeed, the sales of assets should not be delayed too long for fear of fire sales once liquidity in the overall banking union has been made abundant. Central banks used to be knowledgeable in that field. Not all have maintained such competence in the recent period.

This is what I meant when saying that central banks needed to go back to their future. In my view, the central banker of the future needs to integrate into her experience of economics and economic research the experience of commercial bankers. The nature of money and finance evolves across time as technology and communication improve and this continuously redefines the way to be and remain credible. As a result, the detailed knowledge of markets, banks, other

financial intermediaries and their functioning cannot be underestimated.

Central bankers should remain bankers if they are to remain central.

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References

1. Acharya, V.V. (2009). "A theory of systemic risk and design of prudential bank regulation", *Journal of Financial Stability*, Vol. 5.
2. Aglietta, M. and Moutot, P. (1993). "Le risque de système et sa prévention", *Cahiers économiques et monétaires*, Banque de France, No 41, available at: <http://gallica.bnf.fr/ark:/12148/cb343796043/date>.
3. Allen, W. and Moessner, R. (2011). "The International Propagation of the Financial Crisis of 2008 and a comparison with 1931", May, BIS Working Papers No. 337.
4. Atkeson, A.G., Eisfeldt, A.L. and Weil, P.-O. (2012). *The Market for OTC Derivatives*, AEA meetings, 19 November 2012.
5. Bernanke, B.S. (1983). "Nonmonetary effects of the financial crisis in the propagation of the Great Depression", *American Economic Review*, No 73 (3), pp. 257-276.
6. Bernanke, B.S. (2013). *Monitoring the Financial System*, speech at the 49th Conference on Bank Structure and Competition, Chicago.
7. Blanchard, O. and Leigh, D. (2013). "Growth Forecast Errors and Fiscal Multipliers", 3 January. IMF Working Papers.
8. Brender, A. and Pisani, F. (2004). The New American Economy, *Economica*.
9. Brunnermeier M.K. and Sannikov Y. (2011), A Macroeconomic Model with a Financial Sector, pdf.
10. Burkhard, H. and Maubner, A. (2004). *Dynamic General Equilibrium Modelling*, Springer-Verlag, 4 November.
11. Christiano, L., Motto R. and Rostagno M. (2007). Shocks, Structures or Monetary Policies, "The Euro Area and US after 2001", NBER Working Papers No.13521.
12. Clower, R.W. (1967). "A Reconsideration of the Microfoundations of Monetary Theory", *Western Economic Journal*, Vol. 6, No 1, December, pp. 1-9.
13. Cohen-Cole, E., Patacchini, E. and Zenou, Y. (2012). "Systemic Risk and Network Formation in the Interbank Market" - January 23.
14. Diamond, D.W. and Dybvig, P.H. (1983). "Bank runs, deposit insurance, and liquidity", *Journal of Political Economy*, No 91 (3), pp. 401-419.
15. Farmer, D. and Geanakoplos, J. (2008). *The virtues and vices of equilibrium and the future of financial economics*, arXiv: 0803.2996v1 [q-fin.GN], 20 March.
16. Hendry, D.F. and Mizon, G.E. (2014). Why DSGEs Crash during Crises?, Voxeu.org, 18 June 2014.
17. Goodhart, C.A.E. "Lessons to monetary policy from the Euro Area crisis", *Journal of Macroeconomics*, 39 Part B, pp. 378-382.
18. Lannoye, V. (2011). "The Story of Money for Understanding Economics", Amazon.
19. Ljungqvist L. and Sargent, T.J. (2004). *Recursive Macroeconomic Theory*, The MIT Press.
20. Meese R.A. and Rogoff K. "Rational Expectations and the Volatility of Floating Exchange Rates", *International Economic Review*, vol 24-3, pp. 721-723, October,
21. Moutot, P. (1991). *Money in a Non-Linear Dynamic and Stochastic Two-Agent Model*, PhD dissertation, University of Chicago, August.
22. Moutot (2011). "Systemic risk and financial development in a monetary model", ECB Working Paper Series No. 1352.
23. Moutot P., Drudi F. and Musso A. (2010). "Monetary Analysis in the ECB's Monetary Policy Process", in "Enhancing Monetary Analysis", book edited by Papademos, L. and Stark J. published by ECB.
24. Rochet, J.C. and Tirole, J. (1996). "Interbank Lending and Systemic Risk", *Journal of Money, Credit and Banking*, Vol. 28, No 4, Part 2, November.
25. Schiller, R.J. (1991). *Market Volatility*, MIT Press, Cambridge.