



Making the European Banking Union Macro-Economically Resilient

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Making European Banking Union Macro-Economically Resilient¹

Research paper

by Prof. Gael Giraud and Thore Kockerols

Abstract

The first part of our study shows that in a static analysis the currently proposed regulatory framework is not sufficient and for shocks of a size comparable to that of 2007-2009 bailouts would still be needed at the expense of the European taxpayer, even if the Banking Union architecture of 2023 were already in place today. The second part of the study finds that the costs to the economy go much further than the billions necessary to bail out banks. Building on a non-linear dynamic macroeconomic model whose baseline scenario coincides with the Commission's forecasts, we estimate the costs at the euro area level of a medium-sized financial shock (-10% losses in banks' assets compared to 2007-2009) occurring in 2014 at a cumulated loss of EUR 1 trillion in GDP (approximately -9.4% of the 2016 forecast GDP), job losses amounting to 1.91 million (-1.19% supposing a total workforce of 161.3 million according to the model forecast for 2016) and an increase of EUR 51.4 billion in government debt in 2016 (+0.5% of the 2016 forecast debt). Needless to say, the cost would be much higher in the absence of the resolution pillar of the Banking Union (which is not scheduled to be fully in place until 2023).

The most effective remedy, according to our simulations, is to increase the banking sectors' equity ratio target to 9% or more and to lower dividends, in order to make the economy more shock-resistant in the medium term. The study does not claim that an equity ratio target of 9% is the optimal value, although we suspect it to be close to the lower bound, below which the purpose of dampening the impact of a significant shock cannot be reached. We show that the cost of implementing this increased equity ratio is more than offset by the reduction in losses caused by a financial shock. In addition, the separation of retail banks from investment banks, euro area deposit guarantees and a review of fiscal policy seem to provide more efficient tools to mitigate the effects of a new crash than what is currently programmed by the European Banking Union project. An augmented Single Resolution Fund (SRF) with more timely implementation would also certainly reduce the cost of a new crash, but would be insufficient to prevent turmoil in the euro area economy.

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List of abbreviations

AMECO	Annual Macroeconomic Database
BRRD	Banking Recovery and Resolution Directive
BU	European Banking Union
CCP	Central Counterparty Clearing house
CDO	Collateralised Debt Obligation
CDS	Credit Default Swap
DG ECFIN	Directorate General for Economic and Financial Affairs
DSGE	Dynamic stochastic general equilibrium
ECB	European Central Bank
EFSSF	European Financial Stability Facility
ESCB	European System of Central Banks
ESM	European Stability Mechanism
GDP	Gross Domestic Product
HQ	Headquarter
IAS	International Accounting Standard
IFRS	International Financial Reporting Standards
MIP	Macro-Imbalance Procedure
NYU	New York University
OMT	Outright Monetary Transactions
RA	Resolution Authority
SRF	Single Resolution Fund
SRM	Single Resolution Mechanism
SMP	Securities Markets Programme
SSM	Single Supervisory Mechanism
VaR	Value at Risk
VLTRO	Very Long-Term Refinancing Operation

Executive summary

Even though the European Banking Union is the outcome of significant steps towards an integrated banking and monetary union, its ability to immunise the euro area against a new banking crash has not yet been assessed quantitatively. This report is devoted to assessing the potential costs that would be implied by different shocks (ranging from the shocks scrutinised by the European Central Bank (ECB) under the Asset Quality Review up to shocks of the size historically observed in the past two decades) under various scenarios regarding the implementation of the Banking Union's resolution pillar.

The first part of our study provides a static financial analysis, suggesting that the currently proposed regulatory framework is not sufficient for shocks of a size comparable to that of 2007-2009. Bailouts would still be needed at the expense of the European taxpayer, even if the Banking Union architecture of 2023 were *already* in place today. The most effective measure to limit the involvement of government funds would be to interpret the 8% of total assets as a lower bound and to systematically bail-in senior creditors and big depositors above this level.

The second part of the study relies on a new macroeconomic model built on a non-linear dynamic system that allows for endogenous money creation, involuntary underemployment and debt-deflation phenomena. The model is calibrated and estimated so that its baseline scenario coincides with the Commission's forecasts. The macroeconomic costs of a banking crash are then evaluated through the impulse response function of our model to the shocks estimated in Part I.

We find that the costs to the economy go much further than the billions necessary to bail out defunct banks identified in the first part. Indeed, we estimate the costs at the euro area level of a medium-sized financial shock (-10% losses in banks' assets compared to 2007-2009) at a cumulated potential loss of EUR 1 trillion in GDP (approximately -9.4 % of the EUR 10 632 trillion GDP figure forecast for 2016 by the Commission), potential job losses amounting to 1.91 million (-1.19% supposing a total workforce of 161.1 million according to the model forecast for 2016 model) and a possible increase of EUR 51.4 billion in government debt in 2016 (+0.5% of the Commission's forecast of EUR 9 933 billion for 2016). Assuming a shock to occur every ten years on average, the annualised costs would amount to EUR 100 billion in potential output loss per year and 0.19 million workers potentially unemployed per year. Needless to say, the cost would be much higher in the absence of the resolution pillar of the Banking Union (which is not scheduled to be fully in place until 2023). In other words, the Single Resolution Fund turns out to be too small and its implementation is too slow.

The most effective remedy, according to our simulations, is to increase the banking sectors' equity ratio target to 9% or more and to lower dividends, in order to make the economy more shock-resistant in the medium term. We do not claim that an equity ratio target of 9% is the optimal value, although we suspect it to be close to the lower bound, below which the purpose of dampening the impact of a significant shock cannot be reached. Our simulations show that the cost of implementing this increased equity ratio would be more than offset by the reduction in losses caused by a financial shock. In addition, the separation of retail banks from investment banks, euro area deposit guarantees and a review of fiscal policy seem to provide more efficient tools to mitigate the effects of a new crash than what is currently programmed by the European Banking Union project. An augmented Single Resolution Fund with more timely implementation would also reduce the cost of a new crash, but would be insufficient to prevent turmoil in the euro area economy.

Chapter 1: The FINANCIAL COST of an INCOMPLETE BANKING EUROPEAN UNION

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I - GENERAL INTRODUCTION

Key findings

We argue that the link between the fragile European banking sector and heavily indebted public finances might render the impact of a new financial crisis more severe than it was in the aftermath of 2008. By morphing into a monetary crisis, it might even put in danger the survival of the euro area. The European Banking Union aims at buffering such an impact. This explains the need to check its resilience.

The European Banking Union is a promising solution to the euro area crisis. It aims at finding a solution to both the financial and the monetary fragmentation of the euro area financial markets, breaking the alleged vicious circle of domestic banking system impairments and sovereign debt crises, and eventually completing the unification of the euro currency.⁵ However, the shortcomings and hurdles to reaching a full-fledged banking union, and the hazards created by the inconsistencies between their phasing-in as part of the sequential schedule decided by states have been stressed in various places.⁶

In this report, we make a first tentative move towards assessing the macroeconomic cost of such shortcomings in the European Banking Union. To reduce these loopholes, we propose implementing a shared bailout rule during the transition period, consisting of a loss-sharing

⁴ We thank Ségolène Dessertine post doctoral fellow at NYU polytechnic, Francesco Molteni, post doctoral fellow with Labex ReFi and Centre d'Economie de la Sorbonne and Rossi Abi Rafeh, member of the Chair Energy and Prosperity for their excellent technical assistance, as well as the support of the Chair Energy and Prosperity.

⁵ For a summary, cf. Véron (2014).

⁶ Cf. Martin Hellwig (2014), and Béranger et al. (2014), to quote but few.

rule among countries hosting an entity of a bank group⁷. We then estimate the macroeconomic gain that such an addition to the current situation would provide.

Before delving into the details, let us briefly recall which loopholes are in question in this study, and why we believe that an assessment of their macroeconomic cost (complementary to a purely financial estimation) is needed.

I.1. The Banking Union in a nutshell.

At the moment, the Banking Union consists of:

1. a Single Rulebook for the European financial market;
2. a Single Supervisory Mechanism – SSM;
3. a Single Resolution Mechanism – SRM.

The SSM under the auspices of the ECB was adopted in 2013 and has become fully operational in November 2014⁸. A general approach by the Council on the SRM was found in December 2013. It was improved in several steps throughout 2014⁹, but we shall see that it remains unsatisfactory particularly with regard to the timing and deadline chosen for the full implementation of the resolution fund. The eight-year transition period between 2015 and 2023 is a true challenge and the project might be back on the drawing board as soon as new financial turbulences emerge.

It should be recalled that the European banking union (BU), the Single Supervisory Mechanism and the Single Resolution Mechanism, together with the Banking Recovery and Resolution Directive (BRRD), and previously the Capital Requirements Directive IV and Capital Requirements Regulation, as well as the Regulations establishing the European Supervisory Authorities, have all nevertheless represented big steps forward.

Accordingly, the supervision of the banking system and the resolution mechanism will no longer take place at the national level but at the European level: a single supervisor will monitor all ‘significant’ credit institutions of the euro area and is expected to ensure consistent and high-quality supervision. This federal supervisor will also provide guidelines to the national supervisors so that the supervisory rules and practices used for smaller credit institutions will be uniform.¹⁰ Indeed there was no point in trying to promote confidence in the European banking sector by national policy measures when banking activities of most systemic European banks are managed across borders – and borders that often reach beyond the EU’s own. It is also hard to imagine keeping the singleness of the euro currency without unifying the supervision of the credit institutions that issue most of the circulating means of payment (more than four fifths of euros in circulation are issued by commercial banks).

⁷ Cf. Béranger et al. (2014), loc. cit.

⁸ See http://ec.europa.eu/finance/general-policy/banking-union/single-supervisory-mechanism/index_en.htm for more details

⁹ See http://ec.europa.eu/finance/general-policy/banking-union/single-resolution-mechanism/index_en.htm for more details

¹⁰ Cf. Goya et al., 2013; Beck, 2012.

Despite its importance, we will not be concerned much with this aspect of the Banking Union in this report, which focuses on its other aspects. Suffice it to recall that, according to Article 127.5 TFEU, "the European System of Central Banks (ESCB) shall contribute to the smooth conduct of policies pursued by the competent authority relating to the prudential supervision of credit institutions and the stability of the financial system." Indeed, a new banking crisis in the Euro area would pose a serious threat to monetary stability. It remains questionable to what extent there is a conflict of interest between the ECB's mandate in terms of monetary stability and its new mandate as a bank supervisor?

This report does not address the aforementioned issue, but, rather, concentrates on the banking resolution mechanism, which refers to the set of rules that govern the treatment of impaired banks and the rules used to share the resulting losses in case of default. This resolution mechanism should therefore enable an orderly dismantling or closing down of insolvent banks and avoid the systemic effects of bank failure. The relevance of this choice is reinforced by the recent publication of the DG ECFIN Working paper by Breuss et al. (2015), which provides a plea in favour of using the SRM as a privileged tool in order to prevent any intervention of the ESM and any public bailout in case of financial distress. In a sense, the present work aims at checking whether the SRM is indeed able to perform this task and its main conclusion is negative.

1.2. The 'vicious circle' between sovereigns and banks

The Euro Area Summit Statement of June 29, 2012 affirms that 'it is imperative to break the vicious circle between banks and sovereigns' and asks the Commission 'to present proposals ... for a single supervisory mechanism' for banks. However, it does not clearly explain, neither what precisely is meant by 'the vicious circle between banks and sovereigns', nor how the latter relates to the former.

In reality, given the size of banks as a percentage of individual countries' GDP, the burden of bank resolution falls on the shoulder of national authorities in the pre-banking union situation. This mechanically implies that a fragile domestic banking sector impairs the state's creditworthiness. In turn, banks may be impacted by sovereign debt deterioration through two main channels.

First, because banks invest in public debt securities, they may suffer from a degradation of the quality of their assets when the creditworthiness of the sovereign is in doubt. There is indeed a domestic bias in the sovereign bonds portfolio of banks that therefore lacks diversification. This trend became more pronounced with the deepening of the crisis. It was, at least in the short run, logically sound: banks could borrow at a rate close to 1 % and invest those funds in sovereign bonds at higher rates (of between 2 % and 5 %). Even though the evolution of the ratio of home sovereign exposure to Core Tier 1 and the ratio of home sovereign exposures over banks' total assets have been extremely heterogeneous across banks within each country and across countries, when they did rise, these ratios created a channel through which sovereign fragility can have a knock-on effect on banks. As a consequence, when sovereign ratings were downgraded certain banks may have suffered a deterioration of the quality of their balance sheet. Some domestic supervisors seem to have supported this ring-fencing – de facto renationalisation – of sovereign debt held by banks, believing it can make bank resolution easier.

The total assets of the major banking groups are often close to the equivalent of their domestic GDP. In 2013 the total levelled at: about 59 % of German GDP for Deutsche Bank; 179 % of Dutch GDP for ING Group; 87% of French GDP for BNP Paribas; and 109% of Spanish GDP for Santander. In case of trouble, this makes the public bailout of such megabanks unavoidable. Consequently, the deterioration of government creditworthiness reduces the credibility of the implicit government guarantee granted to each bank considered 'too big to fail', which in turn negatively impacts their funding situation by increasing the interest rates they are charged on the market.

Bank	Country	Sovereign		
		Debt/GDP	Debt Yield	Assets/GDP
Banco Santander SA	Spain	94%	4,56%	109%
Bank of Cyprus	Cyprus	112%	6,50%	184%
Bank of Ireland	Ireland	124%	3,79%	81%
Bank of Valletta Plc	Malta	72%	3,36%	100%
BBVA	Spain	94%	4,56%	57%
BCEE	Luxembourg	23%	1,85%	90%
Belfius	Belgium	101%	2,41%	48%
BNP Paribas	France	93%	2,20%	87%
BPCE Group	France	93%	2,20%	55%
Caixa Geral de Depositos	Portugal	129%	6,29%	68%
Commerzbank AG	Germany	78%	1,57%	20%
Crédit Agricole S.A.	France	93%	2,20%	75%
Deutsche Bank AG	Germany	78%	1,57%	59%
Erste Group Bank AG	Austria	75%	2,01%	64%
ING Groep NV	Netherlands	74%	1,96%	179%
National Bank of Greece SA	Greece	175%	10,05%	61%
NLB	Slovenia	72%	5,81%	35%
Nordea Bank	Finland	57%	1,86%	158%
Rabobank	Netherlands	74%	1,96%	112%
Slovenska	Slovakia	55%	3,19%	16%
Société Générale	France	93%	2,20%	60%
Swedbank EE	Estonia	10%	0,00%	48%
Swedbank LV	Latvia	38%	3,34%	22%
UniCredit SpA	Italy	133%	4,32%	54%

Table 1 - Bank assets (HQ level) compared to their host sovereign's finances

As shown by Table 1, the systemic banks that attract attention because their balance sheet exceeds the GDP of their own country are ING Groep NV and Rabobank for Netherlands, Nordea Bank for Finland, Bank of Valetta Plc for Malta, Santander for Spain and Bank of Cyprus. This, however, yields only a partial picture of which countries are currently threatened by their banks. Indeed, looking at the situation of the subsidiaries, Luxembourg emerges as being the most exposed euro area member. On their own, the subsidiaries of the 5 systemic banks listed in Table 2 below represent 530 % of the GDP of Luxembourg. The reason for this affection for the Grand Duchy lies probably in its peculiar tax system. Be that as it may, the bankruptcy of Deutsche Bank, for instance, would represent a threat of 60 % of Germany's GDP

but 223 % of that of Luxembourg. For the bankruptcy of BNP Paribas, the figures would be 66 % of French GDP, 53 % of Belgium's GDP and another 69 % of Luxembourg's GDP.

Bank	Country	Debt/GDP	Sovereign Debt Yield	Assets/GDP
Erste Group Bank AG	Austria	75%	2,01%	54%
BNP Paribas	Belgium	101%	2,41%	53%
BNP Paribas	France	93%	2,20%	66%
Crédit Agricole S.A.	France	93%	2,20%	78%
Société Générale	France	93%	2,20%	54%
Deutsche Bank AG	Germany	78%	1,57%	60%
BNP Paribas	Luxembourg	23%	1,85%	69%
Commerzbank AG	Luxembourg	23%	1,85%	55%
Crédit Agricole S.A.	Luxembourg	23%	1,85%	91%
Deutsche Bank AG	Luxembourg	23%	1,85%	223%
Société Générale	Luxembourg	23%	1,85%	92%
ING Groep NV	Netherlands	74%	1,96%	84%
Rabobank	Netherlands	74%	1,96%	80%
Caixa Geral de Depositos	Portugal	129%	6,29%	58%

Table 2 - Bank assets (subsidiary level) compared to their host sovereign's finances

The aim of the architecture behind the Banking Union is to break these negative feedback loops. This goal has justified, indeed, the non-conventional measures taken by the ECB to alleviate financial market pressure on the sovereign debt markets of the most vulnerable countries - i.e. the sovereign bonds purchase program, i.e. Securities Markets Programme (SMP), on secondary markets starting from May 2010, the very long-term refinancing operation (VLTRO) at low interest rates with a maturity of up to 3 years in December 2011 and February 2012, and the Outright Monetary Transactions programme (OMT) with which the ECB declared its willingness to purchase potentially unlimited quantities of sovereign bonds in return for strict conditionality, commitment on the part of beneficiary countries to a program of 'structural reforms', and fiscal consolidation. This conditionality imposed by a central bank is unprecedented, quite apart from the questions it raises about the independence of that bank with respect to fiscal policy.

I.3. Is it really a circle?

However, as is stressed by Hellwig (2014), one may have some doubts about the relevance of the metaphor of a vicious circle. In this author's words: 'We have seen – and continue to see – contagion effects from sovereigns to banks in some countries and from banks to sovereigns in others, but the picture of a doom loop between the two is more confusing than clarifying. The so-called "euro crisis" is in fact composed of different kinds of crises reflecting different failures of governance in the relation between financial institutions and governments¹¹ (...). The notion of a "vicious circle between banks and sovereigns" diverts attention away from the fact that the weakness of European financial institutions is not limited to countries where the sovereign has

¹¹ For a more extensive discussion of the interplay between the different crises, see Hellwig (2011).

problems. This weakness also plagues countries such as France and Germany, where, so far at least, the sovereign has been able to bear the costs of the crisis. Quite generally, banks suffer from the weakness of their equity positions, from excessive reliance on short-term funding through wholesale markets, and from an inability to earn profits in an environment that is characterized by excess capacity and intense competition' (Hellwig, loc. cit., pp. 3-4)¹². Let us consider, by way of example, the size of the balance sheets of banks that are 'too big to fail', as illustrated by the next diagrams.

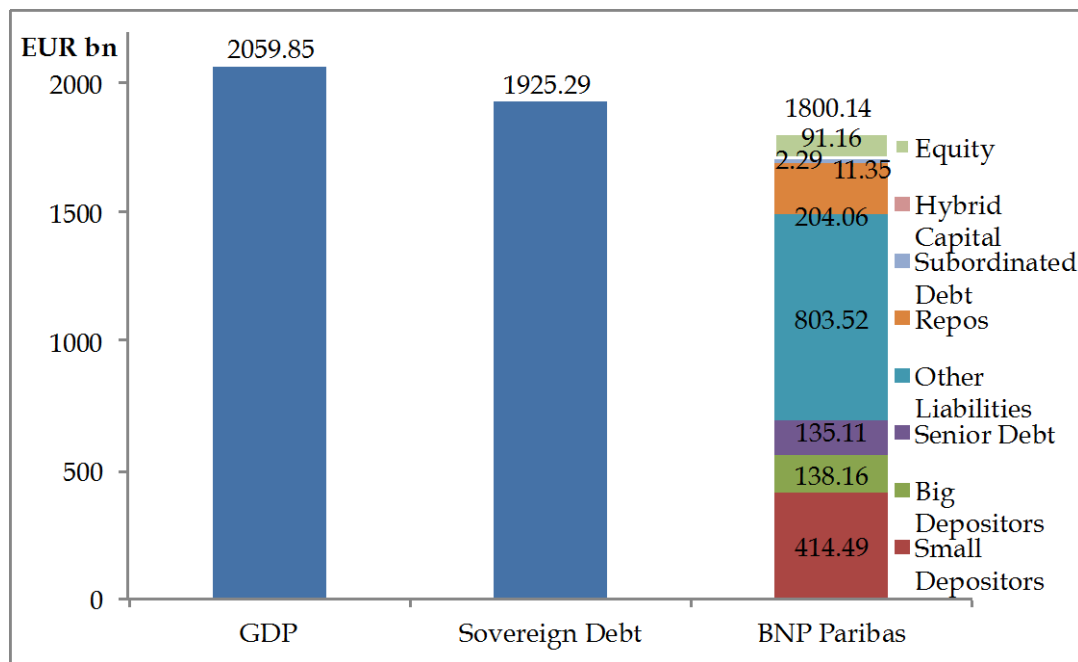


Figure 1 - The balance sheet of BNP Paribas (2013)

The size of the balance sheet of BNP Paribas, for instance, is EUR 1 800.14 billion, that is, 93.5 % of the French sovereign debt and 87.4 % of French GDP (2013), as can be seen in Figure 1. For Société Générale (the second biggest French bank, cf. Figure 2 below), the size of the balance-sheet equates 64 % of the public debt and 60 % of GDP. Together, BNP Paribas and Société Générale represent no less than 147.4 % of the GDP of a country – France – which possesses 4 systemically important banks (BNP Paribas, Société Générale, Crédit Agricole and BPCE Group).

¹² Cf. ASC (2012, 2014).

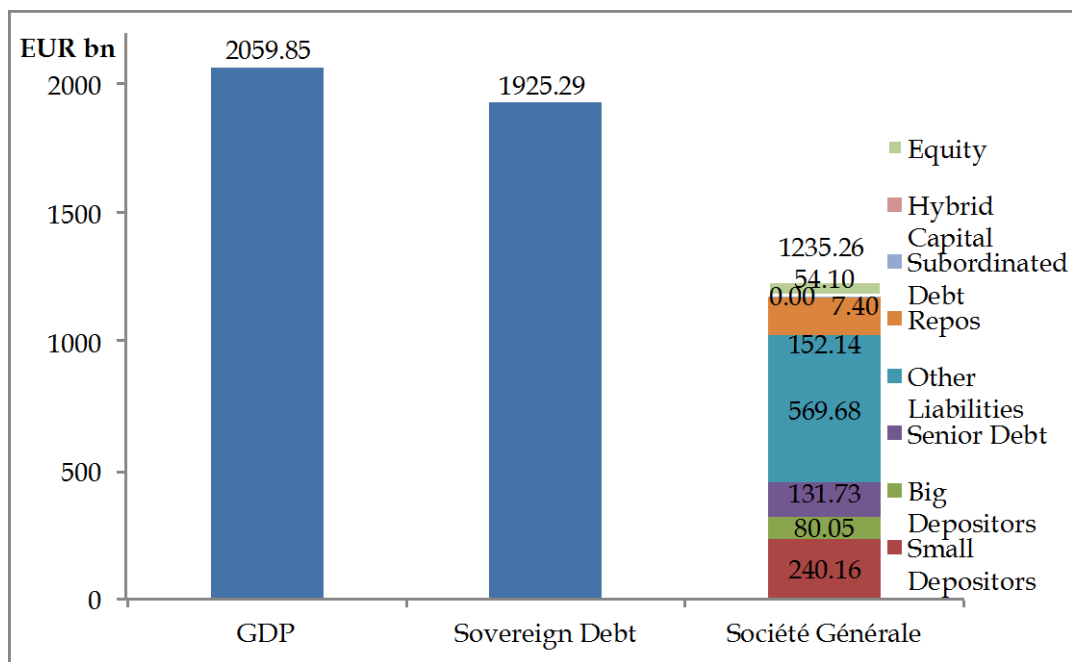


Figure 2 - The balance sheet of Société Générale (2013)

In Germany, the situation is less alarming, as shown by Figure 3. The weight of Deutsche Bank is equivalent to 'only' 58.9 % of German GDP, while adding Commerzbank results in a total weight of 79 %. If one adds the Landesbanken the figure of 100 % is exceeded.

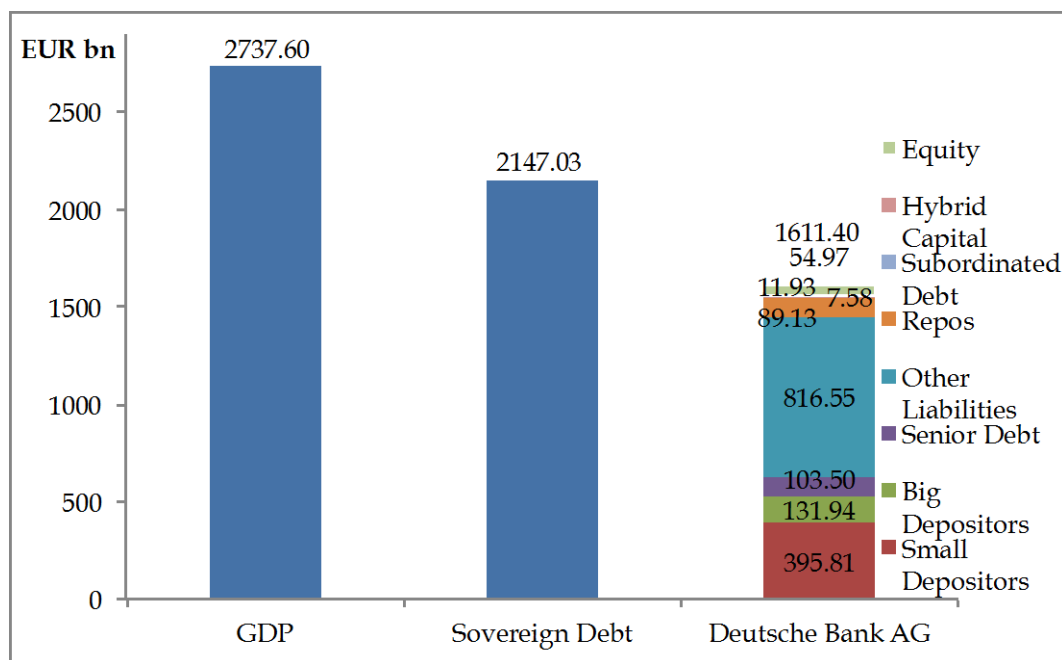


Figure 3 - The balance sheet of Deutsche Bank AG (2013)

These sizes are viewed as being responsible for one branch of the loop connecting the banking sector with the state. However, the main reason is the excessive concentration of the European banking sector. In France the five largest banking groups account for nearly 50 % of the country's total banking assets. Even in countries where concentration is traditionally lower, it has increased in recent times. In Germany for instance, banking concentration increased from 15 % to above 30 % between 1997 and 2010.¹³ This concentration is a key systemic risk factor. It calls for a specific *competition policy* for the banking industry in order to reduce one of the main root causes of systemic risk.¹⁴ One drastic way to reduce the concentration of the European banking sector would consist in not bailing out defunct banks, thus letting the standard 'mechanisms of capitalism' do their work. In a sense, it is too late today to put such a policy into practice given the current size of the banks and this might be one of the main reasons why several banks, such as BNP Paribas, seem to have been increasing the size of their balance sheet in the last decade. This is partly what justifies the Banking Union, especially the SRM. Along this storyline, however, the SRM is a second-best solution, implied by what some observers would call a straitjacket of rapidly growing banks that are able to capture both states and the regulator (cf. e.g., Carpenter and Moss (2015)).¹⁵

Conversely, it is often argued, the deterioration of public finances is responsible for the additional fragility of the banking sector. But, as stressed by Hellwig (2014), several countries (Greece, Portugal, Italy) had old-fashioned sovereign debt crises, of a type that in the past did not endanger their respective banking systems as it does nowadays. This shows, at least, that the current situation of European public finances may aggravate the riskiness of the banking sector, but that it can in by no way be viewed as being the *source* of this riskiness. As documented by Reinhart and Rogoff (2009), sovereign debt crises have a long track record. They spill over into the financial system if the sovereigns in question have used their power to induce 'their' banks into funding them and the sovereign's default imposes large losses on these banks (e.g. Argentina in the 1990s and early 2000s). In the case of Greece, the 2012 haircut on sovereign debt necessitated substantial European Stability Mechanism (ESM) contributions to recapitalising Greek banks in order to save them from being insolvent. Conversely and most usually, if a sovereign crisis spills over into the financial sector there is not much of a spillover back to the sovereign. A clear exception is Greece, where: 1) the inability of troubled banks to finance the real economy led to a collapse of the latter and therefore in corporate tax income; 2) Greek banks being the only ones that buy Greek bonds, their home sovereign would immediately experience a liquidity crisis (and most probably a sovereign default) if its banks were to fall.

Let us simply focus on a specific example, less dramatic than that of the European countries just mentioned, namely France. As shown in Figure 4, the French public debt-to-GDP ratio has been higher than the 60 % threshold laid down in the Maastricht Treaty, at least since the beginning of the 2000s.

¹³ See Chart 2.3.14 on p.18 of Liikanen report, http://ec.europa.eu/internal_market/bank/docs/high-level_expert_group/report_en.pdf

¹⁴ There are plenty of reasons why commercial banks might have a natural tendency to promote an oligopolistic market structure, beginning with the fact that this reduces the need to borrow central bank money in order to comply with reserve requirements or even just to net positions within the interbank market.

¹⁵ To give but one example, despite the financial turmoil, the size of BNP Paribas's balance sheet increased by about 23 % between 2007 and 2014, partly thanks to the absorption of Fortis.

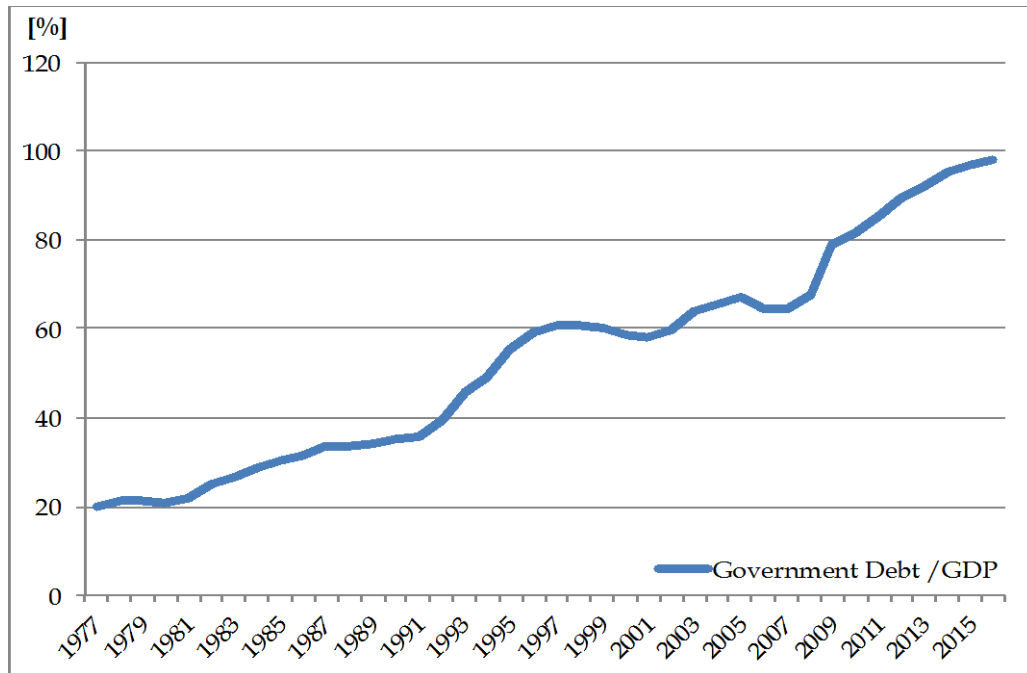


Figure 4 - French gross public debt (1978-2012); Source: Commission

Similarly, France's public deficit had already reached the barrier of 3% in the mid-1980s, as can be seen in Figure 5.

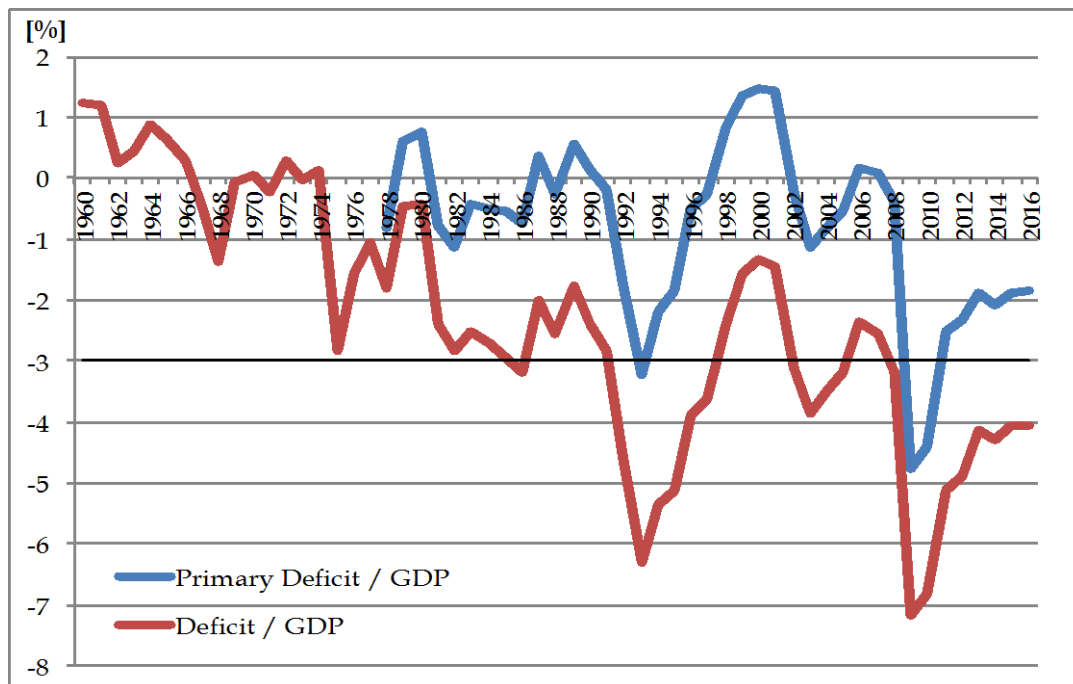


Figure 5 - French public deficit (1960-2016); Source: Commission

Other countries (e.g., Ireland and Spain) had equally old-fashioned banking crises that were induced by boom-and-bust developments in real estate markets. Ireland's public debt in 2007 was not higher than 24 % of its GDP; Spain's public debt stood at 36 % of GDP in 2007.

Therefore Ireland and Spain then belonged to the group of countries with the healthiest public debt levels inside the euro area. The kind of banking crisis they are experiencing has little to do with the health of their public finances, and also has a long tradition. It originated in failures of risk control in banks and in failures of prudential supervision of banks. Over twenty years ago, boom-and-bust developments in real estate markets (and in lending to non-financial companies) were major causes of banking crises in Japan, the United States, the Scandinavian countries, and Switzerland.¹⁶ When such developments occur, governments that find it necessary to support their financial institutions may see their debt levels rise dramatically so that the financial crisis may in turn induce a sovereign debt crisis. This is what happened in 2010 in Ireland (whose public debt skyrocketed to 123 % of GDP in 2013). Fear of such an experience was the reason why in 2012 Spain asked the ESM to recapitalise its banks. By contrast, Iceland (whose major banks all went bankrupt in 2010, having accumulated a financial sector debt akin to 5 times the country's GDP) refused to transfer its banks' debt to the state's balance sheet. To quote Hellwig (2014): 'If such a financial crisis spills over to the sovereign, a spillover back to the financial sector can occur if the initial financial crisis was localised, and the sovereign's difficulties affect the rest of the financial system, a constellation that seems to have been relevant for Spain, where the financial crisis was concentrated in the *cajas* and their successor institutions, but not in Ireland, where the entire banking system seems to have been affected from the beginning'.

The impact of the Greek debt haircut on banks outside of Greece should be seen as evidence of those banks' weakness, rather than a doom loop between sovereigns and banks. As of late 2010, the bank Dexia had equity equal to less than 2 % of its assets. The bank did not have much Greek debt in its portfolio, but with so little equity, the haircut on Greek debt was enough to make the bank go under. Fear of such an event would cause the wholesale short-term lenders to run. Since Dexia, on the other hand, did not have a strong deposit base, it was particularly dependent on wholesale lenders. As we shall see below, the architecture of the European Banking Union had it been in place in 2010 would not have saved Dexia - which confirms that the deep cause of Dexia's trouble was not a supposed vicious circle between home sovereigns and banks (as this is addressed by the Union), but the intrinsic weakness of the bank itself.

1.4. Cross country correlations

Clearly, whenever a country's banking sector is hit, whether it spills over its home sovereign or not this is likely to have an impact on several other European countries' banking sectors. This is so because of the high degree of interconnectedness between European banks. Every systemic European bank possesses subsidiaries in virtually a dozen of other countries within the euro area. What we did *not* do in this report is to try to quantify this correlation or therefore the domino effect that could unfold after a shock. Had we done so, our results would have been more pessimistic (but also, presumably, more realistic).

We did not take this phenomenon into account in our study for multiple reasons. Frunza (2014) has already performed a probabilistic approach of the cost of non-Europe, with a strong reliance on estimates of the correlation between market spreads and credit default swaps (CDS) default rates (see footnote 16 below). Apart from this study and the references therein, recent reliable

¹⁶ See Hellwig (1994, 2009).

estimations of such correlations can hardly be found.¹⁷ Moreover, as it is well documented, correlations between default rates as perceived by the markets increase when stress and volatility rise. Thus, empirical estimations performed during times of relative calm need to be adjusted in order to keep relevance in the case of an extreme event akin to the one studied in this report. Last but not least, the precise channel through which a troubled bank can shake its subsidiaries or, on the contrary, its headquarters abroad, as well as all the financial institutions to which it is financially linked, depends on the network of such dependences. Such information has not to date been made public. Making such data public would considerably help policymakers in their decisions in case of banking stress.¹⁸

There is, however, another aspect of cross-country correlation which is worth mentioning here, namely the fact that the European Financial Stability Facility (EFSF), created in May 2010 with an initial capital of EUR 750 billion, in the way it is currently supposed to work necessarily increases the correlation between the credit default rates of members of the euro area. Indeed, the very moment a country like Greece or Ireland leaves the bond markets and seeks shelter in the EFSF, a greater burden is shared by the countries remaining to guarantee the EFSF's bonds. EFSF loans are raised on the money markets on the guarantees issued by the remaining euro area countries, in proportion to their GDP. The total sum raised is then cut into slices, one guaranteed by Germany, another by France, etc. Given that each country has different creditworthiness, each is charged a different interest rate. Finally, these slices are put together in packets (very much as Collateralised Debt Obligations (CDO) were built before 2008) and sold off as bonds, mostly to Asian investors or to Europe's own banks.

By selling its bonds to European banks, the EFSF is simply reinforcing the vicious circle that the Banking Union aims at disentangling. On the other hand, as soon as a country goes to the EFSF the markets will logically focus on the 'next on the list', namely on the next country (whose burden has just increased) which is borrowing money at the highest rate of interest. Since its burden has just increased, its borrowing rate will most probably increase, reducing the safety of the banks that bought the EFSF bonds, etc. Thus, the very architecture of the EFSF contributes to increasing the default correlation among euro area members.

The designers of the EFSF obviously took inspiration from the securitisation procedures underlying the toxic assets that had led to the 2007-2009 crash. It also seems that they worked on the same assumption, namely that risk diversification is a good means to prevent overall default. Exactly as for CDOs, this popular wisdom may be considered correct only if the correlation between borrowers is low. As testified by the subprime crisis, many commercial banks had undervalued this correlation - probably, simply because it is quite impossible to assess it in a reliable way. The same might hold for the euro area sovereigns.

¹⁷ Schröder and Schüler (2011) provide such an estimate, but their work would need to be updated.

¹⁸ By contrast, Funza (2014) offers an analysis of the impact of a banking (and sovereign) crisis relying essentially on market data, and on the VaR (Value at Risk) of a (Gaussian) stochastic model, emphasizing the lack of a European Deposit Guarantee. Here we have attempted to provide a complementary analysis mostly based on non-market data, using a deterministic (though dynamic and non-linear) approach free of any Gaussian assumption, and emphasizing issues related to the SRM.

I.5. A monetary crisis?

Perhaps the most important consequence of the European banking sector's fragility is the fact that it threatens the euro currency as such. In the 1992 Maastricht Treaty, the governments and heads of state chose to separate two forms of money: currency (coins and notes) on the one hand, and banking deposits on the other. The treaty then promoted the launching of an incomplete currency in spite of the experts' warning (in the Delors report on the establishment of a European monetary union) of the need for a prudential and supervisory policy defined at the European level. The intergovernmental negotiations led the governments to step back on this proposal, the result being a federal monetary union with a multiplicity of national banking supervisors, *de facto* creating a multiplicity of coexisting banking markets, which remain segmented, as a consequence.

Béranger et al. (2014) state: 'In December 2012, demand deposits accounted for 83 % of the monetary aggregate M1 – that comprises all the means of payments – while coins and notes accounted for a small 17 %. The greatest share of the settlements of transactions is made by cards, cheques and bank account transfers that must be understood as the circulation of scriptural money whose acceptability is based on an unwavering trust in its fungibility with coins and notes issued by the ECB or with any other bank money'. In other words, even though one must differentiate between the concept of fungibility of coins and notes (i.e. the credibility of the euro area Member States) and the safety of deposits (i.e. credibility of the deposit taker), a *sine qua non* for the longevity of the euro is that deposit accounts be reliable everywhere within the euro area, thus guaranteeing that one euro in Austria has the same value as one euro in Portugal. The March 2013 agreement on the restructuring of the Cyprus banking sector, however, testifies that this might not be the case. Indeed, this agreement acknowledged overnight that one euro in a Cyprus bank was worth less than one euro in any other euro area Member State.¹⁹

At the same time, a growing fragmentation of the European financial space is currently observed, partially due to financial flows from southern countries (like Spain) to northern countries (like Germany) that widen the gap between the northern zone (Germany, Austria, the Netherlands, Finland, Belgium, Luxembourg) and the rest of the euro area that is already visible in terms of deindustrialisation, and is partially related to national supervisors, who have encouraged their banks, at least since 2010, to concentrate their assets on national public debt. Is this behaviour likely to last any longer? Since such a behaviour merely reflects the intuition that resolution laws have remained so far country-specific (and it is easier to restructure a defunct bank whose liabilities are 'national'), the question boils down to this: will the European Banking Union succeed in providing a truly European resolution mechanism capable of making this kind of 'financial patriotism' superfluous? Even though we will not explicitly address the financial fragmentation of the euro area, this will be one of the key issues discussed in our study. Indeed, by providing (or failing to provide) a federal architecture for the resolution of banks in difficulties, the BU also aims at making this kind of precaution superfluous.

The Cyprus episode, together with the fragmentation of the European financial arena, points up the need for a European deposit insurance scheme that would be aimed at guaranteeing that

¹⁹ Cf. Méadel and Scialom (2013). In a sense, by managing deposit accounts, retail banks contribute to a public good (Aglietta and Scialom (2003), p. 4) or a common good (in the sense of E. Ostrom; cf. Giraud (2013)).

every euro deposited in any European bank will be reimbursed to depositors in case of the failure of the bank, without any haircut (up to a limit of EUR 100 000). For the moment, however, the question of a federal deposit insurance scheme is not on the agenda of the European Banking Union, so that insurance schemes remain strictly national. As a consequence, the current study not only provides insights about the possible interconnections between banking sector fragility and European macro-economy as such, but also aims to shed light on the future of the euro as a currency.

I.6. Contribution of this report

The contribution of this report aims to be twofold. In the first part, we evaluate the impact of an exogenous shock on the assets of a systemic bank, both on the balance sheet of the national banking system and on the public finance of the country (be it the country of location of the bank's head office or of a subsidiary). The impact is quantitatively assessed according to different magnitudes of shock and different resolution scenarios. The first part concludes by examining certain institutional arrangements, that could reduce the burden of a sovereign hosting a systemic bank in difficulties, such as burden sharing among the euro area members.

Throughout the report, unless otherwise stated, we have made the simplifying assumption that the SRF is *already* fully in place at the time where the banking sector is hit. Doing otherwise would have forced us to make our conclusions depend on the *time* at which the shock occurs. Indeed, as already said, even though the supervision pillar is already in action the SRF will only grow slowly from 2015 to 2023. The same shock in 2022 is therefore likely to have less severe consequences than in 2016. Our contention is that by assuming the SRF is already in force we can be sure, once again, that the real impact of a shock will be worse than that quantified here - unless it happens in 2023 or later.

This first part is essentially a preparation for the second, whose aim is more ambitious. Part II aims at assessing the macroeconomic impact of a shock on a country's banking system. The viewpoint underlying our approach is that the impact of such a shock can hardly be gauged by just one measure. This is one of the drawbacks of the otherwise very fruitful cost-benefit analysis. The idea that the impact of a public policy can be assessed through only two parameters, i.e. its costs and its (social) benefits, is one of the drawbacks of cost-benefit analysis. Without denying the usefulness of cost-benefit analysis, the second part of this report tries to move beyond this conventional method, by considering a whole range of indices: the evolution of GDP but also underemployment, public debt, private debt, banking credit, investment, government deficit, etc.

On the other hand, the current situation in Europe amply confirms the intuition that a purely financial appreciation of the medium-term consequences of a financial shock would incur the risk of missing important aspects of the problem. Indeed, whereas the financial sphere seems to have opened a new chapter after the financial turmoil of 2007-2009 (and the results of the Asset Quality Review made public by the ECB in October 2014 might tend to confirm this impression), this is far from being the case in the real sphere. To take but one example, half of young people in Greece, Spain, Portugal and Italy are unemployed today (spring 2015).

Moreover, according to an ECB survey on the funding of small and medium companies,²⁰ about 16 % of loan requests were rejected by banks in 2013 in Spain or Italy, whereas in 2011 the proportion refused was only 10 %. Meanwhile, in Germany the rejection rate fell from 6 % to 2.5 %.²¹ This credit rationing is accompanied by an increase in interest rates in the countries of the so-called 'periphery'. While Spanish and German corporates were offered the same spread in 2011, the gap was about 2 % in 2014.²²

The starting-point of our inquiry was therefore the need to model quantitatively the macroeconomic impact of a financial stress of an order comparable to the subprime crash of 2007-2009, and, in particular, to be able to measure how deep the depression induced by a possible deepening of credit rationing could be, especially in the deflationary context that characterizes the euro area in early 2015. For that purpose, the angle of attack adopted here is that of non-linear dynamical systems, inspired by Minsky's financial instability hypothesis. According to this approach, private (not public) debt is a key determinant of the financial instability of an economy. Drawing on this insight, we shall conclude this introduction by explaining why 'it' could happen again in the near future.

1.7. Can 'it' happen again?

If, after all, we had good reasons to believe that a crisis like 2007-2009 has a negligible probability of occurring again in the coming decade, why should the European Union bother to create or upgrade a European Banking Union?

The reason why a new crash might occur in the coming five years lies in the relationship between *private* sector debt and GDP growth. Debt of any kind – government debt, financial debt, mortgages, credit card debt, student debt – is often ignored in mainstream economics by reason of the argument that 'one person's liability is another person's asset' and that the total level of debt therefore has no economic impact.

As documented by Buiter et al. (2012), in 1980 the total non-financial sector gross debt in 17 developed markets amounted to USD 12.3 trillion, or 168 % of the GDP of the countries concerned. In 2011 the total stood at just over ten times that value (USD 128.5 trillion), amounting to 315 % of GDP. As shown by Keen (2009, 2013a), however, the relationship between private debt and GDP is the key factor that drives our economies. The next questions therefore are: 1) who, within the private sector, bears the debt? and 2) how is it evolving right now? The answers are: 1) the larger part of private debt is the debt of the banking sector; 2) private debt is still very high in the euro area today (as well as in the US), sufficiently high to induce a new panic on financial markets as soon as a significant fraction of debtors turn out to be insolvent. Indeed, as shown by Figure 6 below, consolidated private debt (total debt excluding general government) in the euro area was still close to 230 % of its GDP in 2012.²³

²⁰ <https://www.ecb.europa.eu/pub/pdf/other/accesstofinancesmallmediumsizedenterprises201404en.pdf>

²¹ see chart 15, p. 16 in above cited survey

²² Cf. Al-Eyd and Berkmen, 2013, p. 9.

²³ As we shall see in Chapter 2, the ratio private debt/GDP is a much more accurate tool for measuring the risk of financial turmoil than its public counterpart. Be it sufficient here to suggest that Eurostat could complement its quarterly publication of public debt levels in the euro area with the corresponding figures

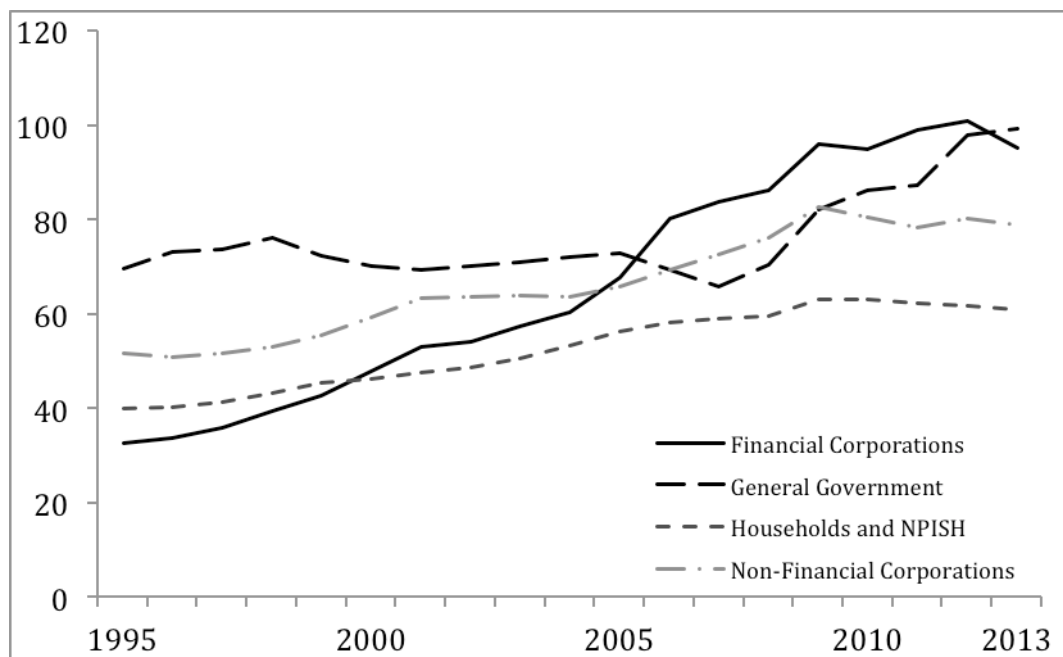


Figure 6 - Consolidated debt to GDP ratios [%] in the euro area (source: Eurostat)

The non-consolidated version of this graph (see Figure 7) is even more alarming but probably more relevant, and confirms that, with a debt/GDP ratio around 95%, public authorities are not the major debtor in the euro area, but commercial banks are (150 %).²⁴

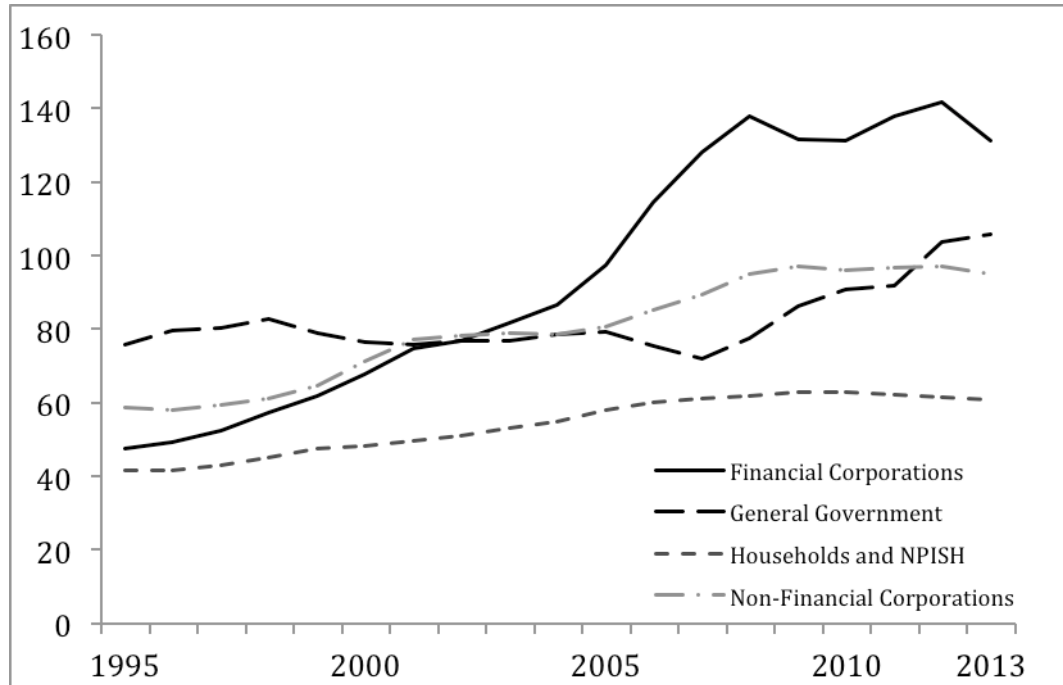


Figure 7 - Non-Consolidated debt to GDP ratios [%] in the euro area (source: Eurostat)

for their private counterparts. Part of the biased focus of public debate on the role of public versus private debt originates indeed, most probably, in the lack of publicly debated figures regarding the latter.

²⁴ Needless to say, deposits are not accounted for in the banks' debts.

At the national level, the situation is quite similar, as illustrated by France (see Figure 8 and Figure 9 below).

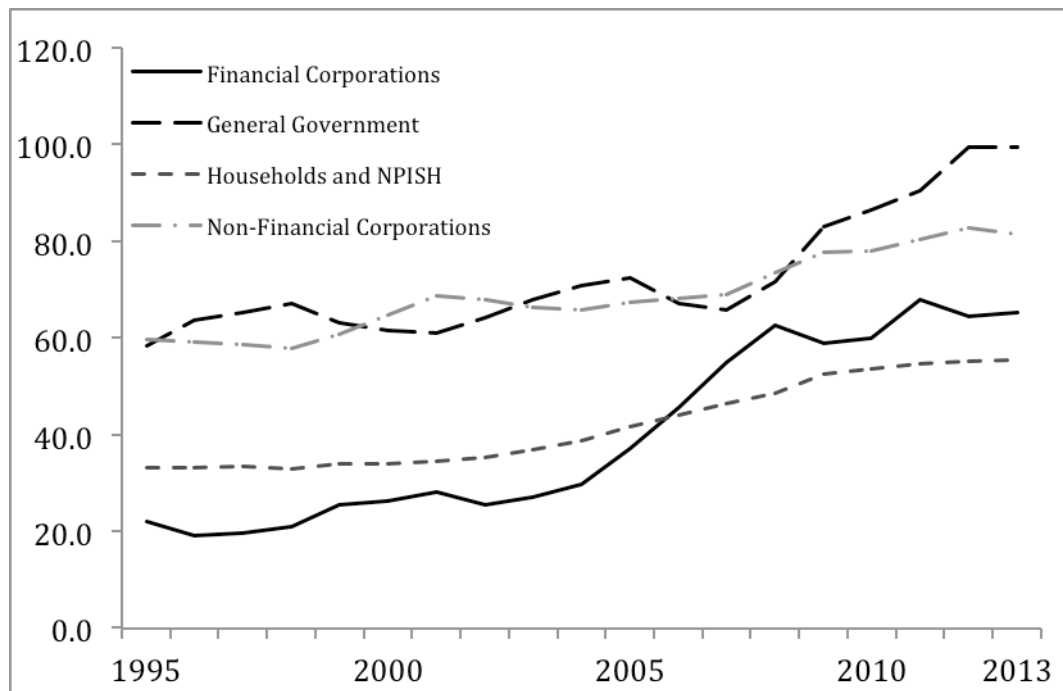


Figure 8 - Consolidated debt to GDP ratios [%] in France (source Eurostat)

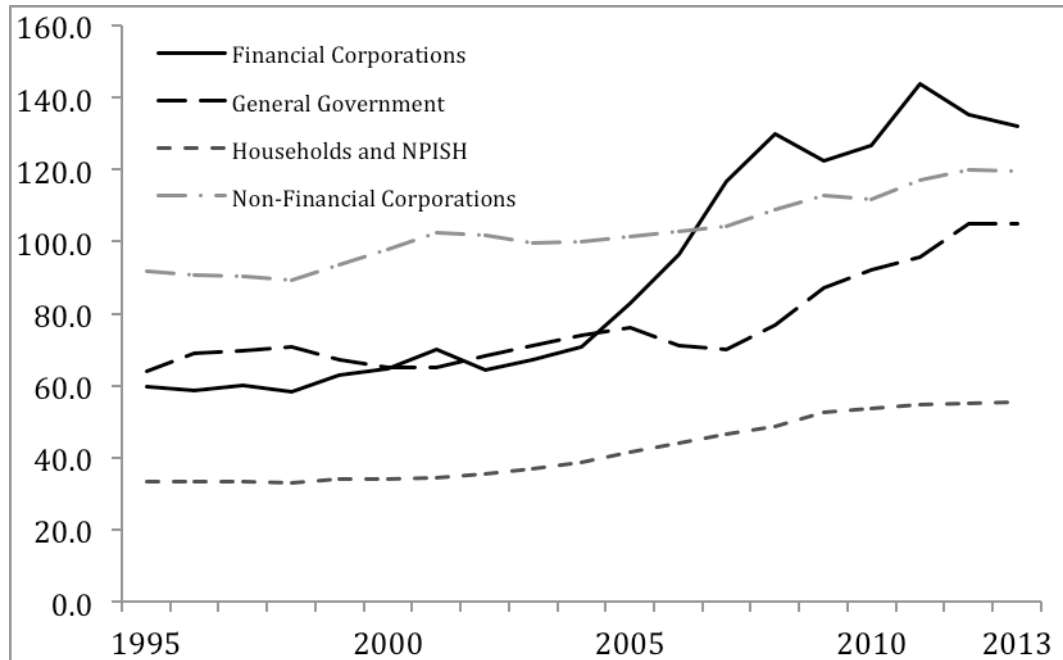


Figure 9 - Non-consolidated debt to GDP ratios [%] in France (source: Eurostat)

Why should this 'moment' occur, when debtors' defaults induce the bursting of the bubble (sometimes called the 'Minsky moment' in the academic literature)? One reason is that, as we already mentioned, the real sphere of the European economy is now largely decoupled from its financial counterpart -the latter having just recently reached historic peaks. Thus, unless the

whole financial sphere grows according to the logic of a Ponzi pyramid,²⁵ or unless the real sphere recovers a rapid growth that will fuel the ability of debtors to pay back their debt in due time, or else unless some way is found to allow private debtors to deleverage without defaulting ... a Minsky moment *is likely to occur*.²⁶

Let us now understand its consequences.

II – What size of shock and how does the SRM work?

Key findings

We take the results of the ECB stress test, New York University (NYU) simulations and historical data as the quantitative foundation for our shock scenarios ranging from -0.3 % asset depletion up to a worst-case scenario of -15 %.

These shocks are then applied to the balance sheet of the banks and absorbed by creditors, the SRF, the ESM, and ultimately governments if necessary, as explained in detail in this section.

Let us begin by highlighting some key tools we use in this first part of our analysis.

II. 1. The leverage ratio

In the first place, we shall emphasise the role played by the mere leverage ratio (i.e. the ratio of equity over balance-sheet size), rather than the risk-weighted ratios on which most of the Basel III methodology is based. The reasons for this choice are manifold:

First, most of the systemic banks we scrutinise in the following pages base their own computation of their respective risk-weighted assets on some home-made risk-model which is not public. It is therefore impossible, within an academic circle, to build on these computations.

Second, all the risk-weighted assets that are used in the banking industry today (be it the home-made models used by banks or the standard model offered by the Basel committee) rely on the Central Limit Theorem, which asserts that it is legitimate to model a series of repeated random events by a Gaussian distribution, provided these shocks are independent and identically distributed. This methodological assumption is crucial, as the Gaussian distribution pervades

²⁵ A Ponzi scheme would be a situation where the speculative bubble could be fuelled *ad libitum* by new debts (that serve to repay old debts), i.e. by perpetual money creation. This might be conceivable on condition that *all* debtors have access to the money printing press (another way of saying that inflation is but one way to escape from the dead end of a generalized overhanging debt). Since in the euro area only commercial banks have access to base money, this implies that, sooner or later, non-bank debtors will be insolvent.

²⁶ According to Vague's rules of thumb (2014), Western economies are still threatened by the sword of Damocles of private debt. Admittedly, it is extremely difficult to try to prophesy which segment of the financial and banking sectors will inflame the rest: insurers, US asset managers, CCPs, Chinese banks ...

most of the financial literature (it is the cornerstone of, for example, the famous ‘Black and Scholes’ approach, still in use today in most of the pricing computations performed by commercial banks.²⁷) As an if-then analysis this is certainly correct. However, the conditions which drive the Central Limit Theorem are almost never met in practice: risks are far from being independent (this is the major lesson to be drawn from the subprime crisis), and diversification does not eliminate risks. Quantitative engineers who have to deal with these issues use sophisticated techniques to circumvent these difficulties, such as copulas, which capture the stochastic dependence across random events. These techniques, however, have their own limitations, among them the fact that we face very scarce time series on which such copulas could be empirically estimated, especially when the random events in question are credit events. As a consequence, most of these techniques are scarcely reliable.

Third and as discussed by Brealey et al. (2010), Demirgüç-Kunt and Detragiache (2010), ‘unweighted equity ratios have been significantly better indicators of bank robustness than risk-weighted equity ratios. From the late 1990s until 2007, unweighted equity ratios of large European banks went down significantly while risk-weighted equity ratios remained roughly the same. Even after correcting for differences in accounting rules, unweighted equity ratios in Europe tend to be significantly lower than for commercial banks in the United States’ (Hellwig (2014)).

As a consequence, and following several academic experts as well as professionals,²⁸ we favour the simpler leverage ratio, whose computation does not rely upon any complicated mathematical assumption. This results in a somewhat different picture of the banks’ balance sheet than that induced by an approach in terms of risk-weighted assets. As recalled by Admati and Hellwig (2013), banks’ leverage ratios were close to 50 % in the nineteenth century, a time where most of them were partnerships (so that their equity was simply the bankers’ own wealth). By the eve of World War I this ratio had fallen to 20 %; by the 1980s, it was no more than 10 %, and today it is little more than 4 %. To offer some examples (see Figures 1 to 3 above), in 2013 the following leverage ratios applied: BNP Paribas 5 %, Société Générale 4.3%, Deutsche Bank 3.4%, Commerzbank 4.9 %, Crédit Agricole 3.1%.

This means, roughly speaking, that a shock hitting the assets of such systemic banks, for instance in the region of -5 %, would induce their bankruptcy. How realistic is the assumption of a 5 % shock?

II.2. Financial shocks: what magnitude?

Our approach is quite standard in the sense that we postulate an exogenous shock affecting a specific banking sector’s assets and quantify its impact. The size of the impact under scrutiny will be crucial for the result. On this point, let us stress the methodological difference between ‘stress tests’, as they are commonly run in physics and engineering, and ‘financial stress tests’ of the type conducted by the European Banking Authorities and the ECB. Physical tests aiming at stressing the strength of materials, for instance, consider a wide range of shock sizes, and

²⁷ To give but one example, the Black and Scholes formula is still used today in order to compute the implicit volatility of securities.

²⁸ See the references already quoted, as well as ASC (2014).

observe with the highest possible accuracy the threshold above which the material in question fails to resist. The next question then becomes: is this shock size realistic in the sense that there is a non-trivial probability of it occurring in 'real life'? If so, this means that the material is definitely too weak. However, independently of the final answer, this method implies that we *must* be able to observe, at least via numerical simulations, the bifurcation point beyond which a car, a satellite, etc. disintegrates. The financial stress tests as conducted by the European banking authorities to date have taken quite a different viewpoint: they choose *one* shock size, and assert which banking sectors would resist under such an exogenous shock. The Asset Quality Review conducted by the ECB in October 2014, for instance, concluded that, under a shock of the size invoked, many Italian banks would turn out unable to resist, while French banks would be able to. This implies that many Italian commercial banks may be presumed to be more fragile than French ones. However, this says nothing about the robustness of the French banking sector *per se*.²⁹ It might be the case, for instance, that with a shock of a slightly larger magnitude several French banks would go under as well.

In other words, testing one shock magnitude, while it definitely provides useful information in terms of comparison of national banking sectors, says little about the effective robustness of each sector itself. This is why we decided to test a large range of shocks, with the aim of identifying, for each country, the thresholds above which negative consequences could be implied by a banking stress.

Which range of shocks can we realistically consider? We decided to leave the door open to as wide a range as possible. To take but one example, according to the ECB asset quality review, an adverse stress scenario could deplete the euro area banks' capital (at least those scrutinised during the Asset Quality Review) by EUR 263 billion.³⁰ In a contrasting estimate carried out using the SRISK³¹ methodology by Viral Acharya of the Stern School of Business (New York University), the same shortfall is found to be as high as EUR 400 billion.³²

Where does the difference come from? On the one hand, Acharya's methodology favours the simple leverage ratio as we do in this report, at the expense of the risk-weighted assets. On the other hand, and this is equally important, Acharya considers that the health of a banking balance sheet should be gauged according to its market value rather than its book value. Again, the financial meltdown of 2007-2009 is a strong argument in favour of such a standpoint: financial markets are those which suddenly provoked the drop in value of Mortgage Backed Securities, independently of their book value. And in case of a banking stress, the key parameter that can convince new investors to lend to a banking establishment currently in distress is not the book value of the establishment's assets, but its instantaneous market value. This simple remark lies at the core of the accounting philosophy underlying the International Accounting Standards (IAS)/International Financial Reporting Standards (IFRS) norms adopted by the European Union in 2005. These norms (especially the IAS39 norm that stipulates the condition under which a financial derivative can be marked to market) have been criticised on the grounds that they introduce speculative bubbles into the accounting measurement of corporates

²⁹ Apart from the trivial assessment that they are less fragile than Italian ones.

³⁰ <https://www.ecb.europa.eu/press/pr/date/2014/html/pr141026.en.html> However, the global assessment of the AQR seems no longer to be publicly available - cf. <https://www.ecb.europa.eu/ssm/assessment/html/index.en.html>.

³¹ SRISK is the amount of capital a firm would need to raise in order to remain functional if there is another financial crisis.

³² Cf. Acharya and Steffen (2013).

(not only banks).³³ However, this does not prevent the market value from being, de facto, the relevant measure for the instantaneous value of a bank in distress, and hence for its ability to survive.

As a consequence, we shall include the magnitude of the shocks envisaged by Acharya as part of the range considered in this report. More precisely, we consider three scenarios of stress

1. the ECB Baseline scenario (3 year cumulated loss);
2. the ECB Adverse scenario (3 year cumulated loss);
3. and the NYU scenario (3 year cumulated loss)

The balance sheet asset reductions to be considered will range from 0.3 % to 15 %, depending on the bank and the scenario under consideration. Table 3 provides the exact magnitudes borrowed from these various sources. For instance, according to the ECB baseline, BNP Paribas experiences a 1.1 % shock, while under the ECB adverse scenario this shock reaches a magnitude of 1.8 %. Under the NYU scenario, it reaches 3.2 %. It should be noted that, for the National Bank of Greece, for instance, the NYU scenario is less 'aggressive' than either of the ECB scenarios.

	ECB adverse scenario [% of tot assets]	ECB baseline scenario [% of tot assets]	NYU scenario [% of tot assets]
BNP Paribas	1,8%	1,1%	3,2%
Banco Santander SA	3,5%	2,5%	2,1%
Bank of Cyprus	5,4%	1,5%	
Bank of Valletta Plc	3,1%	0,9%	0,0%
BBVA	3,1%	2,2%	1,0%
BCEE	0,6%	0,3%	
Belfius	1,1%	0,6%	
BPCE Group	1,5%	0,6%	
Caixa Geral de Depositos	3,3%	1,2%	
Commerzbank AG	1,7%	0,9%	4,4%
Crédit Agricole S.A.	1,8%	0,8%	5,3%
Deutsche Bank AG	0,9%	0,5%	4,8%
Erste Group Bank AG	4,1%	2,1%	3,0%
ING Groep NV	1,1%	0,6%	
National Bank of Greece SA	7,1%	3,6%	0,5%
NLB	6,5%	2,4%	
Nordea Bank	3,0%	1,0%	
Rabobank	1,7%	0,8%	
Slovenska	1,1%	0,4%	
Société Générale	1,5%	0,9%	4,0%
UniCredit SpA	3,2%	1,6%	3,6%
Bank of Ireland	3,4%	1,5%	1,6%

Table 3 - Various shock magnitudes

³³ Cf. Giraud and Renouard (2012).

As for our simulations, we shall complement these figures with much larger shocks up to a 15 % magnitude. This might seem to be an ‘end-of-the-world’ hypothesis but, as shown in Table 4, during the 2007-2009 turmoil, large financial institutions experienced shocks of a 11 % magnitude on average. This implies that even a 15 % shock looks like a reasonable extreme event. The larger study by Kobrak and Troege (2014) amply confirms this assessment (in the second part of this report, we focus on a 10 % shock.)

Table 1- EU consolidated banking data reporting population	2008	2009	Delta
Number of credit institutions			
Stand alone credit institutions	4530	4469	
Banking groups	484	474	
Credit institutions	5014	4943	
Domestic credit institutions	3928	3873	
Foreign-controlled subsidiaries and branches	1086	1070	
Total assets of credit institutions in the sample (EUR billions)			
Domestic credit institutions	37771	34847	-8%
of which:			
Large	29323	26026	-11%
Medium-sized	7443	7833	
Small	1004	989	
Foreign-controlled subsidiaries and branches	7125	8013	

Source: BSC.

Table 4 - 2007-2008: How big was the shock?

The current regulation suggests that banks should absorb a shock of at least 8 % of their assets by bailing in creditors, and that another 5 % of total assets might come from the SRF. At the same time the bank concerned may be refinanced up to a 4.5 % equity ratio.³⁴

This means that a total of 13 % of banks’ assets can be used to absorb losses and recapitalise banks:

$$8\% + 5\% = \text{Loss} + (100\% - \text{Loss}) * 4.5\%.$$

This leads to an overall possible loss absorption of 8.9 %. The remainder (4.1 %) will be used to recapitalise the bank. Above this total possible loss absorption limit, the government would need to step in. In the following section we will scrutinise what influence a split of a bank into a ‘good’ and a ‘bad’ bank may have on the loss absorption capacity.

From a methodological viewpoint, one advantage of having interpreted the 8 % rule as a cap (as it would be, we believe, in any real-life occurrence of the extreme events we focus on) is that this reduces the influence on the outcome of the exact composition of the banks’ balance sheet. What matters essentially is the size of the equity and the amount of recapitalisation needed. In this way, what the current understanding of the resolution procedure says is that the maximal fraction of a bank’s liabilities that will be potentially covered by private funding after 2023 is 8.9 % of the size of its balance-sheet, that is: 8 % by shareholders and creditors plus 5 % by the SRF minus 4.5 % of the resulting balance-sheet (i.e. 4.1 % of the balance-sheet before the shock). Any loss above 8.9 % will involve the taxpayer.

Nonetheless, this is only a rough estimate that does not take into account the scenarios, which we will construct later, or the balance sheets of each institution.

³⁴ Throughout, we have worked with the long term 4.5 % equity ratio target decided by the Basel committee. Hence, we are again rather cautious by anticipating banks to focus on recapitalising and thereby having a better capitalised banking sector when the shock hits.

II.3. Resolution: which scenario?

II.3.a. The government bailout

Despite the efforts of the supervisors to try to clarify what the nature of a resolution procedure would be in case of a banking distress, various options remain as regards the detailed application. Hence it is necessary to state explicitly the various resolution scenarios we have considered. We do not claim that any of these scenarios has a better chance to be put into practice if needed. At least, each of them seems compatible with the current rules of the Banking Union.

Let us suppose, therefore, that a systemic bank experiences a shock of the kind described in the previous subsection. Ultimately the Single Resolution Mechanism (SRM) will be the authority instructing a resolution to the national authorities³⁵, and the cascade of responsibilities involved will run as follows. The SRM is constructed with the objective that resolution is carried out without recourse to national taxpayers' money. Any resolution costs will have to first be borne by the bank's shareholders and creditors. As we shall see shortly, under most scenarios this should be sufficient to absorb shocks of a small magnitude. If additional resources are needed, the Single Resolution Fund can come into play. It should be noted that, even should the Fund's resources turn out not to be sufficient to absorb the initial shock, the SRM would not be able to force a Member State to provide extraordinary public support to a bank resolution.³⁶ Whatever the scenario considered, we shall assume that the government ultimately bails out the resolution bank, in order to prevent any systemic contagion effect. Indeed, the Lehman experience has shown that 'too big to fail' is not a myth: Letting a bank fail can indeed have catastrophic consequences, and can be much costlier than a bailout. We therefore assume that any government will automatically bail out a systemic financial institution if all the procedures that are programmed by the Banking Union have proven insufficient. Nonetheless, this potential bailout has to comply with the rules set out by the BRRD, state-aid rules and SRM legislation.

The desire to avoid a repetition of the post-Lehman panic will certainly force financial and monetary authorities to do whatever it takes to avoid a banking distress having a contagion effect on international markets for financial derivatives. Indeed, the large size of the derivatives portfolios owned by most systemic banks, and their high interconnectedness, make an assessment of the potential impact very unclear.³⁷ Knowing, neither who might be impacted, nor to what extent, is certainly a shortcoming regulators should address by collecting more information.

³⁵ http://ec.europa.eu/finance/general-policy/docs/banking-union/140328-technical-briefing_en.pdf

³⁶ http://europa.eu/rapid/press-release_MEMO-14-295_en.htm

³⁷ It is worth recalling that derivatives represent a total of USD 780 trillion, i.e., approximately 52 times the world's GDP. Contrary to what is often alleged, this notional value does not boil down to any more reasonable level once 'appropriate' netting is taken into account, since these netting operations are not made when a default occurs. French banks, for instance, possess approximately 40 times France's GDP from their balance sheet via derivative assets. Indeed, the largest part of financial risk is not captured by the banks' balance sheets.

The greater proportion of derivatives is now traded on compensated markets, so that, in principle, a clearinghouse should be able to tackle the default of a counterparty. One might suspect, however, that several of those houses would themselves go bankrupt if such an event took place.³⁸ Consequently, there is little doubt that no European government will ever take the risk, at least, within the next decade, of letting a systemic establishment fail (hence automatic bailout) or even of defaulting on derivatives markets.

Similarly, we shall make the assumption that the ECB will always intervene in order to guarantee the liabilities of a systemic bank in distress in the European interbank market. The latter is indeed one of the major channels through which a contagion phenomenon could spill over, converting a local distress into a continental financial meltdown. Thus, by construction, all the bank's debts on the interbank market (e.g. its short positions in repos³⁹) will be secured by the ECB. Moreover, we assume that the Central Bank does this at no cost, essentially by printing base money if needed. As is now well documented, this additional amount of money is not inflationary per se once it is understood that the Money Multiplier theory is erroneous.⁴⁰ The Fed and the ECB (as well as the Bank of Japan) have proved in the recent past that they are perfectly able to react in this way. The ECB's Securities Markets Programmes in 2010 and 2011, its Long-Term Refinancing Operation in 2011/2012, and, last but not least, its announcement of Outright Monetary Transactions in September 2012 all seem to have been motivated by a widely shared sense that European financial institutions are weak, financial markets are jittery, and financial instability is undermining the stability of the financial system and the macroeconomy.

II.3.b. How does the SRM step in?

This having been said, how will the resolution mechanism proceed *before* the government intervenes (if so needed)? The answer depends on the date when the stress is assumed to take place.

Before the Single Resolution Mechanism and the Bank Recovery and Resolution Directive enter into force, bank crises will continue to be managed on the basis of national regimes. However, these regimes are set to converge increasingly towards agreed principles of resolution, in

³⁸ Cf., e.g., Duffie and Zhu (2010). Central Counterparty Clearing houses (CCP) are not at the heart of our study. Thus, we shall be brief on this topic: They probably concentrate 40% of the risk on (large) derivatives markets, and their ability to provide counterparty insurance is key to the global managing of liquidity on such markets. This is the reason why the ECB legitimately asked that all CCPs dealing with euro transactions be located within the euro zone. However, the European Court of Justice has rejected this demand. Today (April 2015), approximately three quarters of euro transactions take place in London – and therefore in a place where the ECB has no mandate for supervision and where a major failure of any CCP would presumably mean powerless European financial and monetary authorities having to face a financial hurricane.

³⁹ Whether this assumption is realistic can be disputed, given the size of a number of banks' liabilities on the Repo market (e.g. EUR 89.13 billion for Deutsche Bank), but our conclusion would obviously be even more pessimistic were we not to make this assumption.

⁴⁰ On this unduly controversial issue, cf. the recent report by Bank of England economists (McLeay et al. (2014)), the less recent one by a former senior vice-president of the Federal Reserve Bank of New York (Holmes (1969)), as well as Giraud (2014). Cf. Chapter 2.I of this report for a brief discussion.

particular the allocation of bank losses to shareholders and creditors instead of taxpayers. This is achieved by the revised guidelines on state aid to banks adopted in July 2013.⁴¹

The SRM will be funded by transfers of the contributions raised by the national resolution authorities to the national compartments (to be merged after a transition period of 8 years) of the Single Fund. The mutualisation of the funds available in the national compartments should be implemented at a 60 % rate over the first two years and 6.7 % in each of the remaining six years. The SRM Regulation will be applicable from 2016, together with the bail-in provisions under the BRRD, with certain specific exceptions: thus, for example, the provisions relating to cooperation between the Board and the national resolution authorities for the preparation of the resolution plans will apply from 1 January 2015.⁴²

For our analysis it is fair to abstract from these aspects of the SRM (which are dealt with in the Regulation⁴³) and simply assume that, as the crash takes place, the SRM is already able to provide EUR 55 billion. Thus, we can ensure that our results cannot be accused of being overly pessimistic, as it is clear that, if the shock occurs before 2023, the outcome will necessarily be worse than our figures suggest.

Moreover, the order of payment is the following (more details in the appendix below):

Step 0: A shock hits the assets of a systemic bank.

Step 1: The bail-in of shareholders takes place.

Step 2: Bail-in of creditors (hybrid securities, subordinated debt and senior debt) up to 8 % of total assets. Indeed, ‘burden-sharing’ by private investors in a bank is a condition of public support from national and European resources (including the European Stability Mechanism ESM). Big depositors might be bailed in as well if needed.

Step 3: Bailout by SRF.

The BRRD as of January 2015 is unambiguous about the fact that creditors of repo liabilities will not be concerned by the Step 2 bail-in. Big deposits (>EUR 100 000) are potentially eligible for bail-in, converting what was initially believed to be extraordinary bail in the case of Cyprus into the regulatory norm. The BRRD is careful to present the 8 % threshold as a floor:

‘Where those exclusions are applied, the level of write down or conversion of other eligible liabilities may be increased to take account of such exclusions subject to the ‘no creditor worse off than under normal insolvency proceedings’ principle being respected. Where the losses cannot be passed to other creditors, the resolution financing arrangement may make a contribution to the institution under resolution subject to a number of strict conditions including the requirement that losses totalling not less than 8 % of total liabilities including own funds have already been absorbed, and the funding provided by the resolution fund is limited to the lower of 5 % of total liabilities including own funds or the means available to the resolution fund and the amount that can be raised through ex-post contributions within three years.’⁴⁴

⁴¹ See IP/13/672: http://europa.eu/rapid/press-release_IP-13-672_en.htm?locale=en

⁴² http://europa.eu/rapid/press-release_MEMO-14-295_en.htm

⁴³ http://europa.eu/rapid/press-release_MEMO-14-295_en.htm

⁴⁴ Directive 2014/59/EU of the European Parliament and of the Council, OJ L 173, 12.6.2014, p. 190.

There are at least two extreme ways to interpret this paragraph. The first would claim that, as soon as the 8 % threshold of bail in has been reached, the SRF steps in. This would de facto turn the 8 % 'floor' into a cap. The second hermeneutic, on the contrary, would conclude that all eligible creditors will have to be bailed in before the SRF intervenes and that, moreover, the latter will do so only provided the 8 % threshold has already been reached. Presumably, the BRRD has been conceived and formulated having some intermediary situation in mind, under which reasonable efforts would be made to force eligible creditors to assume their share of the losses - but not necessarily of *all* losses - and the SRF would intervene at some moment after the 8 % threshold has been reached. How long 'after' remains controversial. Nonetheless, for the purpose of this report we have had to take a clear-cut stance on this issue at the cost of incurring the risk of being accused of making a somewhat ad hoc assumption. As a matter of fact, we believe that the vagueness of this 'intermediary' situation, as we can foresee it ex ante, should not distract us too much. It seems to us that, in the extreme event of a systemic bank being on the verge of bankruptcy, the Single Resolution Board in charge of managing the resolution procedure (usually within a few days) will have very little margin of freedom: The risk of a bank run on the part of creditors (which would only make the resolution more difficult) will most probably force the Single Resolution Board to ensure them that they incur no bail in risk. Hence, for the sake of pragmatism and since we are focusing on extreme events, we have made the assumption that the SRF will step in as soon as the 8 % threshold has been reached -that is, we have adopted the first interpretation.⁴⁵

Throughout our scenarios, we assume that public authorities never choose to liquidate a bank. Thus, in our scenarios and despite the semantic ambiguity attached to the word, 'resolution' always means restructuring.

In order to enforce a restructuring, the SRM has the following tools at its disposal:

Sale of business tools

The Resolution Authority (RA) can force the sale or transfer of shares, assets and liabilities of the failing institution to the market.

Bridge institution tool

The RA can force the sale or transfer of shares, assets and liabilities of the failing institution to a public entity designed for that purpose.

Asset separation tool

The RA can force the sale or transfer of shares, assets and liabilities of the failing institution to a public or partially public asset management vehicle designed for that purpose.

Government financial stabilisation tool

When applying other resolution tools to the maximum extent practicable is not sufficient to maintain financial stability or protect public interest, the Member State could, as a last resort, offer public equity support or impose temporary public ownership.

And, last but not least, there is **the bail-in tool**.

⁴⁵ Such a situation is clearly anticipated in the BRRD of January 2005 (see paragraphs 72 and 73).

The question arises as to whether the bank in question will be split into a 'bad' and 'good' bank, and to what extent SRM, ESM and government funds will be needed afterwards. Historical data⁴⁶ from state aid cases following the financial crisis tells us that an average of 10-30 % of assets from banks were transferred to 'bad' banks. The remaining 70-90 % of assets were left in 'good' banks, which were then recapitalised.

The split ratio influences the size of the required recapitalisation (the larger the bad bank the lower the recapitalisation needed for the good bank). In what follows, we assume that the bad banks would consequently be backed 100 % by state guarantees.

Coming back to the possible loss absorption capacity, the ratio of good bank assets over total pre-shock assets appears as follows:

$$8\% + 5\% = \text{Loss} + (100\% * \text{share of good bank} - \text{Loss}) * 4.5\%.$$

The highest possible loss before governments step in is achieved with a 70 % good bank asset ratio. This leads to maximum loss absorption of 10.31 % (given that equity has been absorbed completely).

We will simulate both scenarios. The consequence is that, whenever all the equity has been absorbed by the shock, public authorities either need to recapitalise the whole defunct bank or the good bank and guarantee the assets of the bad bank. For simplicity, we shall assume that they intervene so as to ensure that the resurrected bank will be Basel-III compliant, i.e. so that its new equity represents 4.5 % of the total remaining viable assets. The SRF, ESM and government cover these costs, in that order.

Before turning to the government and the ESM as the European fund paying up for them in case of sovereign difficulties we create different scenarios describing who exactly bears responsibility for which parts of the bank in question. These are as follows:

1. When a bank is in distress, only its home country takes the burden of bailing out the whole group.
2. The country hosting the group's headquarters only bails out the national part of the bank, not the international subsidiaries, which would be taken care of by their host countries. This procedure has the obvious advantage of allowing a share of the burden, but this share is proportionate to the size of each subsidiary. Direct application of such a rule would put Luxembourg in a difficult situation, since the size of the subsidiaries that are located in the Grand Duchy, as already pointed out, largely exceed its fiscal capacity.

⁴⁶ According to Competition State Aid Brief, Issue 2015-01, 112 banks in the EU received state aid in the wake of the financial crisis, representing 30 % of EU banking sector assets (~EUR 11.3 trillion). EUR 1 288 billion were provided in liquidity and asset guarantees to banks and EUR 671 billion in capital and loan injections. The ECB's consolidated banking data show that the total assets of the banking sector in the EU fell by EUR 2.9 trillion between 2008 and 2009. Hence, EUR 11.3 trillion in total assets of banks in receipt of state aid participated in the asset depletion of EUR 2.9 trillion: for simplicity's sake, we will assume they took on all the losses. In order to establish the pre-shock size of the assets that would later on be collected in bad banks, we argue that a bottom line is provided by the amount of guarantees put into place, i.e. EUR 1288 billion, while an upper limit is provided by the guarantees plus the loss (assuming that only the bad bank's assets took on a loss) minus the injections towards the good bank: EUR 1 288 billion + EUR 2 923 billion - EUR 671 billion = EUR 3 540 billion. Hence, the real size of these assets must be somewhere between EUR 1 288 billion and EUR 3 540 billion, which represents ~10 %-30 % of the pre-shock assets of EUR 11.3 trillion. Therefore, on average, the bad bank's share of pre-shock assets is most likely to lie between 10 and 30 %. At the micro level this fraction can vary significantly.

3. Thus, we shall also explore a third option under which the entire burden of bailing out a bank is shared across all the euro area members (not just those which host a subsidiary or the parent company) and proportionate to the GDP of each country (hence, proportionate to its fiscal capacity and not to the size of the bank located there).

One may argue that procedure B would have the virtue of providing an *ex ante* incentive to countries not to host too many banking groups and subsidiaries. This might even provide an indirect incentive to make them refrain from practising tax dumping, with the purpose of attracting foreign banks to set up entities and operations in a country. The recent revelations of the Luxembourg leak, suggest that specific tax rules might explain the extraordinary size of the banking system in Luxembourg relative to its GDP. Again, we do not claim that any one option should be preferred to any other.

The Appendix provides a more systematic description of the various scenarios we have considered, depending on the options highlighted above.

Step 4: Intervention of the European Stability Mechanism (up to EUR 60 billion), should the necessary bailout after the bail-in of creditors and the SRF intervention induce a 'significant' deterioration of the public balance sheet. Here, we are faced with a political decision, which can hardly be entirely anticipated with purely economic arguments. Relying on the European Union Member States interventions observed during and after the sovereign crisis that began with Greece in January 2010, we postulated that the ESM intervenes only if the country's 10-year bill interest rate jumps above 6 %. In order to model the impact of the public bailout on the sovereign debt yield, we follow Dell'Erba et al. (2013) by assuming the following (empirically grounded) mechanism:

1 % p. Increase in public debt/GDP ratio $\rightarrow$ 0.025 % p. Increase of government debt yield

More sophisticated behaviour rules could have been thought of in order to account for the political decision to let the ESM step in or not.⁴⁷

Step 5: Bailout by the state.

After the bail-in, SRF intervention and the potential ESM intervention, the government is assumed to bear the remaining funding needs in order to absorb losses and recapitalise the bank.

Next to the financial details of the resolution mechanism there are the procedural details, briefly explained in Figure 10. We would like to highlight at this point that the current set-up of an actual restructuring is too complex in the light of the urgency of handling an acute banking crisis, and that national bailouts remain a possibility. Whether governments ultimately are forced to step in or not, and whether the link between banks and sovereigns is finally broken, will be sought to be explained in the examples that follow.

⁴⁷For instance, several macroeconomic models conclude that whenever the rate of a country's public debt increase rises above its GDP growth rate, then the country in question will most probably not be able to pay back its debt. This remark would suggest a reasonable criterion for the intervention of the ESM, but its application would go beyond the scope of this report.

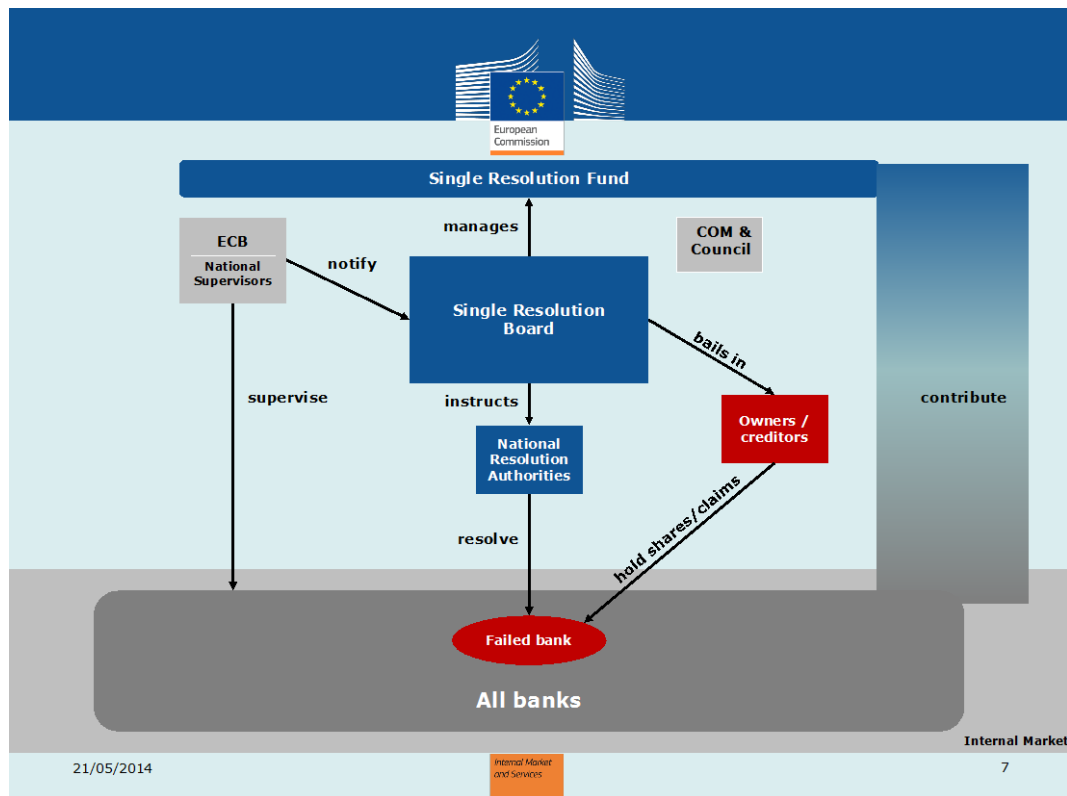


Figure 10 - Cartography of the resolution actors⁴⁸

⁴⁸ From technical briefing of provisional agreement on the proposed Single Resolution Mechanism for the Banking Union, 20.03.2014: http://ec.europa.eu/finance/general-policy/docs/banking-union/140328-technical-briefing_en.pdf

III. Testing the proposed SRM framework

Key findings

Our computations suggest that, even if it had been already in place in 2014, the SRM would not have been able to absorb a medium-sized shock of 10 %, analogous to the one banks experienced in 2008, let alone a larger shock of 15 %. Therefore, the very objective of the Banking Union will be achieved in 2023 only for small-sized shocks. Given a shock in mid 2014, the ESM would cover Greece, Portugal and Cyprus, but other countries would not be, given the criteria set out for support.

For the sake of concreteness, let us examine two examples: Bank A (Netherlands) and Bank B (Cyprus).⁴⁹ We underline that the selection of these two banks were made in order to have two representative, but different examples. We do not have any information indicating that any of these two banks would now or in future need public support.

III.1 Bank A (Netherlands)

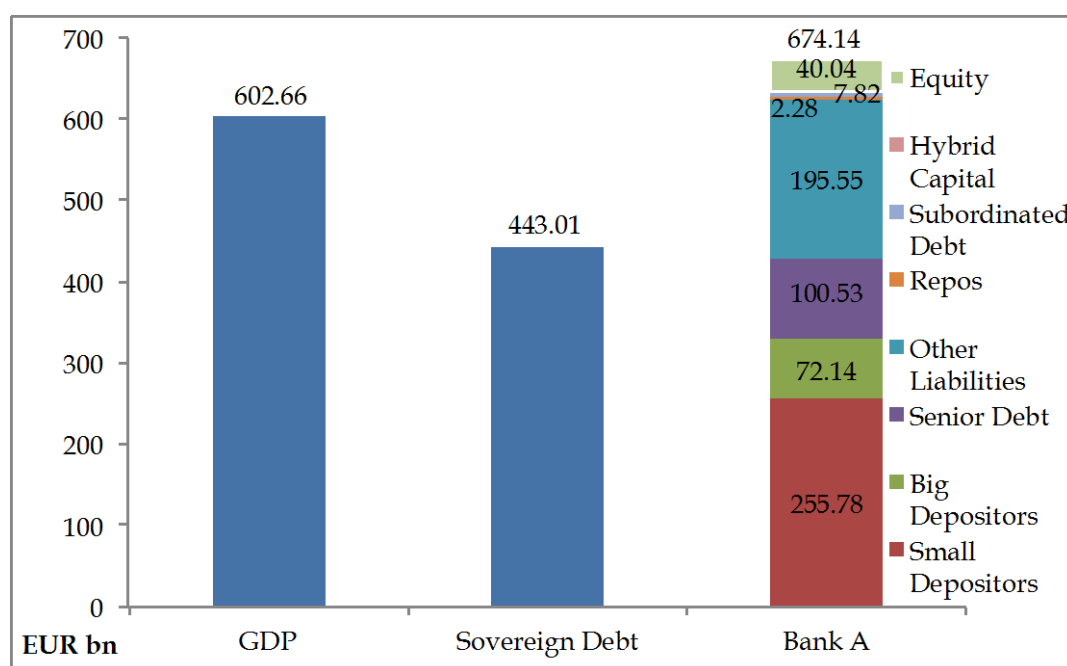


Figure 11 – The balance sheet of Bank A (2013)

Figure 11 puts Bank A's balance sheet in perspective. Suppose that Bank A incurs a loss of 15 % of its assets' value (EUR 101.12 billion).

⁴⁹ The examples shown are based on actual banks in these countries. The data is taken from Bankscope (Bureau van Dijk) – accessed via the ESCP Europe databases throughout the month of September 2014.

Step 1: The shareholders first bail in, and lose the total equity of the bank, i.e. EUR 40.04 billion. The remaining loss to be absorbed amounts to EUR 61.08 billion. The effective 8 % cap on losses for creditors means a total possible loss of EUR 53.93 billion.

Step 2: Subordinated debt is EUR 7.82 billion and is entirely absorbed by the shock as well. Repo liabilities on the interbank market amount to EUR 2.28 billion, but will not be bailed in under the proposed regulation. The other liabilities of the bank would be large enough - EUR 195.55 billion - to absorb the remaining losses, but will not be bailed in either under the proposed regulation. The effective 8 % cap means creditors will lose 'only' an additional EUR 6.1 billion. Thus, senior creditors are asked next and absorb the missing EUR 6.1 billion in losses - a minor loss compared to their total exposure of EUR 100.53 billion. In the case of Bank A all creditors up to senior debt had to be bailed in completely or partially, but big depositors were not concerned. At the end of Step 2, there remain EUR 47.19 billion losses to be absorbed.

Step 3. How much is needed to restructure Bank A at this stage? As already said, there remain EUR 47.19 billion losses, but public authorities also need to recapitalise the bank. Whether or not the bank is split into a good and bad bank or not will influence the cost of recapitalisation⁵⁰. In the case of no split, an additional EUR 27.91 billion will have to be found. In order to demonstrate the influence of a split into a bad and good bank, we consider the largest conceivable bad bank's size (30 % of pre-shock assets).⁵¹ This would reduce the recapitalisation needs to EUR 19.54 billion. Nonetheless, the government would have to guarantee the assets of the bad bank with EUR 202.24 billion. These guarantees are less relevant to our investigation since we focus on actual cash flows and debt levels. Unless guarantees are called upon, they will remain outside the balance-sheet of the home sovereign. Hence, we assume that these guarantees are not called upon within the timeframe of our study (a more conservative approach would treat them just as public debt). Thus EUR 75.1 billion or EUR 66.7 billion still need to be found (i.e. 12.5 % of the Netherlands' GDP), depending on the decision to split the bank or not (EUR 75.1 billion - no split). In both cases, this exceeds the maximum amount that the SRF could provide. This maximum is capped by the 5 % upper limit of the bank's total assets, that is, EUR 33.71 billion.⁵² Thus, after the SRF's intervention, there still remain EUR 41.4 billion (no split) or EUR 33 billion (split) to be funded.

Step 4. The potential government bailout of Bank A would lead to Dutch public debt increasing from EUR 443.01 billion to EUR 484.4 billion (no split) or EUR 476 billion (split), inducing an increase of the public debt/GDP ratio from 74 % to 80 % (no split) or 79 % (split).⁵³ This implies that the 10-year government yield would presumably jump from 1.96 % to 2.2 % (no split) or 2.15 % (split).⁵⁴ According to our scenario, this modest impact should not lead the ESM to step

⁵⁰ Whether, in a concrete situation, authorities will have time to enter into the tough and complicated process of separating bad from good assets depends upon the urgency of the liquidity threat faced by the troubled bank. In the case of the Kerviel crisis at Société Generale (early 2008), authorities had to make a decision within 48 hours.

⁵¹ Cf. footnote 41 above for a discussion.

⁵² Were this limit absent, one could imagine that the SRF would be able to borrow the EUR 20.1 billion (EUR 75.1 billion minus 55 billion) lacking in its own balance sheet - a hypothesis we shall not explore in this report.

⁵³ Here we make the disputable assumption that the Netherlands public debt will remain constant over the period 2014 to 2023. Any other assumption, however, would be equally disputable.

⁵⁴ Again, here, we assume that the Netherlands' yield in 2023 will be comparable to its yield at the end of 2014. Our 'educated guess' also presumes that the markets would not anticipate that the additional public guarantee will be called upon sooner or later.

in, since the resulting fiscal health of the Netherlands still remains viable, even after the government bailout.

Step 5. Ultimately the Dutch government intervenes with EUR 41.39 billion (no split) or EUR 33.02 billion (split) in order to restructure Bank A.

The financial impact for different shock sizes on Bank A is summarized in Figure 12.

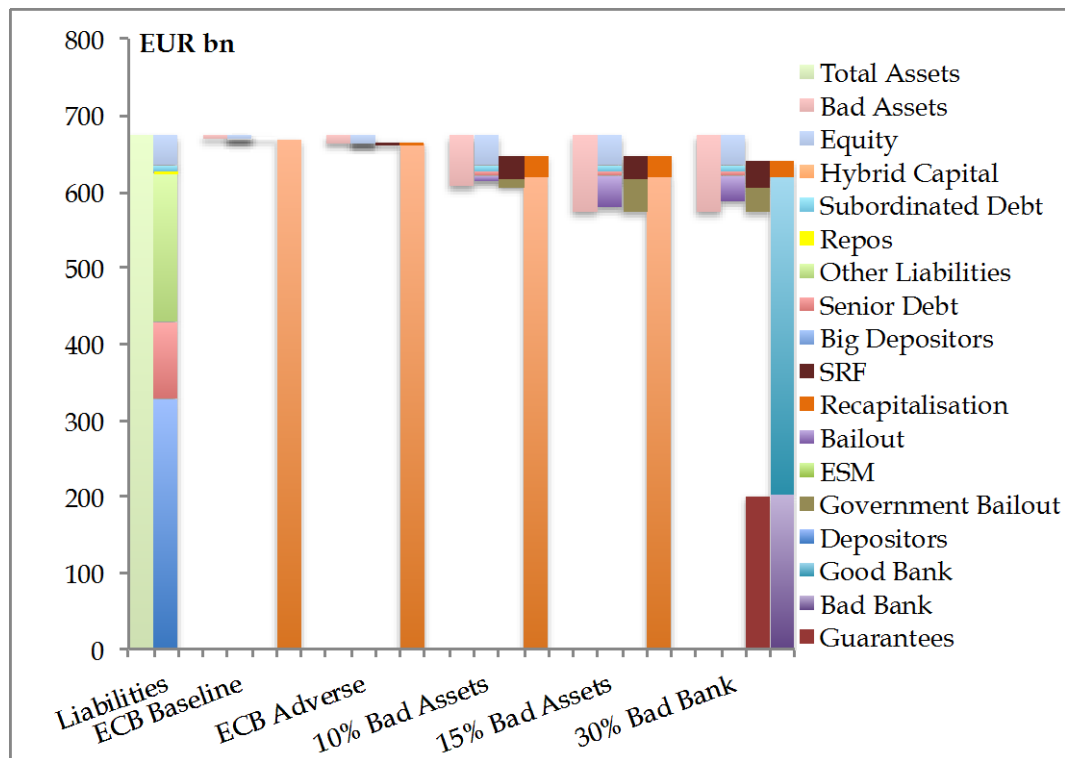


Figure 12 - Financial impact of a shock on Bank A with HQ host country responsibility

What does this concrete example tell us? First, that the ECB scenarios entail so small a shock (0.8 % and 1.7 %) that it can be entirely absorbed by the bank's equity. Second, that even under a large shock comparable to the 2007-2008 meltdown (15 %), the crisis would be quite manageable by the Netherlands, as we just saw, and the split into bad and good banks would only have a marginal impact on the necessary recapitalisation. Thirdly, however, it may be doubtful to credit this robustness to the Banking Union set-up. Indeed, the contribution of the SRF to the bailout of the bank amounts to EUR 33.71 billion, while the Dutch taxpayers' contribution amounts to EUR 41.39 billion. In other words, what ensures the viability of the current situation is the healthy public finance situation of the Netherlands. As we saw, this contribution could have been paid for by senior creditors and / or 'big depositors'.

In terms of public policy, this prompts the following question: what guarantee do we have that placing the burden on the shoulders of the taxpayers has a smaller recessive impact than if it were to be shared by a larger subset of (senior) creditors and/or by big depositors? In the second case the number of people directly affected will be smaller, but this cannot be an argument in favour of either of the two options: the wealth that needs to be subtracted from the

national economy is the same in both cases. This calls again for the kind of exercise we run in the second part of the report, that is: assessing the macroeconomic impact of the options implicitly chosen by the Banking Union architecture.

Again, the ECB shocks are so small that they do not affect the bank's balance-sheet structure beyond its equity. If we interpret the current rule concerning the 8 % limit as a floor rather than a cap, public intervention might be significantly lower. For a 10 % shock (losses of EUR 67.41 billion), a complete senior debt bail-in would absorb the rest of the loss of EUR 19.56 billion to be absorbed by senior creditors in the default order set out by the Bank Recovery and Resolution Directive. For a 15 % shock (losses of EUR 101.12 billion), the contribution of senior debt reaches EUR 53.3 billion. Nonetheless, we assume that the SRF finances the recapitalisation back to a 4.5 % equity ratio. Hence, the SRF would ultimately bear EUR 27.3 billion. Interpreting the 8 % limit as a floor would save the Dutch government finances in both scenarios, but our assumption throughout our calculations is that effectively the SRF will be called to provide assistance as soon as the 8 % limit is reached.

III.2 Bank B (Cyprus)

Let us now turn to another example where, this time, the ESM does step in.

As shown in Figure 13, for a 10 % shock (and a fortiori for the lower shocks scrutinized by the ECB), the ESM does not need to intervene. However, for a 15 % shock it does, and pays out EUR 1.56 billion to protect Cyprus from a new sovereign crisis. The SRF, on the other hand, has to provide EUR 1.52 billion. When choosing to split the bank into a good and bad bank, the ESM would intervene with EUR 1.18 billion due to the lower recapitalisation need. Having noted the limited impact of a split into a bad and good bank in our previous example, we focus in the rest of our study on the no-split case. The reasons for this are twofold: 1) we concentrate on extreme events that will most probably force regulators to act swiftly, so that there would be little time to split a troubled bank into a good and bad bank; 2) alternatively, even if the authorities had enough time to disentangle good from bad assets in the balance sheet of a troubled bank, one could adopt a conservative viewpoint and treat public guarantee in the same way as public debt is treated by the Maastricht criteria. According to this standpoint, whether authorities do split or not has little relevance.

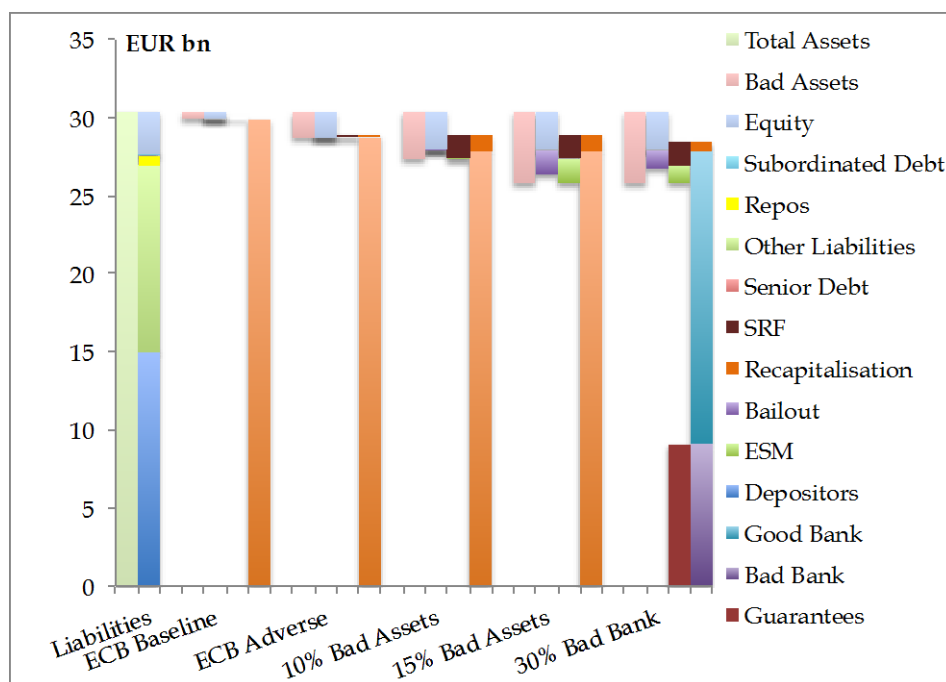


Figure 13 - Financial impact of a shock on Bank B HQ host country responsibility

As for the ECB scenarios, the corresponding asset depletion is so low that it can be entirely absorbed by equity. Nonetheless, in the adverse ECB scenario the equity ratio falls below the 4.5 % target and a recapitalisation by the SRF fund is necessary, but only one that is small in magnitude (EUR 0.2 billion).

III.3. General results

All the results of our simulations are available on request. Let us simply draw some preliminary lessons from this purely financial analysis.

Consider a 15 % shock, and look at its transversal impact on all the systemic or nationally significant banks within the euro area. The potential bailout responsibility lies with the country hosting the headquarters (cf. Figures 14 and 15). Except for the Greek, Portuguese and Cypriot banks in our sample (which are potentially bailed out by the ESM), all other banks would need a government intervention. For BNP Paribas, the French government would need to inject EUR 145.5 billion – EUR 55 billion being covered by the SRF just in order to fill the hole induced in the balance sheet by the assets' depletion. Of which EUR 74.53 billion are necessary for the recapitalisation of the bank, which gives a total of EUR 145.5 billion, in circumstances where the ESM will not step in. The German government would need to inject approximately EUR 124.5 billion for a possible 15 % shock to Deutsche Bank's balance sheet. Supposing that the four French systemic banks were hit simultaneously by a 15 % shock to their assets, this eventuality would cost around EUR 414.5 billion in total (to which further billions would have to be added if the event were to occur before the SRF is fully in place, i.e. during the next 8 years).

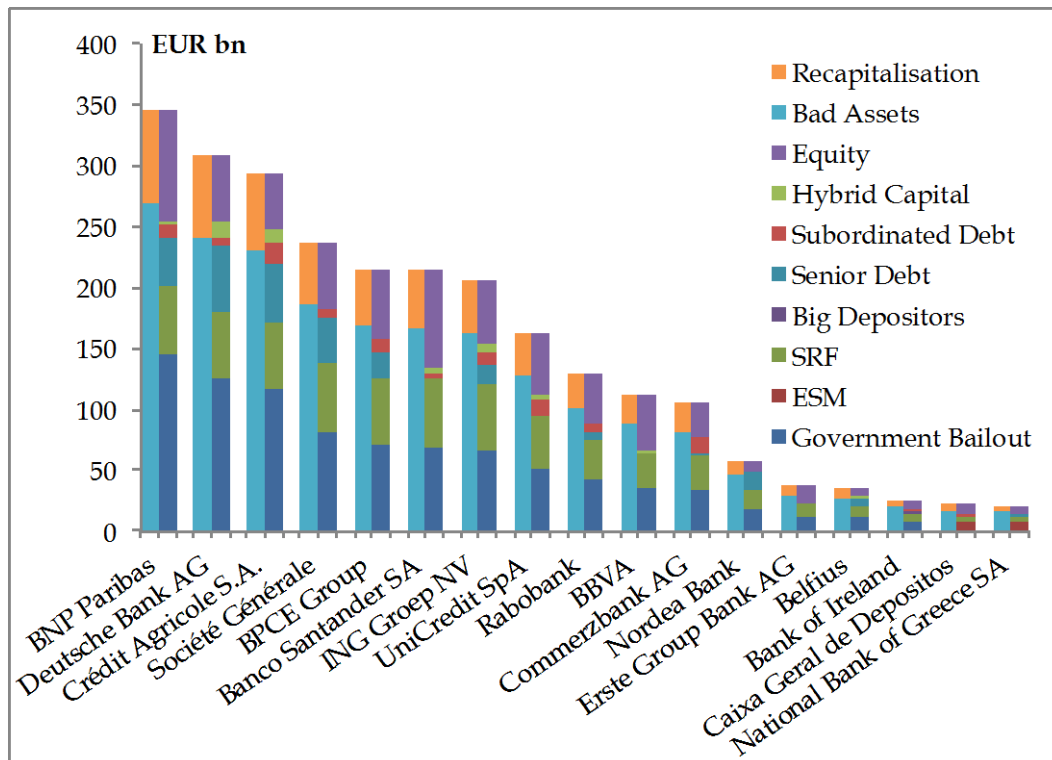


Figure 14 – 15 % shock - Transversal impact with HQ burden sharing

For the Bank of Cyprus, Caixa Geral de Depósitos and the National Bank of Greece, as illustrated in Figures 14 and 15, the ESM would step in before the state.

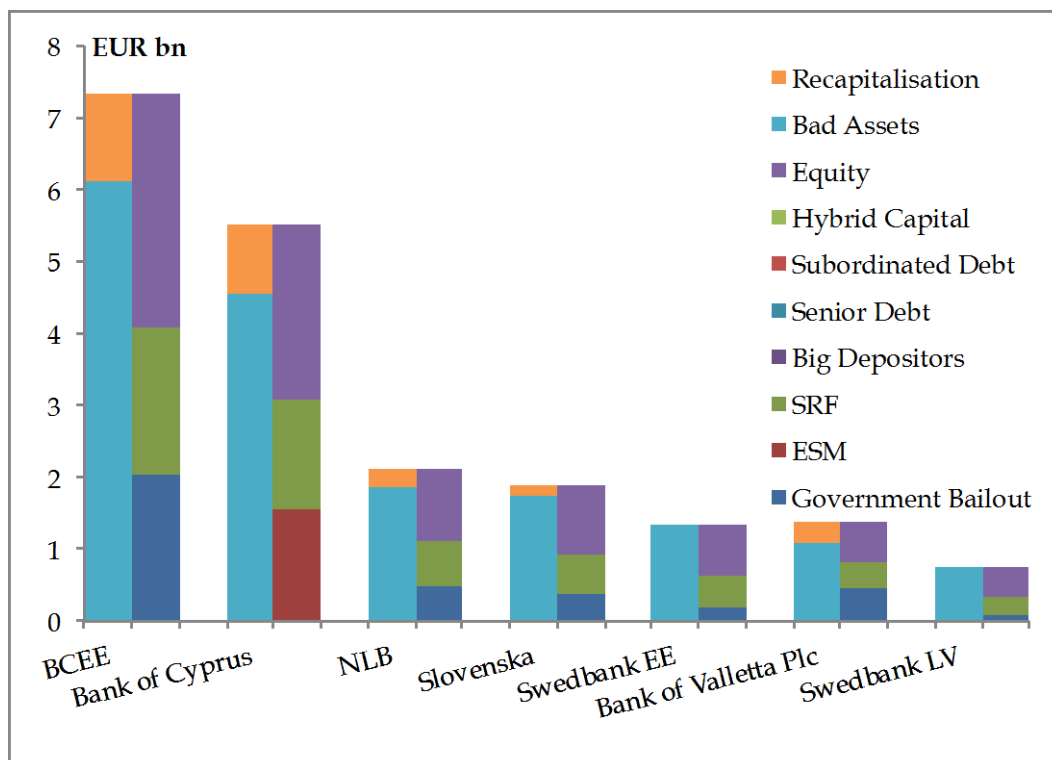


Figure 15 - 15% shock - Transversal impact with HQ burden sharing

A 10% shock as illustrated in Figures 16 and 17 would see governments involved for the majority of the systemic and significant banks in the euro area, excepting the banks of Latvia, Estonia, Slovenia, Slovakia and Luxembourg. Cyprus, Portugal and Greece are covered by the ESM. Interestingly, all major banks would require a government intervention in case of a more moderate 10% shock.

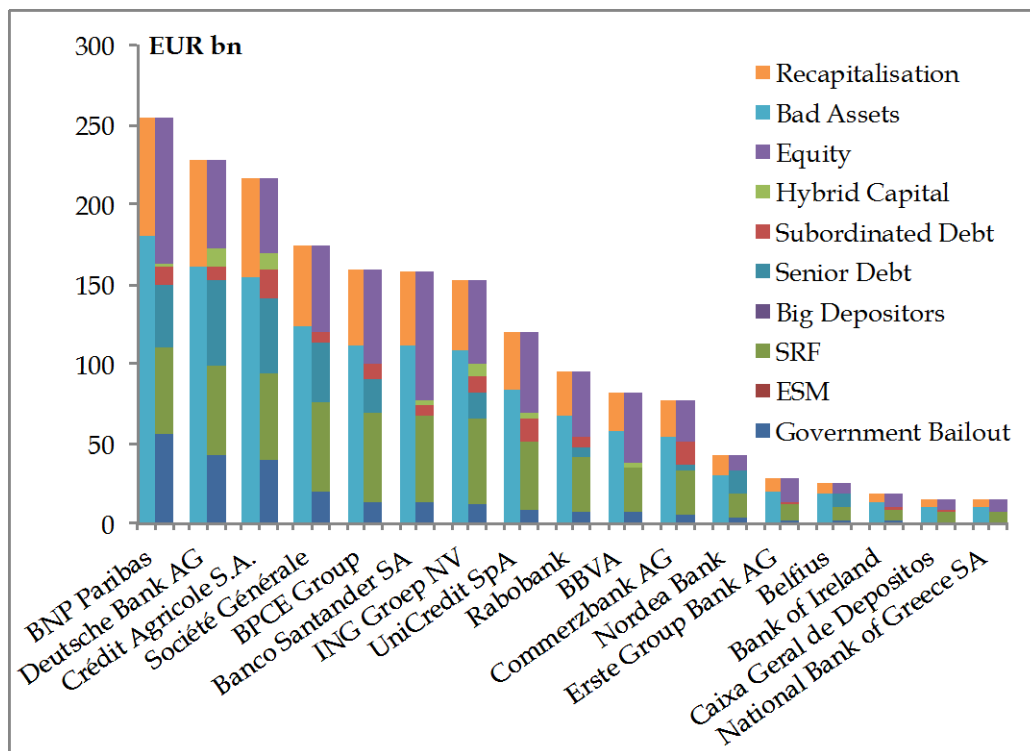


Figure 16 – 10 % shock and HQ shared burden

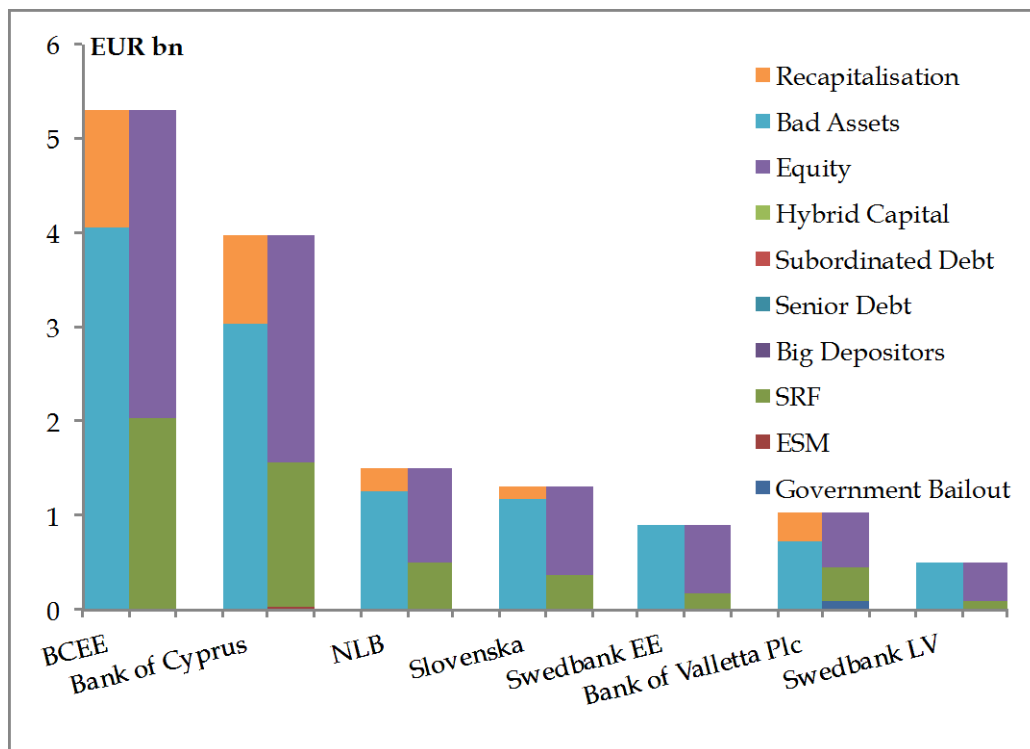


Figure 17 – 10 % shock and HQ shared burden

For smaller shocks, such as those considered in the ECB adverse scenario, Figures 18 and 19 show that the capital shortfall is too small to involve other creditors than equity. Nonetheless, the SRF would intervene in order to recapitalise the banks above the 4.5 % equity target ratio.

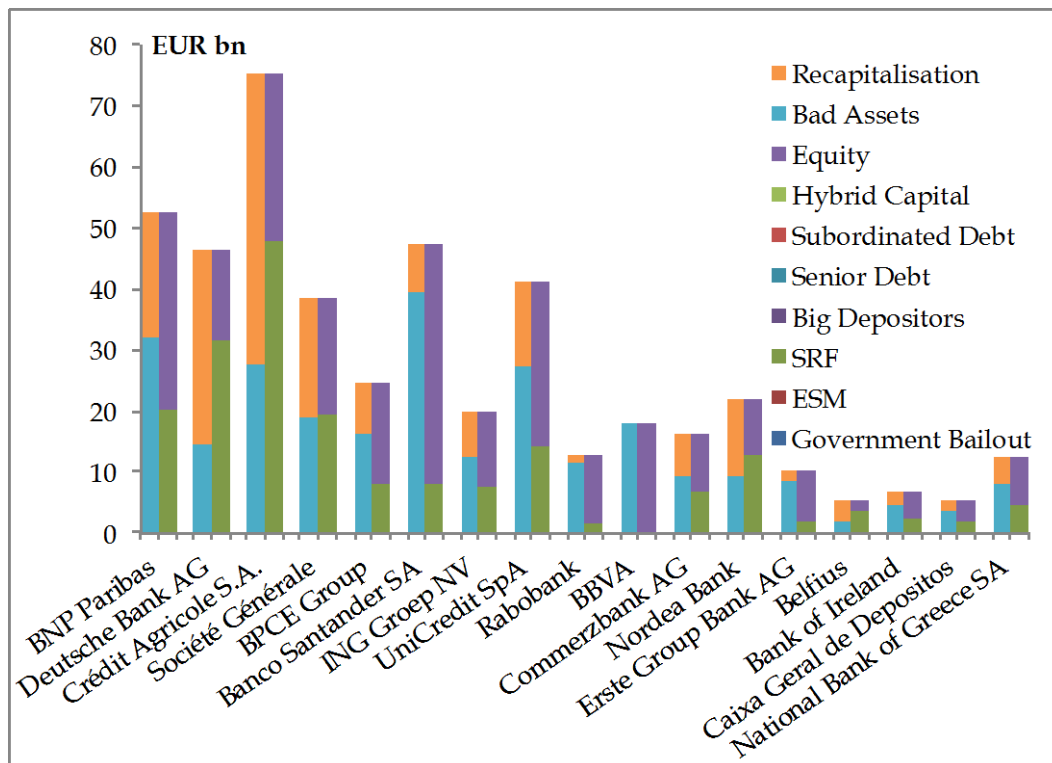


Figure 18 - ECB adverse scenario - HQ burden sharing

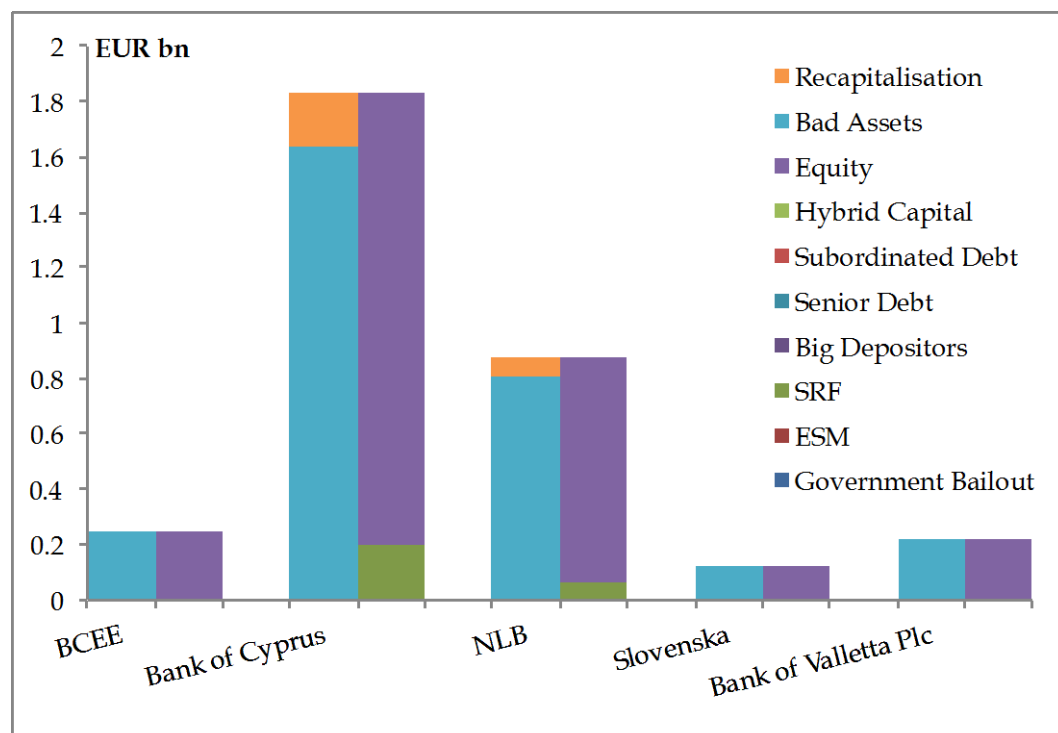


Figure 19 - ECB adverse scenario - HQ shared burden

IV.1. How to improve the resolution scheme?

Key findings

In order to protect the European taxpayer, a more promising approach seems to consist in a systematic bail-in of senior creditors and big depositors. A federal sharing of the bailout burden across euro area sovereign members is another means of reducing the individual burden and avoiding letting one sovereign encounter severe difficulties. This can be achieved either by letting each host country of a subsidiary take responsibility for that entity or by sharing the burden of the bank restructuring proportionate to the GDP share of each euro area country.

What improvements to the SRM could be implemented? One obvious solution would consist in increasing the size of the SRF. This would certainly alleviate the cost for the taxpayer, but it should be equally clear that a marginal increase of the SRF would not suffice since, as we have just observed, the bill would easily exceed EUR 100 billion for, say, the French government in case of a 15 % shock. Is it realistic to imagine a EUR 165 billion SRF? Given the current negotiations led by commercial banks and their national supervisors in order to exempt their contributions to the national resolution fund from taxation, the answer is likely to be negative - or else, presumably, a significant fraction of this increase in the size of the SRF would have to be paid by the taxpayer, which would simply amount to involving the taxpayer in the ex ante funding of the next banking crisis.

IV.1. Senior creditors and big depositors

Alternative tracks seem more promising. The first would consist in considering the complete bail-in of senior creditors and big depositors as being mandatory (instead of leaving this decision in the hands of the government and public authorities, who will have to make extremely urgent but complex decisions within a few days). This would consist in generalising the Cypriot scenario that eventually unfolded in 2012 at the euro area level. Our computations (see Figures 20 and 21) suggest that this would suffice to spare the taxpayers a 15 % shock, with one exception. As we assume that the recapitalisation would be paid for by the SRF, ESM or governments, it follows that France, in the case of BNP Paribas, would have to bear a recapitalisation cost of EUR 68.86 billion while EUR 55 billion would be paid out by the SRF; however, EUR 13.86 billion would still be asked for from the French taxpayer. This is clearly a symptom of 'too-big-to-fail'. Furthermore, Deutsche Bank and Crédit Agricole would still demand government involvement.

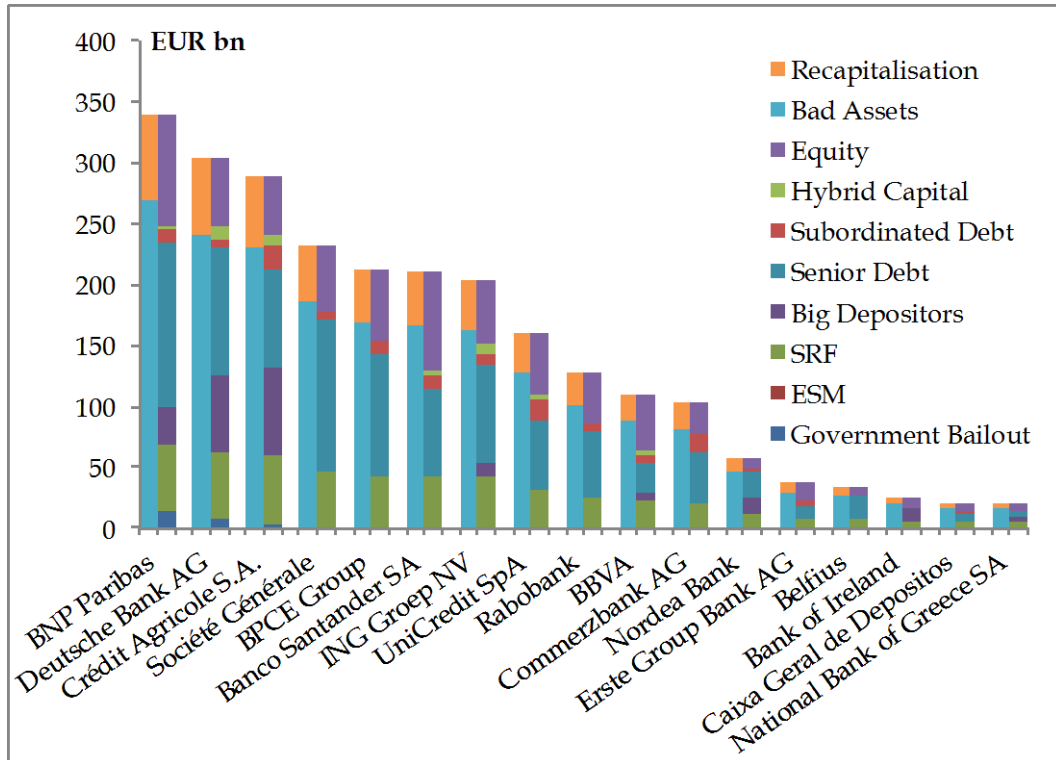


Figure 20 - 15 % shock and complete senior debtors' and big depositors' bail-in; HQ host country responsibility

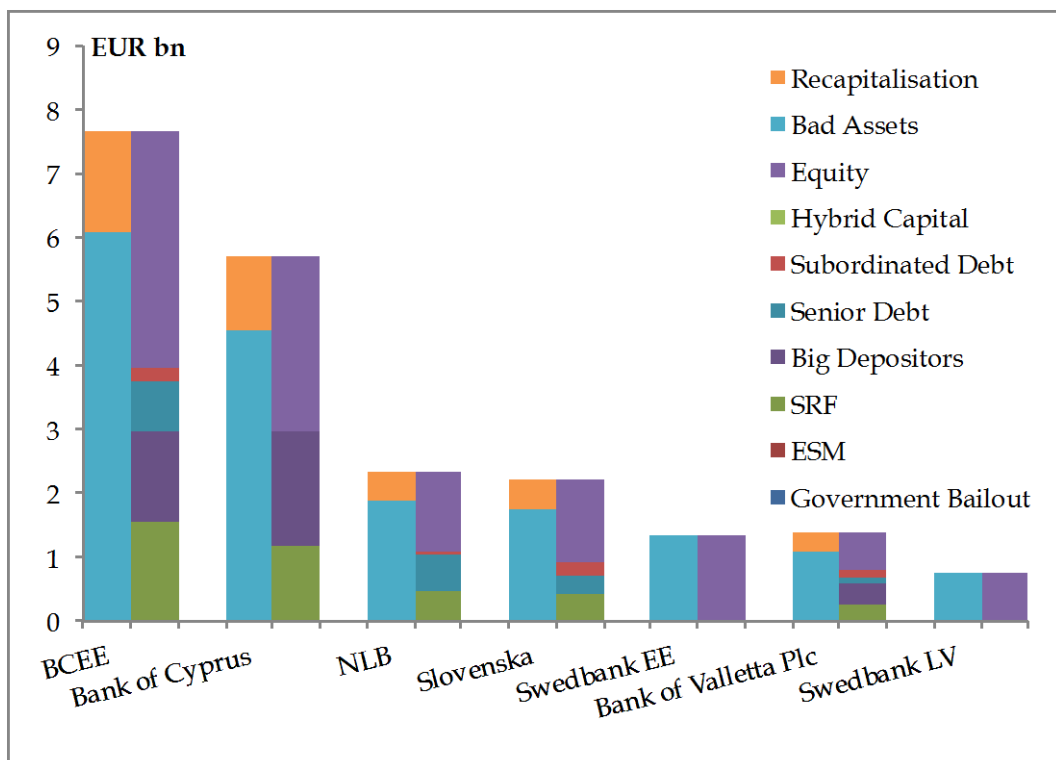


Figure 21 - 15 % shock and complete senior debtors' and big depositors' bail-in; HQ host country responsibility

We argued for the forced inclusion of senior debt and big depositors taking our harshest scenario, but the same applies to the 10 % scenario. The more gentle ECB scenarios are not severe enough to require even a senior debt bail-in.

IV.2. Sharing the burden among European taxpayers

The second avenue that could help upgrade the SRM's effectiveness in the face of large shocks would consist in sharing the burden across the countries, which host subsidiaries of the problem bank. It goes without saying that the network of each bank's subsidiaries is a key factor for assessing whether one should distribute the resolution burden in accordance with each host country or let the headquarters' host country manage the whole banking group. Let us illustrate this with an example. If we suppose that a French Bank C is hit by a 15 % loss, Figure 22 illustrates the impact of such an event on five euro area countries in which subsidiaries of Bank C are present.

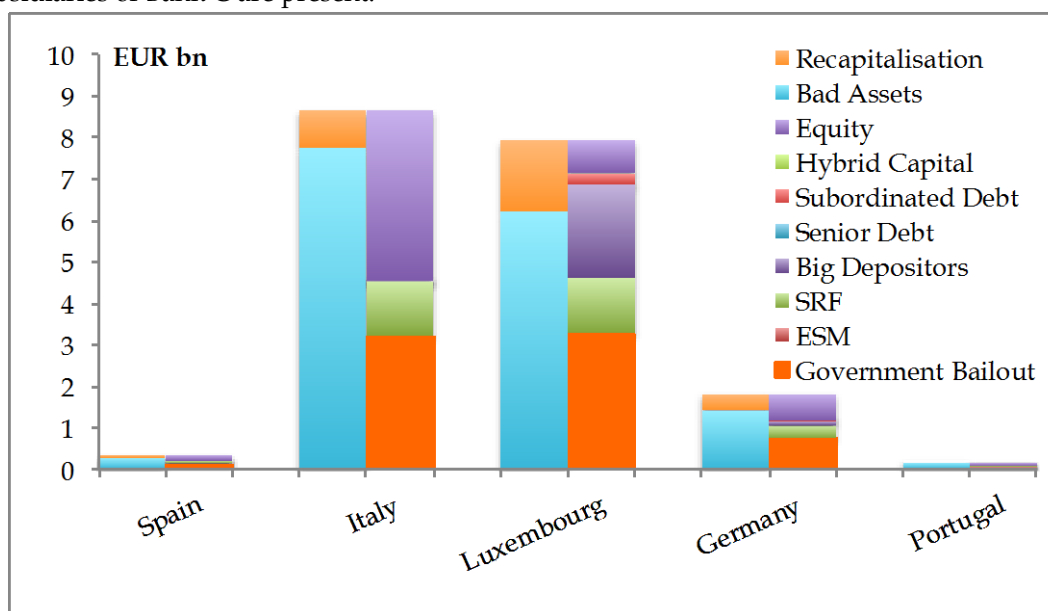


Figure 22 - Impact of a 15 % shock on Bank C through its subsidiaries

If the burden is distributed according to the size of the subsidiary, it turns out that the SRF must intervene in all five countries. Figure 22 shows that taxpayers are asked for a bailout, with the one exception of Portugal, where the ESM would step in. Should the taxpayers of Italy, Germany, Spain and Luxembourg pay for the bankruptcy of a French systemic bank? Our purpose here is not to take a stance on this question but, rather, to simply show that there *is* an issue.

On the other hand, France might have an incentive to include other countries in sharing the burden. This depends solely on the distribution of 'bail-in-able' liabilities across the subsidiaries of the group. In the case of Bank C there is little incentive to do so, but there are certainly cases where a government might opt for this solution, as we have seen in the case of the bailout of Dexia, where France, Belgium and Luxembourg were involved.

Whether senior debt and big deposits are bailed in or not has a much more significant effect on the country hosting the headquarters office. A similar conclusion could be reached by analysing the other systemic banks we have scrutinised.

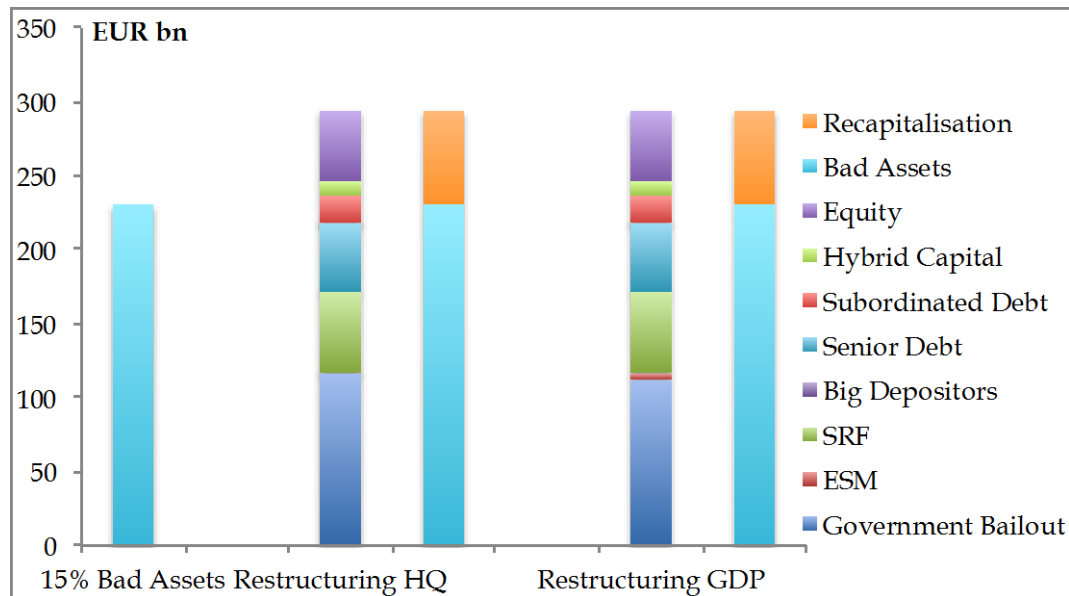


Figure 23 - Impact of a 15 % shock on Bank C in France

Last, but not least, a third alternative distribution of the burden can be examined, under which *all* euro area countries accept their part of the resolution cost (not just those which host the headquarter (HQ) or a subsidiary), but this time each contribution is computed not according to the respective weight of each subsidiary but, rather, proportionately to the GDP of the country itself. Figure 23 shows the impact of such an institutional sharing in the case of a 15 % shock hitting French Bank C, by comparison with HQ host country burden sharing. Figure 24 shows each country's and institution's contribution. The French state would obviously pay less since Germany would suddenly bear the biggest part of the bailout. Cyprus, Greece and Portugal could not be asked to contribute at this stage, and the ESM would step in for them.

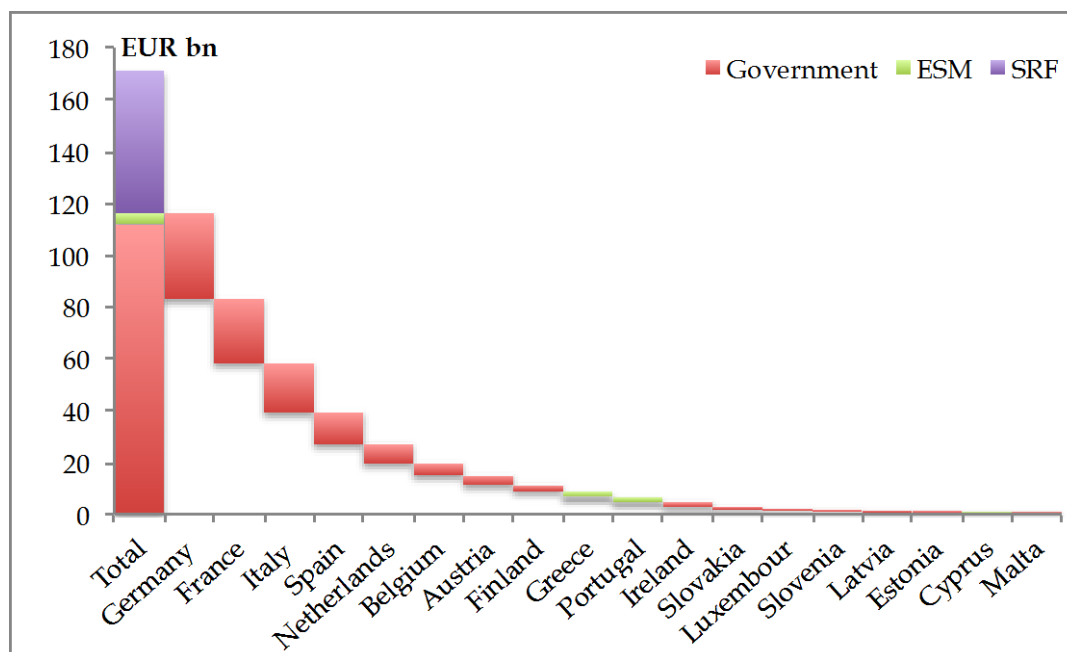


Figure 24 - Impact of a 15 % shock on Bank C with burden shared according to GDP

Since Germany is the biggest single contributor to the SRF, taxpayers in that country would indirectly bear the highest burden. Is this simulation politically realistic? Probably not, but it suggests the kind of fiscal solidarity that would be required by a march towards a centralised management of a unified European Banking Union. Needless to say, this would provide a strong incentive for each country to exert pressure on the ECB to perform efficiently as a supervisor.

IV.3. Provisional conclusions

To summarise, our findings are the following:

Small shocks, such as for example the ECB scenarios, would not involve a government bailout, but the SRF might step in to recapitalise banks falling below the 4.5 % equity ratio target.

This optimistic conclusion fails as soon as any of the provisos just recalled are not met. In particular, even if the 2023 set-up were in place today, a larger shock (in the region of 10-15 %, similar to what was experienced by European banks in 2007-2009) would lead to the step-in of taxpayers should the largest European systemic banks (especially French) be endangered. In this sense, the SRM can neither prevent involvement of government funds. A similar conclusion arises should the shock hit single large banks in the next 2 or 3 years (the 2023 device not yet being in place) or hit several such large banks simultaneously (even after 2023).

As to which improvement could enable the SRM to face such big shocks hitting the largest European banks, three proposals have been explored.

1. The systematic bail-in of senior creditors and big depositors seems to be the most efficient solution. This would call for a generalisation of the Cypriot scenario. The major drawback of such a solution, however, is that it could potentially place a number of European banks on the verge of trouble on the very same day when it was decided: anticipating danger and feeling they are no longer in a safe place, creditors could indeed react by withdrawing their savings and stopping interbank overnight and short term lending, at the risk of immediately provoking a liquidity crisis.⁵⁵
2. On the other hand, sharing the burden of the resolution cost, according to the balance-sheet size of the headquarter and subsidiaries of a troubled bank, turns out to have a marginal impact on the distribution of costs.
3. Finally, sharing the total burden according to each country's GDP is an alternate way of spreading the cost. This third option might be considered, but probably only within the context of a strong political dynamic towards a European fiscal federalism.

⁵⁵ The very fact that they did not react this way after the resolution procedure had been adopted (and even after its most recent version was made public in the BRRD of January 2015) reveals that they have interpreted the 8 % threshold as we did, namely as a cap rather than a floor.

Chapter 2 – The MACROECONOMIC COST of an INCOMPLETE BANKING UNION

This second part is devoted to analysing the macroeconomic consequences of the potential financial turmoil described in Part I. After all, these consequences - in terms of GDP growth, unemployment, sovereign and private debt, etc. - are major policy drivers. They should therefore be at the front of an assessment of the 'cost' of a potential new financial crash. We take over from the first part the size of the necessary government bailout, selecting for each country the worst-case scenario among all our scenarios. Regarding the shock size, we have chosen 10% ⁵⁶. Hence, our results reflect the less severe shock scenario but, as we will see, this scenario will bear already significant economic costs.

In order to assess the economic costs of a repeated financial crisis we argue for a new kind of macroeconomic model, which will then be calibrated to the euro area economies.

This chapter is organized as follows: first, we argue for a new macroeconomic model; next, we explain in what configuration we apply our scenarios to this model and present the results of the simulations for representative cases; and finally, we summarise the results for all countries concerned and draw conclusions.

I - The need to renew monetary macroeconomics

Key findings

A dynamic analysis enables us to show the medium-term costs to the economy of a large exogenous banking shock, while most equilibrium models (especially Dynamic stochastic general equilibrium (DSGE) models), being linear, are only relevant in the short-run and for small shocks.

For this purpose, a model is needed which exhibits the following features relevant to our analysis:

1. The non-neutral effect of money on the real economy (that is, the fact that an increase in the quantity of money does have a real effect on output and employment both in the short and medium run);
2. An out-of-equilibrium dynamics, which allows for studying the medium-run impact of large shocks (by contrast with most equilibrium models which, being linear, are relevant only for small shocks and in the short-run);
3. An aggregate approach that allows for emergence phenomena (i.e., that does not prohibit *a priori* the possibility of complex aggregate behaviours arising from the aggregation of millions of individual behaviours);

⁵⁶ At 10% Latvia, Estonia and Slovakia, will not see a government involvement. That is why we take a 15% shock for these countries.

4. A banking system with endogenous money creation (i.e., where the ability of commercial banks to create money *ex nihilo* is made explicit);
5. An explicit impact of private debts on the economy by contrast with many models based on the “representative agent” assumption, where, by construction, private debts cannot be taken into account (since the single agent “representing” the whole private sector cannot have debts owed to himself).

In the first part of this report, we offered a static analysis of the cost of a new shock. The results varied depending on the size of the shock, the country and/or systemic bank in question, and the extent of implementation of the bail-in/bailout procedure by the European authorities. Thus far, our analysis remained entirely static in the sense that we did not try to assess the impact of a shock in the short to medium term (up to 2.5 years). It can be presumed that a purely static approach would miss the feedback loops that could deepen the intensity of the recession (deflationary pressure will probably induce pessimistic perspectives in the case of corporates and lead to lower investment, which in turn leads to lower credit demand, thus making the task for banks to recover profitability even harder, while rising unemployment will probably downsize households' demand for goods, etc.), as well as the endogenous forces that will enable the private sector to rebound (rising underemployment will presumably prevent wages from increasing, thus helping firms improve their profitability, etc.). In order to take due account of these various dynamic narratives, a quantitative macroeconomic and financial model was needed.

This part is organised as follows: in section 1, we briefly explain why we decided to build a somewhat new monetary macroeconomic model in order to provide the assessment just alluded to; in section 2, we informally describe our model; section 3 is devoted to analysing our simulations; and the final section presents our conclusions. Technicalities are explained in the Appendix.

The monetary macroeconomic model, which we use to reach the conclusions mentioned above, possesses a number of features that distinguish it from several traditional models (especially, those belonging to the DSGE tradition⁵⁷). In this section, we briefly explain why a different approach was needed.⁵⁸

Our standpoint is based on ideas going back to Hyman Minsky's ‘instability hypothesis’ and Irving Fisher's debt-deflation theory. Minsky (1957, 1970, 1982) says that, intuitively speaking, markets are rarely spontaneously in a stable equilibrium state; therefore, instability phenomena and out-of-equilibrium dynamics should be at the core of any economic study involving modern economies. Fisher (1933), on the other hand, showed that an overhang of private debt (as in the early 1930s in the US, in the early 1990s in Japan, and since 2008 in the Euro area) might lead to a deflationary trap. It seems, especially since 2008, that these two features cannot be sidestepped in any sensible diagnosis of the financial situation of the euro area.

⁵⁷ See, e.g., Acurio et al. (2015) for a recent example.

⁵⁸ Most of the remarks that follow concern elements underlined as being urgently needed for a renewal of economic modelling at the INET congress held in Paris in April 2015.

Here is a list of some features which pervade most conventional macroeconomic models, and which we need to avoid if our aim is to capture financial instability and deflation:⁵⁹

Treating a complex monetary market economy as a barter system. Surprising, as it might seem, many standard models treat the macroeconomy as a barter game in which money is either absent (Real Business Cycles) or neutral in both the short and the long run. *Neutrality* of money means that the quantity of circulating money has no impact on the economy, apart from pinning down the absolute level of prices. According to this view, market forces drive the relative prices while the quantity of money (pumped in by the Central Bank) fixes their absolute level. If this were true, the quantitative easing policies put into practice by many central banks since 2007 would be nonsensical, as they would be unable to claim to have any influence on the real economy (on, say, the level of investment, economic activity, unemployment, etc.).

There exist general equilibrium models in which money is non-neutral in the short run⁶⁰. Thus, this first criterion would not suffice to justify disregarding every general equilibrium model. However, other criteria enter into play.

Assuming that the macroeconomy is either always in equilibrium (partial or general, perfect or imperfect), or that it will return to equilibrium rapidly if disturbed. Can the turmoil of 2007-2009 be adequately captured as an equilibrium phenomenon?⁶¹ It is well known today that we can model a (rationally) speculative bubble by means of some equilibrium framework⁶². However, this implies, when coupled with the (otherwise standard) rational expectations hypothesis⁶³ that a crash can only occur as being a rare event in a thin tail of risk distribution - or, to put it metaphorically, as a 'black swan'⁶⁴. In a sense, it is unfair to try to analyse the impact of a financial crash within a framework that is not suited to such an event, or where such an event can only occur with a negligible probability. On the other hand, if we consider the financial planet as a whole, it has experienced financial turmoil every 4 years on average since the onset of financial deregulation in the 1980s. Thus, whether we can truly consider crashes as being 'black swans' remains an open question. For this reason, it seems legitimate to us to explore an alternative approach under which every economic phenomenon is not necessarily viewed *ex ante* as taking place *at equilibrium*.⁶⁵

⁵⁹ See, e.g., Keen (2012), from which analysis we take inspiration in this discussion.

⁶⁰ Cf., e.g., Dubey and Geanakoplos (2003); Krugman and Eggertson (2012).

⁶¹ 'Equilibrium', in the economic sense of the word, does not just refer to market clearing or accounting consistency: it represents a spontaneous adjustment of all market forces, by analogy with mechanics.

⁶² Giraud and Pottier (2014a); Pottier and Giraud (2014).

⁶³ The 'rational expectations' hypothesis postulates that a 'rational' individual is someone who can accurately foresee the future. Such an assumption is utterly unrealistic, although widespread in the contemporary economic literature. Our point, here, is not to discuss the general relevance of such an assumption but to make it clear that it is not suited for the study of a crash: if a crash occurs, under such an assumption it should have been foreseen by everyone from the start. Its impact should therefore have been immediately damped by the back-up that everyone should rationally have adopted in advance. This is why most models relying on rational expectations usually conclude that crashes are not as terrible as popular wisdom claims they are.

⁶⁴ Cf. Nassim Taleb (2007).

⁶⁵ This does not mean that equilibria are absent from our analysis, as we shall see shortly. Rather, we aim at understanding the out-of-equilibrium dynamics of an economy and its possible convergence towards some equilibrium.

Modelling the entire economy using ‘applied microeconomics’ and hence ignoring emergence phenomena. In physics, an emergence phenomenon is one that can be observed only at a certain aggregation level. Thermodynamics, statistical physics and biology, to take but a few examples, are full of emergence phenomena.⁶⁶ The Sonnenschein-Mantel-Debreu conditions (Sonnenschein (1972), Sonnenschein (1973), Kirman (1989), Shafer and Sonnenschein (1993)) establish that the demand side of an economy also exhibits such phenomena: in principle, violations of the law of demand (i.e., situations where the net demand for a commodity whose price increases would not decrease) cannot be observed at the household level, but are compatible with the aggregate behaviour of many households. On the supply side, Mas-Colell (1989) also demonstrated that standard general equilibrium theory is not immune to emergence phenomena. Thus, modelling the demand side of a macroeconomy *as if* it had been generated by the behaviour of a unique (representative) household or firm makes no sense, according to the standard theory itself. Hence the need for a modelling approach where such a shortcut is not postulated from the beginning.⁶⁷

Persisting with a ‘money multiplier’ model of money creation when the empirical evidence against this model is overwhelming.

This issue is particularly important when dealing with the impact of stress in the banking sector. Indeed, the traditional ‘money multiplier’ theory asserts that credit issuance by commercial banks is *caused* by central bank money creation. This belief is at the root of the various quantitative easing policies that have been put into practice first by the US Federal Reserve in 2008, and later by the Bank of Japan, the Bank of England and the ECB. If this theory were correct, the trillions that have been injected in the various interbank markets by the respective central banks should have boosted credit, and therefore investment and growth. As is well known, this is not what we have observed since 2008. The last decade makes it hard to take such a scenario for granted: the significant increase in base money (which was more than doubled between 2008 and 2011) hardly induced any revival of the credit flow. This seriously calls in question the ‘money multiplier’ theory. In addition, there is a long-standing tradition of practitioners who assert that in reality money is endogenously created by commercial banks (which need only to refinance *ex post* part of their loans in the interbank market) (cf. Holmes (1969), Moore (1979, 1988), Kydland and Prescott (1990), McLeay et al. (2014)). To quote the last-named, ‘the majority of money in the modern economy is created by commercial banks making loans. Money creation in practice differs from some popular misconceptions—banks do not act simply as intermediaries, lending out deposits that savers place with them, and nor do they ‘multiply up’ central bank money to create new loans and deposits’ (McLeay et al., abstract). Why is this point crucial for our analysis? The reason is that were we to apply a standard ‘money multiplier’-based model, some additional money injection by the central bank would

⁶⁶ Cf. Anderson (1972).

⁶⁷ As Solow himself notes: ‘Suppose you wanted to defend the use of the Ramsey model as the basis for a descriptive macroeconomics. What could you say? ... You could claim that ... there is no other tractable way to meet the claims of economic theory. I think this claim is a delusion. We know from the Sonnenschein-Mantel-Debreu theorems that the only universal empirical aggregative implications of general equilibrium theory are that excess demand functions should be continuous and homogeneous of degree zero in prices, and should satisfy Walras’ Law. Anyone is free to impose further restrictions on a macro model, but they have to be justified for their own sweet sake, not as being required by the principles of economic theory. Many varieties of macro models can be constructed that satisfy those basic requirements without imposing anything as extreme and prejudicial as a representative agent in a favorable environment.’ (Solow (2008), p. 244; emphasis added; see also Solow (2001, 2003, 2007)).

normally suffice to restore the proper functioning of the banking system after our hypothetical shock: by pumping enough fresh money, so the theory goes, the ECB should be able to re-stimulate bank credit flow, and therefore investment and growth. As this is at odds with recent empirical observations, we should refrain from analysing the possible impact of the next shock on the banking sector using a theoretical tool that has just proven inadequate in the last decade. There is a need for modelling the banking system with endogenous money creation (as opposed to the money multiplier theory). As we shall see, doing so makes it possible to capture the possibility that the shock be followed by a credit crunch, analogous to the one observed in the euro area since 2010, which prevents the economy from resurrecting automatically from any disaster.

Ignoring the pivotal roles of credit and debt in the macroeconomy

Only a few applied general equilibrium models include a banking sector and private debt (both in the corporate and household sector). Indeed, many of them rely on the simplifying assumption that households and/or firms are captured through a representative agent. This usually means that they cannot both have debts. At least one of them must be a creditor to the other. This restriction is viewed as being harmless, inasmuch as the distribution of private debts is understood as being irrelevant for economic growth.

In reality, it is now clear that both sectors are highly indebted in the euro area, and that this debt overhang might be responsible for the threat of a deflationary process, as first theorised by Irving Fisher in the 1930s. Moreover, private actors' debts are significantly higher, at least within the euro area, than sovereign debts. Thus, an inspection of the impact of a crash that would leave open the possibility that private debts might play a macroeconomic role seems to be a must.

In view of this list, the methodological viewpoint adopted here has been to simulate the impact of a shock on the euro area using a (non-linear) dynamic-systemic approach, heavily drawing on the path breaking work of Minsky (*loc. cit.*), Goodwin (1967) and Keen (1995, 2000), as well as that of Grasselli, Costal and Lima (2012), Grasselli, Nguyen and Huu (2014, 2015), Giraud and Grasselli (2015) and Giraud, Nguyen and Huu (2015).

II - Macroeconomic simulations of the impact of a financial shock

Key findings

Our model adapted to the previously mentioned conditions allows us to draw the following conclusions:

The costs of a financial shock (calibrated so that it leads to the same size of a bailout, we estimated in the worst case in the first part equivalent to a 10% shock on a single bank) in the euro area are estimated at:

- EUR 1 trillion cumulated loss in GDP, approximately 9.4 % of EUR 10 632 billion 2016 GDP Commission forecast, EUR 100 billion annualised over ten years
- 1.91 million more unemployed, or 1.19 % assuming a total workforce of 161.1 million in Q4-2016 model forecast, 0.19 million annualised over ten years
- EUR 51.4 billion difference in government debt in 2016 (EUR 56 billion bailout), approximately 0.5 % of EUR 9 933 billion 2016 government debt Commission forecast

All countries experience a repeated recession following the shock, but they differ as to which sector of the economy is concerned and to what extent.

A sharp increase in the SRF would slightly reduce the impact of the shock in terms of underemployment and debt-to-GDP ratio. However, this would be insufficient. An increase of the prudential leverage ratio required from banks up to 9 % or more would suffice to dampen almost entirely the effect of the shock.

II.1. The results

II.1.1. Shock

In the first part of the study we assessed the possible involvement of government funds in the case of a financial shock of up to 15 % of total assets to the bank in question. As emphasised in Part I, such a magnitude is higher than the size of shocks under scrutiny in the ECB's last Asset Quality Review, but it remains quite reasonable⁶⁸, given the historical context of the 2007-2009 episode and the overall financial context in 2015. The size of the necessary bailout and the shock to the bank in question are the variables we take over from the first part. We calibrate our macroeconomic model so that its baseline scenario coincides with the Commission's forecasts. The base case therefore represents the plausible course of the economy in normal times given the dynamics of our model, historical data and the Commission's forecasts. Next, for each country, we superimpose an exogenous shock to the banking sector, calibrated so that it leads to

⁶⁸ In their study of 40 years of international attempts to bolster bank safety, Kobrak and Troege (2014) find an average size of shocks hitting Western banking systems of over 10 %.

the same size of a bailout, we estimated in the worst case in the first part. This means the bailout is equivalent to the worst case scenario for each country of a 10 % scenario shock to a single bank (except for Latvia, Estonia and Slovakia, for which countries we take 15 %, since no government funds are involved at a 10 % shock). We then use these inputs (baseline + shock) to simulate the long-term costs. Our adverse case therefore describes a scenario where a financial institution is hit by a shock and ultimately needs to be bailed out by the government. One has to bear in mind that in the first part of the study we looked at individual banks, whereas in our model we deal with the banking sector as a whole. Hence, we take over the necessary bailout from the first part in order to accurately capture the strain on government finances and calibrate the model accordingly.

The basic question we address is therefore: 0) 'given a shock, what would be the consequences in the economy presupposing the proposed full Banking Union framework to be in place now?'

A fully-fledged macroeconomic model, such as the one used here, presents us with multiple metrics and also allows us to measure the costs to the real economy, e.g. in terms of output or unemployment.

Later on, we explore various alternative scenarios: 1) what would happen if we were to experience a shock with no Banking Union? The difference will provide us with a sense of how much the Banking Union is likely to reduce the cost of a given shock. 2) What would happen were we to expand the size of the Single Resolution Fund? 3) What if banks were forced to increase their equity ratios? These various scenarios will allow us to draw some conclusion about the strength and weaknesses of the European Banking Union, and the way one could improve its architecture.

The way we capture a shock hitting the banking sector consists in a sudden, sharp and unexpected, reduction of its assets' value -- to which the one and only sensible response consists in recapitalising the bank in one way or another. On the other hand, whatever the scenario under scrutiny, we *always* assumed that in case of trouble the ECB would immediately intervene on the interbank market to prevent any contagion effect. It is obvious, indeed, that in the absence of any intervention by the ECB the failure of a systematically risky bank could shrink the common pool of liquidity on the European interbank market, creating new liquidity shortages and, possibly, new failures. We decided *not* to consider this kind of contagion effect, for two reasons. First, preventing this kind of situation and ensuring the stability of the banking system is part of the ECB's mandate, as already recalled in the first part. Thus, there is little doubt that Frankfurt would intervene as we have assumed it will in our study. Second, were we to try to understand the impact of a shock with no ECB intervention, we would have to be able to measure the size of the contagion effect, hence to identify the specific network of contractual relationships the failed bank was entertaining with others just at the time it was hit - information which is not available *ex ante* and would take too long to study interim. For the same reasons, we made the assumption that a bank's failure will have no impact on the international markets for derivatives. That is, we take it for granted that clearing houses will be able to do their job without themselves going bankrupt. By contrast with our automatic ECB intervention hypothesis, this time it is admittedly a strong assumption. But again, dealing with the precise network of contracts in which a given systemic bank is embedded on the derivatives markets is an impossible task. This continuously evolving network is too big, too complex and too interconnected with other markets to be tracked.

Consequently, we are aware that we most probably tend to underestimate the impact of the shocks under scrutiny - especially given the size and depth of the exposure of European banks to derivatives markets. However, we believe such shortcuts are methodologically necessary. Proceeding in this way, we are fairly sure that the real cost to be endured by the euro area in the case of indeed being hit by such a shock would be higher than that estimated here.

One might nevertheless wonder whether by proceeding in this way we did not place too much emphasis on solvency crises liable to affect banks, thus neglecting liquidity crises. This concern is likely to be motivated by the idea that when a bank becomes insolvent a bailout may create moral hazard problems. Our opinion, however, is that at the macro level on which this study situates itself one can hardly distinguish between the two. As has been argued by Diamond and Rajan (2002), 'while it is well known that systemic illiquidity can cause bank failures, ... the reverse phenomenon is also possible – bank failures can cause systemic illiquidity. This then suggests the possibility of a contagion of bank failures where a bank's failure subtracts liquidity from the system, and this negative spill over effect raises the likelihood of failure of other banks. It is possible that the entire system melts down making everyone worse off, even though it would survive intact if a few banks were recapitalised'. Therefore, from a systemic perspective it probably makes little sense to try to distinguish between liquidity shortage and insolvency. Thus, we contented ourselves with considering the macroeconomic and monetary consequences of a shock, without looking at the roots of the shock itself.

The countries we have scrutinised were selected according to the following criteria:

1. they must belong to the euro area;
2. the shock considered implies a bailout by the government. This, obviously, depends upon the balance-sheet structure of the troubled bank, on the magnitude of the shock and on whether the ESM steps in before the government (hence Greece, Portugal and Cyprus are not considered here). Part I of the present study tells us which countries to examine.

II.1.2. Model

On the basis of the preconditions for a satisfactory model set out in the previous section, we designed a new evolution of the Goodwin-Keen model incorporating the distinct features necessary for our analysis.

Our model features non-neutral money, is independent of the economy being in or out of equilibrium, allows for emergence phenomena, and presupposes a banking system with endogenous money creation and in which private and public debt levels have a significant effect on the real economy. More details on the exact workings of the model in a technical and non-technical description may be found in the Appendix. Here, we limit ourselves to briefly describing the dynamics at work in order to illustrate the basic behaviour of our simulations.

Once the shock hits the banking sector, the bailout of banks is followed by fiscal consolidation that is implemented to counteract the rise in sovereign debt-to-GDP ratio. The rise of government debt is a direct effect of the bailout and reflects what we observe in reality. Furthermore, the crisis triggers automatic stabilisers, which will let subsidies rise and diminish

tax receipts, because of the falling taxable income. This aggravates the fiscal situation and lead to the implementation of fiscal consolidation policies in the Euro Zone. Our model captures this effect by imposing fiscal consolidation above a certain debt to GDP ratio. This effect and the higher interest rates charged by banks in the real economy diminish the profits and, thereby, the disposable income of companies, and the credit crunch prevents companies from financing their desired investment through new debt issuance. Depending on the extent to which a corporate sector relies on debt financing and the size of the previously mentioned effects, the drop in investment can vary from modest up to a free fall. This not only puts downward pressure on investment and thereby on future output, but also depresses the demand side. Households receive fewer dividends from banks and firms and less net government transfers. Here again, disposable income diminishes as a result of the shock and the credit crunch further aggravates the situation, since households cannot rely on new debt to finance their desired consumption. The short-run lack of demand causes an increase in inventories and thereby deflationary pressure on consumer prices, on top of rapidly declining economic activity and higher unemployment. The simultaneous deleveraging of households, firms, banks and governments reaches a point where the balance sheets are restored and capital markets function normally again. This marks the point at which the economy rebounds.

II.1.3. Results of the simulations for the euro area

Given the model outlined above, the publicly available economic data for the respective countries and our results from the first part, we will analyse the costs of a potential shock to the economies of: Germany, France, Spain, Italy, Belgium, the Netherlands, Luxembourg, Ireland, Austria, Slovakia, Slovenia, Estonia, Finland, Latvia, Malta, and the euro area as a whole. As can be seen from the results in the first part, Cyprus, Greece and Portugal are covered by the ESM.⁶⁹ For the simulations in the second part they would still fulfil the conditions for support by the ESM at the moment of the shock. Therefore, we do not include these countries in our simulations, because no government bailout is necessary under these circumstances.

The macro-imbalance procedure (MIP) provides a set of macroeconomic indicators (scoreboard) through which one can gauge the situation of an economy.⁷⁰ Drawing on the extensive list, we selected the indicators, which are represented in the model. The external imbalances part of the MIP is, for example, static in our model, because it is not essential for the purpose of our investigation and therefore not taken into account. Nonetheless, this is one of the points of further research to enhance the model. Furthermore, we added to the historical data of the MIP the Winter 2015 projections of the Commission's DG ECFIN, published in the annual macroeconomic database (AMECO). These projections serve as our benchmark and are the basis for the calibration of our model. As a consequence our baseline coincides with the Commission's forecasts.

The results from the Commission regarding the economy of the euro area are summarised in Table 5:

⁶⁹ A bailout by the respective government of the bank in trouble would qualify as a significant deterioration of public finances (10 year government debt yields above 6%) and under these circumstances the ESM steps in.

⁷⁰ Details can be found on the Commission website:

http://ec.europa.eu/economy_finance/economic_governance/macroeconomic_imbalance_procedure/index_en.htm

Country	Year	real GDP growth EC	Inflation EC	Unemployment EC	Debt to GDP EC	Primary Deficit to GDP EC	Deficit to GDP EC	Investment to GDP EC	Private Debt to GDP MIP (cons.)	HH Debt to GDP (part. cons.)	Firm Debt to GDP ECB (part. cons.)
EMU (Euro-stat)	2000	3,83%	1,42%	8,7%	68,0%	3,57%	-0,22%	22,7%	NA	48,2%	64,9%
	2001	2,07%	2,45%	8,1%	66,9%	1,68%	-1,99%	22,3%	NA	48,6%	67,7%
	2002	0,93%	2,47%	8,5%	66,7%	0,74%	-2,68%	21,6%	NA	49,9%	67,5%
	2003	0,65%	2,22%	9,0%	68,0%	0,10%	-3,11%	21,5%	NA	51,7%	67,9%
	2004	2,24%	1,94%	9,2%	68,3%	0,12%	-2,90%	21,7%	NA	53,7%	67,9%
	2005	1,66%	1,89%	9,1%	69,2%	0,38%	-2,53%	22,0%	NA	56,7%	70,2%
	2006	3,24%	1,92%	8,4%	67,4%	1,37%	-1,46%	22,7%	NA	58,6%	72,4%
	2007	3,03%	2,45%	7,5%	65,0%	2,25%	-0,61%	23,1%	NA	59,4%	75,3%
	2008	0,48%	1,97%	7,6%	68,7%	0,83%	-2,11%	22,9%	NA	60,7%	78,0%
	2009	-4,51%	1,04%	9,5%	78,4%	-3,39%	-6,19%	21,1%	NA	64,3%	80,9%
	2010	2,02%	0,71%	10,1%	83,9%	-3,39%	-6,13%	20,6%	NA	64,3%	80,6%
	2011	1,62%	1,06%	10,1%	86,5%	-1,14%	-4,12%	20,7%	NA	63,6%	78,5%
	2012	-0,73%	1,31%	11,3%	91,0%	-0,61%	-3,62%	20,2%	NA	63,1%	78,0%
	2013	-0,49%	1,31%	12,0%	93,3%	-0,08%	-2,87%	19,6%	NA	62,1%	76,7%
	2014	0,83%	0,83%	11,7%	94,5%	0,12%	-2,57%	19,5%	NA	NA	NA
	2015	1,33%	0,84%	11,3%	94,6%	0,39%	-2,17%	19,7%	NA	NA	NA
	2016	1,91%	1,38%	10,7%	93,4%	0,62%	-1,90%	20,2%	NA	NA	NA

Table 5– Commission forecast and MIP data for the euro area

This compares with our projections in Table 6:

Country	Scenario	Year	real GDP Growth	Unemployment	Debt to GDP	Primary Deficit to GDP	Deficit to GDP	Investment to GDP	Private Debt to GDP	HH Debt to GDP	Firm Debt to GDP	Financial Sector Leverage
EMU	base	2014	1,0%	11,5%	93%	0,4%	-2,6%	22,2%	145%	65%	79%	5,9
		2015	1,0%	11,4%	94%	0,5%	-2,5%	22,8%	146%	64%	82%	4,8
		2016	1,6%	11,0%	93%	0,7%	-2,5%	22,6%	146%	62%	84%	4,1
	adv.	2014	-0,5%	12,3%	95%	0,4%	-3,2%	20,8%	147%	66%	81%	7,7
		2015	-1,0%	12,4%	98%	0,6%	-2,7%	19,9%	152%	66%	86%	5,6
		2016	1,1%	12,2%	98%	1,0%	-2,5%	19,7%	152%	63%	89%	4,6
	adv. no SRF	2014	-0,5%	12,3%	96%	0,4%	-3,7%	20,8%	147%	66%	81%	7,7
		2015	-1,0%	12,4%	99%	0,6%	-2,7%	19,9%	152%	66%	86%	5,7
		2016	1,1%	12,2%	99%	1,0%	-2,5%	19,7%	152%	63%	89%	4,6
	adv. large SRF	2014	-0,5%	12,3%	94%	0,4%	-2,6%	20,8%	147%	66%	81%	7,6
		2015	-1,0%	12,4%	97%	0,6%	-2,7%	19,9%	151%	66%	86%	5,6
		2016	1,1%	12,2%	98%	0,9%	-2,5%	19,7%	152%	63%	89%	4,5
	adv. +Eq Target -Div	2014	0,9%	11,5%	93%	0,4%	-2,6%	22,0%	147%	67%	80%	7,5
		2015	0,8%	11,4%	94%	0,5%	-2,6%	22,3%	151%	68%	82%	5,4
		2016	1,5%	11,2%	94%	0,7%	-2,5%	22,0%	153%	68%	85%	4,3
	base +Eq Target -Div	2014	0,9%	11,5%	93%	0,4%	-2,6%	22,1%	146%	67%	80%	5,6
		2015	1,0%	11,4%	94%	0,5%	-2,5%	22,6%	148%	66%	82%	4,5
		2016	1,6%	11,1%	94%	0,7%	-2,5%	22,4%	149%	65%	84%	3,8

Table 6 – Euro Area simulations

Let us recapitulate the various scenarios presented in Table 6:⁷¹

1. **Scenario EC** is the Commission forecast (Winter 2015).
2. **Base:** corresponds to our baseline scenario (which, as already noted, stays very close to the Scenario EC).
3. **Adv.:** corresponds to a shock⁷² hitting the banking sector of a country (or the entire euro area) on the assumption that a EUR 55 billion Resolution Fund is already in place (thus anticipating the 2023 Banking Union).
4. **Adv. no SRF:** corresponds to the same shock but with no Resolution Fund in place.
5. **Adv. large SRF:** corresponds to the same shock with a EUR 165 billion SRF.

⁷¹ Being macro-dynamic in nature, these scenarios should not be confused with the financial and static ones explored in the first part of this report.

⁷² The shock is calibrated so that the necessary government bailout in the model matches the result from the first part.

6. **Adv. +Eq target -Div:** corresponds to the same shock hitting the banking sector, but with a higher equity ratio target for banks and lower bank dividends.
7. **Base +Eq target -Div:** corresponds to the baseline scenario with a higher equity ratio target for banks and lower bank dividends.

The economy of the euro area suffered a severe shock during the financial crisis and a mild double-dip recession afterwards. For the coming two years, the Commission forecasts accelerating growth of up to 1.91 % in 2016, as well as decreasing unemployment. Government debt-to-GDP levels will stagnate around 93 %, and the euro area as a whole will have a public primary surplus of 0.6 % of GDP in 2016. Investment, which dropped significantly following the financial crisis, should rebound slightly, rising to 20.2 % of GDP in 2016.

Our simulations of the base case are broadly in line with these projections. Our projected primary surplus is slightly smaller than the one forecasted by the commission, and investment as a share of GDP picks up somewhat more significantly according to our projections.

How does this compare to a scenario where we apply a shock to the banking sector in Q2 2014 of a size, where the bailout is equivalent to the worst case result of the first part for a 10% shock to a single bank? Hence, the shock is large enough to bring a major European bank into difficulties.

As shown by the green curve (which is covered by the blue curve) in Figure 25, the euro area would experience a brief recession (-0.5 % real GDP growth in 2014 and -1 % in 2015) followed by a period of suppressed growth, when compared to the base case. As Figure 25 shows, the severe drop in output in 2009 was followed by the second recession in 2012-2013. A further financial shock would not be as abrupt or as violent as the 2009 recession, but would plunge the European economy into a third prolonged recession and period of sub-par growth.

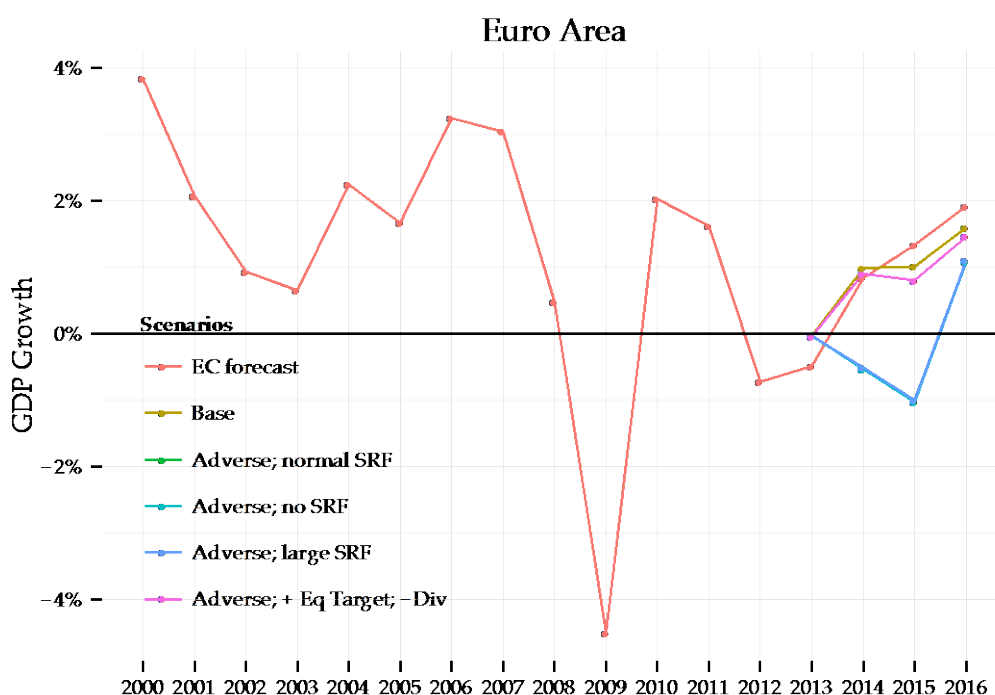


Figure 25 - Real GDP growth in the euro area

This first adverse scenario should be compared with the three other scenarios we have scrutinised: the curves ranging in colour from green to blue describe the scenarios where changes to the size of the SRF were made. The striking outcome is that, actually, the size of the SRF has little influence on the impact of the shock, at least in terms of GDP.

What does make a real difference is a change in the equity ratio target of banks (pink line). Here, we have assumed that banks are forced by law to seek a 9 % equity ratio and that they do so by reducing the return on equity they serve to their shareholders. It turns out that this would suffice to significantly dampen the impact of the shock. We do not claim that an equity ratio target of 9 % is the optimal value, although we suspect it to be close to the lower bound, below which the purpose of dampening the impact of a significant shock cannot be reached. Here, we content ourselves with showing that a 9% ratio would *suffice* for this purpose.

Let us now turn to the labour market. Figure 26 shows that in 2014 the difference in unemployment would be 0.8 percentage points. Towards the end of our simulation period the difference in unemployment would be as large as 1.2 percentage points. Figure 26 reminds us that, already in 2008, the labour market was profoundly hit by the financial crisis. According to our simulations, if we experience another financial shock the effect might be as devastating as during the last crisis. Our adverse case simulation projects an unemployment rate peaking at 12.4 % in 2015. Again, little influence may be ascribed to the size of the SRF. In contrast to the situation where the impact of the shock was measured solely in GDP terms, this time a tripled SRF enables a slight softening of the consequences of the shock in terms of unemployment, approximately two years on. Again, an increase in the banks' equity ratio target to 9 % or more would suffice to bring the cost in terms of unemployment down to below 0.2 percentage points.

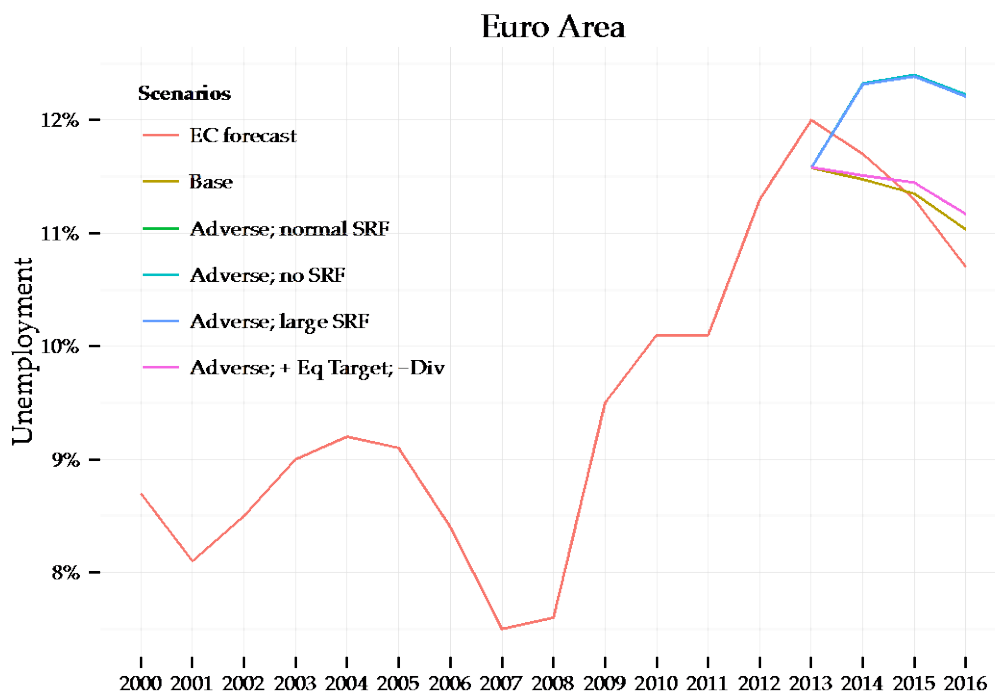


Figure 26 - Unemployment rate in the euro area

Unsurprisingly, the shock induces an abrupt rise in public debt levels. This is due to the direct costs of the bailout, which add on the already significant government debt levels. In the aftermath of another financial shock, however, our simulations exhibit a stabilisation of government debt-to-GDP levels, mostly due to growth picking up again and fiscal consolidation policies being implemented. Nor should it come as a surprise that, this time, the size of the SRF does matter, as it directly influences the cost of the shock to the taxpayer. Figure 27 shows that a tripled SRF would reduce the public debt-to-GDP ratio by approximately 0.5 percentage points. Eventually, the efficiency of our alternative proposal - an increase in the equity ratio - is striking. Banks refinance their equity in the run-up to the shock, and governments are no more called upon to provide bailout funding. This explains part of the significantly lower debt-to-GDP ratio. Nonetheless, there is a difference to the base case because this increased equity base needs to be financed somehow and ultimately represents a cost to the economy in the form of otherwise higher GDP.

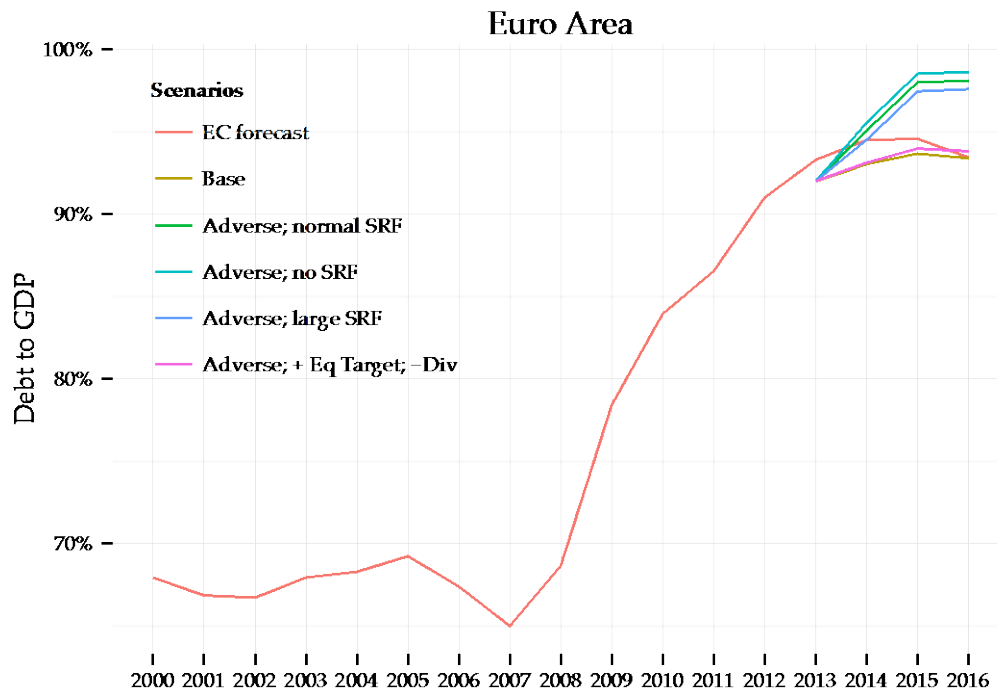


Figure 27 - Government debt-to-GDP ratio in the euro area

Table 6 gives further details as to why the economy behaved this way in our simulations. Part of the reduction in GDP comes from the significant drop in investment, which is comparable to that observed during the 2007-2009 turmoil. Reduced investment also helps explain the sub-par growth in the following periods. Private sector debt reacts in the same way as during the last crisis: the shock to GDP lets the private debt-to-GDP ratio rise, and the deleveraging follows only slightly delayed. The fiscal consolidation allows the primary surplus to rise as a consequence of the crisis. Finally, the financial sector leverage ratio naturally rises as a consequence of a shock to the equity in the financial system. Hence, the debt-to-equity ratio increases, together with the level of risk and instability in the financial system. That ratio quickly diminishes, however, as banks try to recover equity by raising interest rates and shedding assets or ceasing to lend. The illustrations above give an indication of how the development of the economy diverges in case of a shock.

Furthermore, Table 6 tells us, how the economy would fare, under the different scenarios and measured by macroeconomic indicators derived from the MIP. The first three columns are the broadest measures we assess to gauge the economic performance. GDP growth, unemployment and sovereign debt-to-GDP ratio react strongly to the shock, and the effects are significantly less severe under the scenario with a higher equity ratio target and lower dividends. The size of the SRF has an impact on sovereign debt, which in turn may trigger fiscal consolidation. Since the debt burden is already high, interest payments are high on the already high debt burden and widening the gap between the primary deficit (taxes / subsidies) and the deficit including interest payments. Investment in the economy falls as a share of GDP after a shock, and must thereby fall more sharply than consumption. Firms are structurally more credit dependent in our simulation and their debt to GDP ratio rises more sharply than that of households. It reveals that, deflationary forces are pushing household consumption and company investment down. For the higher equity ratio target and lower dividends scenario, we observe a different story: a stable investment ratio alongside slightly less increasing firm leverage, with households increasing their consumption financed by higher debt. Ultimately the financial sector increases its leverage due to the shock to its equity, but it quickly accumulates new equity by charging a higher interest rate to the economy. This rich behaviour in response to a shock under the different regulatory set-ups is a result of our non-linear model, calibrated to past economic performance and the European Commission forecast.

In the following we shall attempt to quantify the costs of another financial shock given the currently proposed regulatory set-up. The costs would amount to: a **cumulated GDP loss of EUR 1 trillion** (approximately - 9.4 % of EUR 10 632 trillion - 2016 GDP Commission forecast), **1.91 million more unemployed** (-1.19 % supposing a total workforce of 161.1 million - 2016 model forecast) and a **difference of EUR 51.4 billion in government debt** in 2016 (+0.5 % of EUR 9 933 billion 2016 government debt - Commission forecast). It should be borne in mind that before the government needs to step in, the SRF would have intervened with EUR 55 billion already. On an annualised basis over ten years this would amount to EUR 100 billion of potential output loss per year and 0.19 million workers potentially more unemployed per year. As already explained, we simulated the impact of such a shock on the assumption that the banking union resolution environment of 2023 is already in place today. This means that, if a shock of the magnitude studied occurs in the euro area before 2023 and if the financial and macroeconomic fundamentals are then close to those observed today, the consequences would presumably be worse than those described here, as the banking union environment will not yet be fully in place.

Given the four different adverse scenarios and the possible policy implications, it is worth comparing them among themselves. Table 7 compares the differences between the different scenarios to benchmark values. As seen above, the adverse scenario leads to a cumulated loss in GDP of EUR 1 trillion. What is the benefit of increasing the equity ratio target and lowering dividends? In order to analyse the benefits of this specific set-up we first compare its reaction to a shock with the normal adverse scenario (standard SRF configuration). By comparison with the normal adverse scenario, the euro area economy would be better off by EUR 909 billion in cumulated GDP over the time horizon Q2 2014 - Q4 2016 only (line 4). If we add the difference between the base case and the higher equity ratio target and lower dividends scenario (line 5) to this, it adds up to the difference between the adverse case and the base case (line 1). Given a shock the proposed banking union framework would result in a worse economic performance, compared to the scenario with a higher equity ratio target and lower dividends. On the labour market the difference would be one of 1.7 million unemployed (1.05 % percentage point) and in

terms of government debt the euro area economy would be better off by EUR 50.2 billion, since banks do not need to be bailed out by governments and also because the dynamic of the economy would become more favourable to government finances.

How does the changed equity ratio and dividends scenario fare versus the base case? Or: what would the economic costs be should a shock occur with this regulatory regime in place? The cost to the economy would amount to EUR 91.6 billion in cumulated GDP loss, 0.22 million unemployed, and only a EUR 1.2 billion difference in government debt (line 5).

Hence, the costs to the economy are significantly lower given the higher equity ratio target and lower dividend scenario, but this does not come for free.

The prior comparison combines two effects; a financial shock, and a changed equity target ratio plus lower dividends. In order to disentangle the two, the last position in the table tells us what the effect of the higher equity ratio target and lower dividends is on the economy in the absence of any shock. In other words, it measures the cost to the economy of adopting the alternative regulatory regime. That this is costly to the economy arises from the fact that commercial banks need to gain more equity from the real economy via raising interest rates and reducing dividends. The goal of this policy is to make banks resilient enough to resist a shock without the help of public funds. If the cost for such a policy turned out to be too high in 'normal times', it would make little sense to recommend it, even if it might perform well in the tempest. The better capitalised banking sector costs the economy EUR 35.9 billion in cumulated GDP loss, 0.07 million unemployed and a EUR 0.4 billion difference in government debt (line 6). Hence, the cost of adopting such a policy would be marginal in normal times, and the benefits substantial in case of trouble.

Lines 2 and 3 of Table 7 show the difference arising from a change of the size of the SRF (no SRF or large SRF). Without going into further detail, one can see that the difference is rather small in the light of those previously found, but we can certainly see that an enlarged SRF is favourable over no SRF at all.

Country	Scenario	nominal GDP difference 2014Q3 2016Q4	nominal GDP BC forecast FY2016	difference in number of Unemploy ed [tsd]	2016Q4 Workforce Model forecast [tsd]	difference in Unemploy ment	Sov Debt difference [bn]	Sov Debt BC forecast 2016 [bn]	Bailout (from static simulation) [bn]	SRF (from static simulation) [bn]
		[bn]	[bn]	[tsd]	[tsd]					
EMU	adv. vs base	1 000,6		1 914,1		1,19%	51,4			
	adv. no SRF vs adv.	5,2		10,0		0,01%	51,3			
	adv. vs adv. large SRF	9,1	10 631,8	19,5	161 063,0	0,01%	46,3	9 932,7	56	55
	adv. vs adv. higher Eq. Target	909,0		1 696,6		1,05%	50,2			
	adv. +Eq Target -Div vs base	91,6		217,5		0,14%	1,2			
	base +Eq Target -Div vs base	35,9		70,5		0,04%	0,4			

Table 7 - Scenario comparison of the shock impact in the euro area economy

Figure 28 yields the dynamic of our baseline scenario (dotted lines), focusing on debts at the euro area level. As already said, we carefully follow the forecasts of the Commission. Interestingly, our projection over 2015 suggests that household debts would slightly increase while firms would tend to deleverage. This is due to our empirical estimation of the aggregate behaviour of corporate investment (as a function of the profit rate) and of households' aggregate consumption behaviour (as a function of the wage rate). Whether this projection will be confirmed by the real data will be an interesting issue to be checked in 2016. The impact of this aspect of our modelisation can be seen in the leverage ratios of firms and households

respectively, and hence in the willingness of the banking sector to lend or not to the private sector.

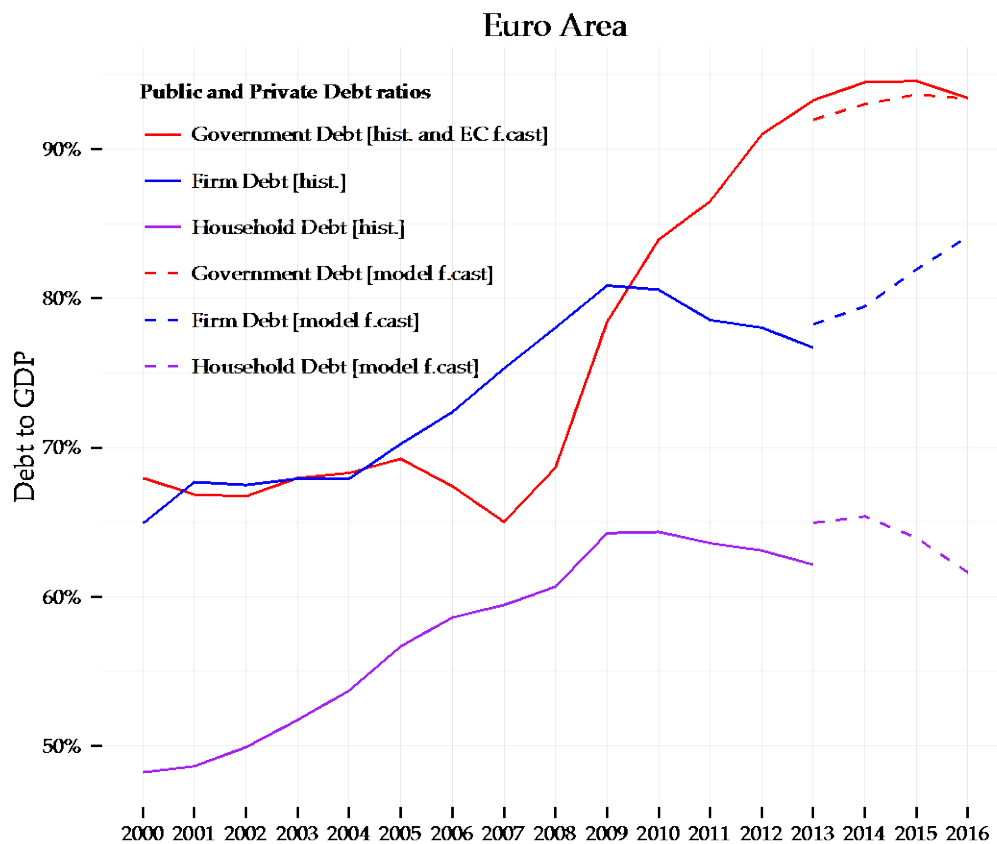


Figure 28 - The evolution of debts

II.1.4. Results for all countries

This section summarises the results of our simulations for all countries of the euro area whose governments would be involved in a bailout in case of banking distress. Tables 10 to 13 summarise the evolution of the macro-imbalance procedure indicators throughout all our scenarios, while Tables 8 and 9 summarise the scenario comparison.

An in-depth explanation on how to read the following tables is provided in the section detailing the results at the euro area level.

Country	Scenario	nominal GDP difference 2014Q3 2016Q4 [bn]	nominal GDP EC forecast FY2016 [bn]	difference in number of Unemploy ed [tsd]	2016Q4 Workforce Model forecast [tsd]	difference in Unemploy ment	Sov Debt difference [bn]	Sov Debt EC forecast 2016 [bn]	Bailout (from static simulation) [bn]	SRF (from static simulation) [bn]
EMU	adv. vs base	1 000,6		1 914,1		1,19%	51,4			
	adv. no SRF vs adv.	5,2		10,0		0,01%	51,3			
	adv. vs adv. large SRF	9,1	10 631,8	19,5	161 063,0	0,01%	46,3	9 932,7	56	55
	adv. vs adv. higher Eq. Target	909,0		1 696,6		1,06%	50,2			
	adv. +Eq Target -Div vs base	91,6		217,5		0,14%	1,2			
	base +Eq Target -Div vs base	35,9		70,5		0,04%	0,4			
DE	adv. vs base	351,4		222,9		0,53%	57,9			
	adv. no SRF vs adv.	2,2		1,5		0,00%	51,1			
	adv. vs adv. large SRF	3,1	3 108,5	2,1	42 123,6	0,01%	54,9	2 141,5	51	50
	adv. vs adv. higher Eq. Target	291,1		162,0		0,38%	58,9			
	adv. +Eq Target -Div vs base	60,3		61,0		0,14%	-0,9			
	base +Eq Target -Div vs base	33,0		31,9		0,08%	-0,7			
FR	adv. vs base	319,0		322,0		1,12%	50,6			
	adv. no SRF vs adv.	2,0		2,1		0,01%	58,1			
	adv. vs adv. large SRF	2,7	2 237,9	2,8	28 821,8	0,01%	60,9	2 196,7	56	55
	adv. vs adv. higher Eq. Target	285,5		297,6		1,03%	54,4			
	adv. +Eq Target -Div vs base	33,5		24,4		0,08%	-3,8			
	base +Eq Target -Div vs base	24,7		15,9		0,06%	-2,3			
IT	adv. vs base	240,2		291,8		1,13%	13,4			
	adv. no SRF vs adv.	1,6		1,7		0,01%	48,2			
	adv. vs adv. large SRF	2,7	1 675,6	3,2	25 811,6	0,01%	10,3	2 210,9	9,6	42
	adv. vs adv. higher Eq. Target	219,9		289,0		1,12%	12,4			
	adv. +Eq Target -Div vs base	20,3		2,8		0,01%	1,0			
	base +Eq Target -Div vs base	15,8		5,6		0,02%	0,7			
ES	adv. vs base	177,7		798,6		3,36%	20,0			
	adv. no SRF vs adv.	1,9		8,3		0,04%	63,4			
	adv. vs adv. large SRF	3,0	1 121,1	14,6	23 752,0	0,06%	17,7	1 149,0	13,5	55
	adv. vs adv. higher Eq. Target	159,6		693,6		2,92%	19,9			
	adv. +Eq Target -Div vs base	18,1		104,9		0,44%	0,1			
	base +Eq Target -Div vs base	13,0		71,7		0,30%	0,1			
NL	adv. vs base	92,1		90,1		1,01%	7,5			
	adv. no SRF vs adv.	1,2		1,2		0,01%	57,3			
	adv. vs adv. large SRF	0,6	683,3	0,6	8 932,6	0,01%	12,2	482,0	12,3	54
	adv. vs adv. higher Eq. Target	87,1		83,3		0,93%	7,7			
	adv. +Eq Target -Div vs base	5,0		6,8		0,08%	-0,2			
	base +Eq Target -Div vs base	4,3		5,3		0,06%	-0,2			
BE	adv. vs base	37,8		16,8		0,34%	4,8			
	adv. no SRF vs adv.	0,2		0,1		0,00%	7,0			
	adv. vs adv. large SRF	0,4	420,6	0,2	4 929,4	0,00%	6,3	448,2	5,8	6,7
	adv. vs adv. higher Eq. Target	35,0		16,8		0,34%	5,2			
	adv. +Eq Target -Div vs base	2,8		0,0		0,00%	-0,5			
	base +Eq Target -Div vs base	2,0		0,0		0,00%	-0,4			
AT	adv. vs base	37,0		6,9		0,16%	1,4			
	adv. no SRF vs adv.	0,2		0,0		0,00%	10,5			
	adv. vs adv. large SRF	0,9	347,8	0,3	4 393,5	0,01%	1,0	293,8	2,3	10
	adv. vs adv. higher Eq. Target	35,5		6,9		0,16%	2,8			
	adv. +Eq Target -Div vs base	1,5		0,0		0,00%	-1,5			
	base +Eq Target -Div vs base	1,0		0,0		0,00%	-1,0			

Table 8 – Scenario comparison (1)

Country	Scenario	nominal GDP difference 2014Q3 2016Q4 [bn]	nominal GDP BC forecast FY2016 [bn]	difference in number of Unemploy ed [tsd]	2016Q4 Workforce Model forecast [tsd]	difference in Unemploy ment	Sov Debt difference [bn]	Sov Debt BC forecast 2016 [bn]	Bailout (from static simulation) [bn]	SRF (from static simulation) [bn]
FI	adv. vs base	23,5		4,9		0,19%	3,40			
	adv. no SRF vs adv.	0,2		0,0		0,00%	16,17			
	adv. vs adv. large SRF	0,2	213,6	0,0	2 632,7	0,00%	3,34	133,6	3,5	15,2
	adv. vs adv. higher Eq. Target	20,1		4,1		0,16%	3,52			
	adv. +Eq Target -Div vs base	3,4		0,8		0,03%	-0,13			
	base +Eq Target -Div vs base	2,6		0,6		0,02%	-0,10			
IE	adv. vs base	65,0		24,7		1,19%	0,68			
	adv. no SRF vs adv.	0,2		0,2		0,01%	6,44			
	adv. vs adv. large SRF	0,0	199,0	0,0	2 068,1	0,00%	1,58	214,6	1,5	6,6
	adv. vs adv. higher Eq. Target	59,4		22,5		1,09%	1,33			
	adv. +Eq Target -Div vs base	5,6		2,2		0,11%	-0,65			
	base +Eq Target -Div vs base	1,2		0,4		0,02%	-0,33			
SK	adv. vs base	9,1		13,5		0,50%	0,50			
	adv. no SRF vs adv.	0,0		0,0		0,00%	0,43			
	adv. vs adv. large SRF	0,0	81,3	0,1	2 700,4	0,00%	0,47	44,9	0,4	0,6
	adv. vs adv. higher Eq. Target	8,4		11,9		0,44%	0,49			
	adv. +Eq Target -Div vs base	0,7		1,6		0,06%	0,01			
	base +Eq Target -Div vs base	0,3		0,7		0,03%	0,01			
LU	adv. vs base	14,4		0,0		0,00%	2,25			
	adv. no SRF vs adv.	0,0		0,0		0,00%	3,00			
	adv. vs adv. large SRF	0,1	51,3	0,0	252,5	0,00%	3,21	12,9	3,1	3,1
	adv. vs adv. higher Eq. Target	12,5		0,0		0,00%	2,43			
	adv. +Eq Target -Div vs base	1,9		0,0		0,00%	-0,18			
	base +Eq Target -Div vs base	1,1		0,0		0,00%	-0,22			
SI	adv. vs base	5,5		11,0		1,08%	0,39			
	adv. no SRF vs adv.	0,0		0,0		0,00%	0,67			
	adv. vs adv. large SRF	0,0	39,2	0,0	1 019,3	0,00%	0,52	32,1	0,5	0,6
	adv. vs adv. higher Eq. Target	5,4		11,0		1,08%	0,90			
	adv. +Eq Target -Div vs base	0,1		0,0		0,00%	-0,51			
	base +Eq Target -Div vs base	0,2		0,0		0,00%	-0,50			
LV	adv. vs base	0,8		3,8		0,36%	0,68			
	adv. no SRF vs adv.	0,0		0,1		0,01%	0,34			
	adv. vs adv. large SRF	0,0	26,7	0,0	1 038,3	0,00%	0,70	9,5	0,1	0,3
	adv. vs adv. higher Eq. Target	0,7		3,4		0,32%	0,13			
	adv. +Eq Target -Div vs base	0,1		0,4		0,04%	0,55			
	base +Eq Target -Div vs base	0,1		0,4		0,04%	0,00			
BE	adv. vs base	2,0		8,4		1,24%	0,08			
	adv. no SRF vs adv.	0,0		0,1		0,01%	0,40			
	adv. vs adv. large SRF	0,0	21,5	0,0	675,3	0,00%	0,12	2,1	0,2	0,5
	adv. vs adv. higher Eq. Target	1,9		7,6		1,12%	0,08			
	adv. +Eq Target -Div vs base	0,2		0,8		0,12%	0,00			
	base +Eq Target -Div vs base	0,1		0,3		0,05%	0,00			
MT	adv. vs base	2,2		0,3		0,14%	0,55			
	adv. no SRF vs adv.	0,0		0,0		0,00%	0,42			
	adv. vs adv. large SRF	0,0	8,7	0,0	181,6	0,00%	0,52	5,8	0,5	0,4
	adv. vs adv. higher Eq. Target	2,1		0,2		0,13%	0,55			
	adv. +Eq Target -Div vs base	0,0		0,0		0,01%	0,00			
	base +Eq Target -Div vs base	0,0		0,0		0,01%	0,00			

Table 9 – Scenario comparison (2)

Looking at the results presented in Tables 8 and 9 on aggregate, one can observe that the impact varies significantly, between both countries and economic sectors. Italy, Luxembourg, the Netherlands, Malta, Ireland, and France would be impacted more strongly in terms of cumulated potential output loss, but the source of the downturn is different for each country.

Certain countries have relatively less efficient labour markets, such as Spain, the Netherlands, Ireland, Italy and France, compared to those with relatively more resilient labour markets, such as Luxembourg, Germany and Austria. We distinguish these economies on the basis of our forecasts for their labour markets only.

The source of the downturn for Luxembourg, Belgium, France, Estonia and Ireland lies rather in a slowdown of investment in response to the shock, whereas Italy, Austria, Finland, Malta, Slovakia and Latvia would experience a more simultaneous drop in consumption and investment.

Country	Scenario	Year	real GDP	Unemplo	Debt to	Primary	Deficit to	Investme	Private	HH Debt	Firm	Financial
			Growth	yment	GDP	Deficit to	GDP	nt to	Debt to	to GDP	Debt to	Sector
EMU	base	2014	1,0%	11,5%	93%	0,4%	-2,6%	22,2%	145%	65%	79%	5,9
		2015	1,0%	11,4%	94%	0,5%	-2,5%	22,8%	146%	64%	82%	4,8
		2016	1,6%	11,0%	93%	0,7%	-2,5%	22,6%	146%	62%	84%	4,1
	adv.	2014	-0,5%	12,3%	95%	0,4%	-3,2%	20,8%	147%	66%	81%	7,7
		2015	-1,0%	12,4%	98%	0,6%	-2,7%	19,9%	152%	66%	86%	5,6
		2016	1,1%	12,2%	98%	1,0%	-2,5%	19,7%	152%	63%	89%	4,6
	adv. no SRF	2014	-0,5%	12,3%	96%	0,4%	-3,7%	20,8%	147%	66%	81%	7,7
		2015	-1,0%	12,4%	99%	0,6%	-2,7%	19,9%	152%	66%	86%	5,7
		2016	1,1%	12,2%	99%	1,0%	-2,5%	19,7%	152%	63%	89%	4,6
	adv. large SRF	2014	-0,5%	12,3%	94%	0,4%	-2,6%	20,8%	147%	66%	81%	7,6
		2015	-1,0%	12,4%	97%	0,6%	-2,7%	19,9%	151%	66%	86%	5,6
		2016	1,1%	12,2%	98%	0,9%	-2,5%	19,7%	152%	63%	89%	4,5
	adv. +Eq Target -Div	2014	0,9%	11,5%	93%	0,4%	-2,6%	22,0%	147%	67%	80%	7,5
		2015	0,8%	11,4%	94%	0,5%	-2,6%	22,3%	151%	68%	82%	5,4
		2016	1,5%	11,2%	94%	0,7%	-2,5%	22,0%	153%	68%	85%	4,3
	base +Eq Target -Div	2014	0,9%	11,5%	93%	0,4%	-2,6%	22,1%	146%	67%	80%	5,6
		2015	1,0%	11,4%	94%	0,5%	-2,5%	22,6%	148%	66%	82%	4,5
		2016	1,6%	11,1%	94%	0,7%	-2,5%	22,4%	149%	65%	84%	3,8
DE	base	2014	1,7%	5,1%	75%	1,1%	0,1%	20,8%	116%	60%	56%	5,3
		2015	1,6%	5,0%	72%	1,2%	0,2%	20,4%	117%	61%	56%	4,0
		2016	1,8%	4,9%	70%	1,3%	0,4%	19,5%	118%	62%	56%	3,2
	adv.	2014	-0,3%	5,5%	78%	1,1%	-1,9%	20,0%	119%	61%	58%	7,4
		2015	-0,9%	5,5%	78%	1,2%	0,1%	18,6%	124%	60%	64%	4,7
		2016	1,0%	5,4%	75%	1,4%	0,3%	17,4%	124%	58%	66%	3,6
	adv. no SRF	2014	-0,3%	5,5%	80%	1,1%	-3,7%	20,0%	119%	61%	58%	7,5
		2015	-0,9%	5,5%	80%	1,2%	0,0%	18,6%	124%	60%	64%	4,8
		2016	0,9%	5,4%	77%	1,4%	0,3%	17,4%	125%	58%	66%	3,6
	adv. large SRF	2014	-0,3%	5,5%	76%	1,1%	0,1%	20,0%	119%	61%	58%	7,3
		2015	-0,8%	5,4%	76%	1,2%	0,1%	18,6%	123%	60%	63%	4,7
		2016	1,0%	5,4%	73%	1,4%	0,4%	17,5%	124%	58%	66%	3,5
	adv. +Eq Target -Div	2014	1,4%	5,2%	75%	1,1%	0,1%	20,2%	122%	65%	56%	7,0
		2015	1,1%	5,1%	73%	1,2%	0,2%	19,2%	128%	71%	57%	4,2
		2016	1,2%	5,0%	70%	1,3%	0,4%	17,9%	133%	77%	57%	3,0
	base +Eq Target -Div	2014	1,5%	5,2%	75%	1,1%	0,1%	20,4%	120%	64%	56%	4,6
		2015	1,4%	5,1%	73%	1,2%	0,2%	19,8%	124%	67%	57%	3,4
		2016	1,5%	4,9%	70%	1,3%	0,4%	18,6%	128%	72%	56%	2,7
ES	base	2014	1,6%	24,1%	96%	0,0%	-5,2%	21,8%	193%	82%	111%	5,4
		2015	2,0%	22,7%	99%	0,1%	-5,3%	23,6%	190%	79%	111%	4,6
		2016	2,5%	20,9%	101%	0,2%	-5,4%	25,3%	186%	72%	113%	4,1
	adv.	2014	-0,4%	26,0%	100%	0,0%	-6,7%	21,0%	198%	84%	114%	7,2
		2015	-1,0%	25,2%	107%	0,1%	-5,8%	22,0%	204%	82%	122%	5,3
		2016	1,0%	24,3%	112%	0,3%	-6,0%	23,8%	203%	73%	130%	4,4
	adv. no SRF	2014	-0,4%	26,0%	105%	0,0%	-11,9%	21,0%	198%	84%	114%	7,4
		2015	-1,0%	25,2%	113%	0,1%	-6,2%	22,0%	204%	82%	122%	5,4
		2016	1,0%	24,3%	118%	0,3%	-6,5%	23,8%	202%	72%	130%	4,5
	adv. large SRF	2014	-0,3%	25,9%	98%	0,0%	-5,3%	21,0%	198%	84%	114%	7,1
		2015	-0,9%	25,2%	105%	0,1%	-5,7%	22,0%	204%	82%	122%	5,2
		2016	1,0%	24,2%	110%	0,3%	-5,9%	23,8%	203%	73%	130%	4,4
	adv. +Eq Target -Div	2014	1,4%	24,2%	96%	0,0%	-5,2%	21,5%	205%	92%	113%	6,3
		2015	1,7%	22,9%	100%	0,1%	-5,3%	23,0%	211%	96%	115%	4,2
		2016	2,2%	21,4%	102%	0,3%	-5,4%	24,5%	214%	96%	118%	3,3
	base +Eq Target -Div	2014	1,5%	24,2%	96%	0,0%	-5,2%	21,6%	202%	90%	113%	4,3
		2015	1,8%	22,8%	99%	0,1%	-5,3%	23,2%	204%	90%	114%	3,5
		2016	2,3%	21,2%	102%	0,3%	-5,4%	24,8%	203%	87%	116%	3,0
IT	base	2014	0,9%	11,7%	129%	2,7%	-3,4%	18,9%	133%	48%	84%	4,9
		2015	0,4%	12,4%	131%	2,8%	-3,5%	18,6%	135%	50%	85%	4,1
		2016	1,2%	12,8%	131%	2,9%	-3,5%	17,8%	135%	50%	85%	3,5
	adv.	2014	-1,4%	12,6%	133%	2,8%	-4,0%	18,5%	136%	49%	87%	6,4
		2015	-2,3%	13,3%	140%	3,1%	-3,8%	17,8%	142%	48%	94%	4,5
		2016	0,4%	13,9%	141%	3,4%	-3,8%	17,0%	142%	44%	98%	3,7
	adv. no SRF	2014	-1,5%	12,6%	136%	2,8%	-6,7%	18,5%	136%	49%	87%	6,6
		2015	-2,3%	13,3%	142%	3,1%	-4,1%	17,8%	142%	48%	94%	4,6
		2016	0,5%	13,9%	144%	3,4%	-4,0%	17,0%	142%	44%	98%	3,8
	adv. large SRF	2014	-1,4%	12,6%	133%	2,8%	-3,5%	18,5%	136%	49%	87%	6,4
		2015	-2,3%	13,3%	139%	3,1%	-3,8%	17,8%	142%	48%	94%	4,5
		2016	0,5%	13,9%	140%	3,4%	-3,7%	17,0%	142%	44%	98%	3,7
	adv. +Eq Target -Div	2014	0,5%	11,8%	130%	2,7%	-3,4%	18,3%	139%	53%	85%	5,9
		2015	-0,1%	12,6%	132%	2,8%	-3,5%	17,3%	147%	60%	87%	3,8
		2016	2,1%	12,8%	131%	3,0%	-3,5%	15,8%	149%	64%	84%	3,1
	base +Eq Target -Div	2014	0,6%	11,8%	130%	2,7%	-3,4%	18,4%	137%	52%	85%	4,2
		2015	0,1%	12,5%	132%	2,8%	-3,5%	17,7%	141%	55%	86%	3,4
		2016	1,7%	12,8%	131%	3,0%	-3,5%	16,4%	142%	58%	85%	2,9

Table 10 – Cost and reference values (1)

Country	Scenario	Time	real GDP	Unemplo	Debt to	Primary	Deficit to	Investme	Private	HH Debt	Firm	Financial
			Growth	yment	GDP	Deficit to	GDP	nt to	Debt to	to GDP	Debt to	Sector
						GDP		GDP			GDP	Leverage
BE	base	2014	1,2%	7,9%	108%	1,0%	-1,4%	23,7%	151%	57%	94%	4,7
		2015	1,0%	8,1%	107%	1,2%	-1,2%	23,1%	155%	58%	97%	3,9
		2016	1,6%	8,2%	105%	1,4%	-1,0%	22,1%	158%	59%	99%	3,3
	adv.	2014	-0,6%	8,3%	112%	1,0%	-3,0%	22,6%	154%	58%	96%	6,4
		2015	-1,2%	8,5%	114%	1,5%	-1,3%	20,9%	162%	58%	104%	4,6
		2016	2,6%	8,5%	110%	2,0%	-0,7%	19,5%	163%	59%	105%	3,6
	adv. no SRF	2014	-0,6%	8,3%	113%	1,0%	-4,7%	22,6%	154%	58%	96%	6,5
		2015	-1,3%	8,5%	115%	1,5%	-1,4%	20,9%	162%	58%	104%	4,6
		2016	2,6%	8,5%	111%	2,0%	-0,8%	19,5%	163%	58%	105%	3,7
	adv. large SRF	2014	-0,6%	8,3%	110%	1,0%	-1,4%	22,6%	154%	58%	96%	6,3
		2015	-1,2%	8,5%	112%	1,5%	-1,2%	20,9%	162%	58%	104%	4,5
		2016	2,6%	8,5%	108%	2,0%	-0,7%	19,5%	163%	59%	105%	3,6
	adv. +Eq Target -Div	2014	0,9%	7,9%	109%	1,0%	-1,4%	23,1%	157%	62%	95%	5,8
		2015	0,6%	8,2%	108%	1,2%	-1,2%	21,9%	167%	69%	98%	3,8
		2016	2,3%	8,2%	105%	1,5%	-0,9%	20,2%	173%	75%	98%	3,0
	base +Eq Target -Div	2014	1,0%	7,9%	108%	1,0%	-1,4%	23,2%	156%	62%	95%	4,0
		2015	0,8%	8,1%	108%	1,2%	-1,2%	22,3%	163%	65%	98%	3,2
		2016	2,1%	8,2%	105%	1,5%	-0,9%	20,9%	168%	70%	98%	2,7
	NL	2014	0,6%	6,4%	70%	-1,0%	-2,2%	18,9%	212%	124%	87%	4,5
		2015	1,0%	6,5%	71%	-0,9%	-2,1%	18,9%	211%	125%	86%	3,5
		2016	1,9%	6,4%	70%	-0,8%	-2,0%	18,7%	207%	126%	81%	2,8
		2014	-1,6%	7,2%	73%	-1,0%	-4,1%	18,4%	217%	127%	91%	7,6
		2015	-1,6%	7,4%	76%	-0,6%	-2,1%	17,7%	224%	128%	97%	4,7
		2016	1,3%	7,4%	76%	-0,1%	-1,6%	17,5%	222%	126%	97%	3,5
		2014	-1,6%	7,2%	82%	-1,0%	-12,7%	18,4%	217%	127%	91%	8,0
		2015	-1,7%	7,4%	85%	-0,6%	-2,4%	17,7%	225%	128%	97%	4,9
		2016	1,3%	7,5%	85%	-0,1%	-2,0%	17,5%	222%	125%	97%	3,6
		2014	-1,5%	7,2%	72%	-1,0%	-2,2%	18,4%	217%	126%	91%	7,5
		2015	-1,6%	7,4%	75%	-0,6%	-2,0%	17,7%	224%	128%	96%	4,6
		2016	1,3%	7,4%	74%	-0,1%	-1,5%	17,5%	222%	126%	97%	3,4
		2014	0,4%	6,5%	70%	-1,0%	-2,2%	18,6%	228%	138%	90%	6,5
		2015	0,9%	6,6%	71%	-0,9%	-2,1%	18,4%	238%	149%	89%	3,6
		2016	1,8%	6,5%	71%	-0,8%	-2,0%	18,0%	243%	158%	85%	2,6
		2014	0,4%	6,5%	70%	-1,0%	-2,2%	18,7%	225%	136%	89%	3,5
		2015	0,9%	6,6%	71%	-0,9%	-2,1%	18,5%	230%	141%	88%	2,6
		2016	1,9%	6,5%	70%	-0,8%	-2,0%	18,1%	231%	147%	84%	2,1
	FR	2014	0,7%	10,1%	95%	-1,3%	-3,2%	22,5%	147%	61%	85%	7,0
		2015	0,9%	10,2%	97%	-1,2%	-3,3%	21,8%	152%	64%	88%	5,8
		2016	1,9%	10,1%	97%	-1,2%	-3,3%	20,8%	156%	69%	87%	5,0
		2014	-1,3%	10,7%	100%	-1,3%	-6,1%	21,4%	150%	62%	88%	8,8
		2015	-1,9%	11,0%	105%	-1,0%	-3,5%	19,8%	160%	63%	97%	6,6
		2016	0,2%	11,2%	107%	-0,6%	-3,3%	19,1%	166%	65%	102%	5,5
		2014	-1,3%	10,7%	102%	-1,3%	-8,7%	21,4%	150%	62%	88%	8,9
		2015	-1,9%	11,0%	108%	-1,0%	-3,6%	19,8%	160%	63%	97%	6,7
		2016	0,2%	11,2%	110%	-0,6%	-3,4%	19,1%	166%	65%	102%	5,5
		2014	-1,3%	10,7%	97%	-1,3%	-3,3%	21,4%	150%	62%	88%	8,6
		2015	-1,9%	11,0%	102%	-1,0%	-3,4%	19,8%	160%	63%	97%	6,5
		2016	0,2%	11,2%	104%	-0,6%	-3,1%	19,1%	166%	65%	102%	5,4
		2014	0,4%	10,2%	95%	-1,3%	-3,3%	21,9%	154%	67%	87%	8,1
		2015	0,6%	10,3%	97%	-1,2%	-3,3%	20,8%	166%	76%	90%	5,5
		2016	2,1%	10,2%	97%	-0,9%	-3,2%	19,3%	174%	86%	88%	4,3
		2014	0,5%	10,2%	95%	-1,3%	-3,2%	22,0%	153%	67%	87%	5,8
		2015	0,7%	10,3%	97%	-1,2%	-3,3%	21,1%	162%	73%	89%	4,7
		2016	2,1%	10,1%	97%	-1,0%	-3,2%	19,7%	169%	81%	88%	3,9
	AT	2014	1,1%	4,8%	85%	-0,7%	-2,4%	23,6%	148%	56%	92%	4,1
		2015	0,8%	5,0%	85%	-0,4%	-2,2%	23,1%	150%	56%	94%	3,5
		2016	1,6%	5,1%	84%	0,0%	-1,7%	22,0%	151%	57%	94%	3,0
		2014	-0,7%	4,9%	87%	-0,8%	-3,1%	23,8%	152%	57%	95%	7,1
		2015	-1,3%	5,1%	90%	-0,3%	-2,3%	22,8%	160%	56%	104%	4,7
		2016	1,4%	5,3%	89%	0,5%	-1,6%	21,2%	161%	52%	108%	3,7
		2014	-0,7%	4,9%	90%	-0,8%	-6,3%	23,8%	152%	57%	95%	7,3
		2015	-1,4%	5,1%	93%	-0,3%	-2,4%	22,8%	160%	56%	104%	4,8
		2016	1,4%	5,3%	92%	0,5%	-1,7%	21,2%	161%	52%	108%	3,7
		2014	-0,7%	4,9%	86%	-0,8%	-2,4%	23,8%	152%	57%	95%	7,0
		2015	-1,3%	5,1%	89%	-0,4%	-2,3%	22,9%	160%	56%	104%	4,7
		2016	1,4%	5,2%	88%	0,1%	-1,8%	21,5%	160%	52%	108%	3,7
		2014	0,6%	4,8%	85%	-0,7%	-2,4%	22,8%	155%	62%	93%	6,7
		2015	0,2%	5,0%	86%	-0,3%	-2,1%	21,2%	165%	70%	96%	4,2
		2016	3,2%	5,1%	83%	0,5%	-1,4%	19,2%	168%	76%	92%	3,2
		2014	0,8%	4,8%	85%	-0,7%	-2,4%	23,0%	153%	61%	93%	3,8
		2015	0,6%	5,0%	86%	-0,3%	-2,1%	22,1%	158%	63%	95%	3,1
		2016	2,4%	5,1%	83%	0,3%	-1,5%	20,5%	160%	67%	93%	2,6

Table 11 – Cost and reference values (2)

Country	Scenario	Time	real GDP	Unemplo	Debt to	Primary	Deficit to	Investme	Private	HH Debt	Firm	Financial
			Growth	yment	GDP	Deficit to	GDP	nt to	Debt to	to GDP	Debt to	Sector
LU	base	2014	2,5%	5,6%	24%	-1,3%	-1,8%	18,9%	181%	61%	120%	4,6
		2015	2,6%	5,9%	25%	-1,3%	-1,6%	18,3%	184%	62%	122%	3,5
		2016	2,7%	6,2%	26%	-2,0%	-2,3%	17,5%	184%	61%	123%	2,8
	adv.	2014	-2,5%	5,6%	32%	-1,4%	-9,5%	16,8%	193%	64%	129%	11,3
		2015	-3,4%	5,9%	35%	-0,7%	-1,6%	13,9%	212%	63%	149%	6,5
		2016	2,5%	6,2%	34%	0,2%	-0,7%	12,9%	210%	56%	153%	4,5
	adv. no SRF	2014	-2,5%	5,6%	39%	-1,4%	-16,6%	16,8%	193%	64%	129%	11,4
		2015	-3,4%	5,9%	42%	-0,7%	-1,8%	13,9%	212%	63%	149%	6,6
		2016	2,5%	6,2%	40%	0,2%	-0,9%	12,9%	210%	56%	153%	4,5
	adv. large SRF	2014	-2,5%	5,6%	26%	-1,4%	-1,9%	16,8%	193%	64%	129%	11,1
		2015	-3,4%	5,9%	28%	-0,7%	-1,4%	13,9%	212%	63%	149%	6,4
		2016	2,4%	6,2%	27%	0,2%	-0,5%	12,9%	210%	57%	153%	4,4
	adv. +Eq Target -Div	2014	1,9%	5,6%	24%	-1,3%	-1,7%	17,6%	202%	79%	124%	10,4
		2015	1,7%	5,9%	25%	-1,4%	-1,8%	15,9%	223%	95%	127%	5,6
		2016	2,3%	6,2%	26%	-1,4%	-1,8%	14,7%	232%	105%	127%	3,9
	base +Eq Target -Div	2014	2,0%	5,6%	24%	-1,2%	-1,7%	17,9%	197%	75%	123%	4,2
		2015	2,3%	5,9%	25%	-1,3%	-1,6%	17,0%	205%	81%	125%	3,2
		2016	2,5%	6,2%	25%	-1,6%	-1,9%	16,0%	209%	85%	125%	2,6
FI	base	2014	1,3%	8,2%	59%	-3,0%	-3,6%	23,7%	159%	70%	89%	8,4
		2015	1,0%	8,4%	62%	-2,7%	-3,7%	23,1%	165%	75%	89%	6,6
		2016	1,2%	8,7%	63%	-2,4%	-3,7%	21,6%	169%	82%	87%	5,6
	adv.	2014	-0,5%	8,4%	62%	-3,1%	-7,9%	24,0%	162%	70%	92%	10,0
		2015	-1,0%	8,6%	66%	-2,8%	-7,8%	23,4%	171%	71%	100%	7,4
		2016	1,0%	8,8%	68%	-2,5%	-3,6%	21,7%	175%	72%	103%	6,0
	adv. no SRF	2014	-0,5%	8,4%	69%	-3,1%	-15,6%	24,0%	162%	70%	92%	10,4
		2015	-1,0%	8,6%	74%	-2,8%	-8,0%	23,4%	171%	71%	100%	7,6
		2016	1,0%	8,8%	76%	-2,5%	-4,0%	21,7%	175%	72%	103%	6,2
	adv. large SRF	2014	-0,4%	8,4%	60%	-3,1%	-3,8%	24,0%	162%	70%	92%	9,9
		2015	-1,0%	8,6%	65%	-2,8%	-3,7%	23,4%	171%	71%	100%	7,3
		2016	1,0%	8,8%	67%	-2,5%	-3,3%	21,7%	175%	72%	103%	6,0
	adv. +Eq Target -Div	2014	1,1%	8,2%	59%	-3,0%	-3,7%	23,3%	161%	72%	89%	9,3
		2015	0,6%	8,5%	62%	-2,7%	-3,7%	22,2%	169%	79%	90%	6,9
		2016	1,2%	8,7%	64%	-2,4%	-3,6%	20,3%	175%	88%	87%	5,6
	base +Eq Target -Div	2014	1,1%	8,2%	59%	-3,0%	-3,6%	23,3%	161%	72%	89%	8,0
		2015	0,8%	8,5%	62%	-2,7%	-3,7%	22,5%	167%	78%	90%	6,3
		2016	1,2%	8,7%	64%	-2,4%	-3,6%	20,6%	173%	86%	87%	5,3
IE	base	2014	3,6%	12,0%	116%	5,4%	-0,3%	19,2%	247%	86%	160%	5,2
		2015	3,5%	10,4%	112%	5,4%	0,0%	19,0%	240%	83%	157%	4,1
		2016	3,5%	8,7%	107%	5,8%	0,6%	18,1%	233%	82%	151%	3,4
	adv.	2014	-0,5%	12,4%	122%	5,6%	-1,0%	16,1%	258%	91%	167%	11,1
		2015	-5,0%	11,2%	129%	6,8%	-0,1%	12,1%	273%	96%	178%	6,5
		2016	-2,8%	9,9%	128%	8,4%	1,2%	11,5%	275%	97%	178%	4,7
	adv. no SRF	2014	-0,5%	12,4%	126%	5,6%	-4,7%	16,1%	258%	91%	167%	11,3
		2015	-5,0%	11,2%	133%	6,9%	-0,3%	12,1%	273%	96%	177%	6,6
		2016	-3,0%	9,9%	132%	9,1%	1,4%	11,4%	276%	97%	178%	4,7
	adv. large SRF	2014	-0,5%	12,4%	121%	5,6%	-0,3%	16,1%	258%	91%	167%	11,0
		2015	-5,1%	11,2%	128%	6,8%	0,0%	12,1%	273%	96%	178%	6,4
		2016	-2,8%	9,9%	127%	8,4%	1,3%	11,5%	275%	97%	178%	4,6
	adv. +Eq Target -Div	2014	3,2%	12,0%	117%	5,5%	-0,2%	18,6%	259%	98%	161%	9,5
		2015	2,8%	10,4%	113%	5,7%	0,1%	17,5%	264%	106%	158%	5,3
		2016	3,0%	8,8%	108%	6,2%	0,8%	16,7%	265%	115%	150%	3,7
	base +Eq Target -Div	2014	3,5%	12,0%	117%	5,5%	-0,2%	18,9%	256%	96%	161%	4,6
		2015	3,5%	10,4%	112%	5,5%	0,1%	18,7%	254%	98%	157%	3,5
		2016	3,5%	8,7%	107%	5,9%	0,7%	17,9%	253%	103%	150%	2,7
MT	base	2014	3,2%	5,9%	70%	1,3%	-1,4%	16,7%	129%	41%	89%	2,0
		2015	3,1%	5,9%	69%	1,3%	-1,4%	16,1%	121%	37%	84%	2,0
		2016	3,5%	5,8%	67%	1,3%	-1,3%	15,5%	115%	39%	75%	2,0
	adv.	2014	-0,8%	6,0%	73%	1,3%	-1,5%	16,4%	138%	44%	94%	8,6
		2015	-2,7%	6,0%	84%	1,6%	-9,4%	15,6%	149%	45%	104%	6,1
		2016	0,2%	5,9%	84%	2,3%	-1,5%	15,1%	152%	44%	107%	4,7
	adv. no SRF	2014	-0,7%	6,0%	75%	1,3%	-3,9%	16,4%	138%	44%	94%	8,6
		2015	-2,6%	6,0%	90%	1,7%	-12,8%	15,6%	149%	45%	104%	6,2
		2016	0,3%	5,9%	90%	2,4%	-1,7%	15,2%	151%	44%	107%	4,8
	adv. large SRF	2014	-0,7%	6,0%	73%	1,3%	-1,5%	16,4%	138%	44%	94%	8,5
		2015	-2,8%	6,0%	77%	1,4%	-1,7%	15,6%	149%	45%	104%	5,9
		2016	0,6%	5,9%	77%	1,5%	-1,7%	15,2%	151%	44%	107%	4,6
	adv. +Eq Target -Div	2014	3,0%	5,9%	70%	1,3%	-1,4%	16,3%	154%	64%	90%	6,8
		2015	2,8%	5,9%	69%	1,3%	-1,4%	15,3%	171%	85%	87%	4,2
		2016	3,4%	5,8%	67%	1,3%	-1,3%	14,6%	183%	105%	78%	3,2
	base +Eq Target -Div	2014	3,0%	5,9%	70%	1,3%	-1,4%	16,4%	151%	61%	90%	1,8
		2015	2,9%	5,9%	69%	1,3%	-1,4%	15,5%	153%	67%	86%	1,7
		2016	3,4%	5,8%	67%	1,3%	-1,3%	14,8%	156%	78%	77%	1,6

Table 12 – Cost and reference values (3)

Country	Scenario	Time	real GDP	Unemplo	Debt to	Primary	Deficit to	Investme	Private	HH Debt	Firm	Financial
			Growth	yment	GDP	Deficit to	GDP	nt to	Debt to	to GDP	Debt to	Sector
						GDP		GDP				Leverage
SK	base	2014	2,7%	13,2%	55%	0,4%	-1,9%	20,4%	75%	32%	43%	0,8
		2015	2,5%	12,8%	55%	0,4%	-2,0%	19,7%	76%	34%	42%	0,7
		2016	3,3%	12,3%	55%	0,3%	-2,2%	18,7%	76%	36%	39%	0,7
	adv.	2014	0,8%	13,6%	57%	0,4%	-2,3%	20,4%	77%	32%	45%	1,7
		2015	0,3%	13,2%	58%	0,4%	-2,3%	19,7%	79%	31%	47%	1,1
		2016	2,7%	12,8%	58%	0,3%	-2,3%	18,8%	78%	30%	48%	0,9
	adv. no SRF	2014	0,7%	13,6%	58%	0,4%	-3,0%	20,4%	77%	32%	45%	1,8
		2015	0,3%	13,2%	59%	0,5%	-2,3%	19,7%	79%	31%	47%	1,1
		2016	2,7%	12,8%	59%	0,6%	-2,4%	18,8%	78%	30%	48%	0,9
	adv. large SRF	2014	0,8%	13,6%	56%	0,4%	-2,0%	20,4%	77%	32%	45%	1,7
		2015	0,3%	13,2%	58%	0,4%	-2,2%	19,7%	79%	31%	47%	1,0
		2016	2,7%	12,8%	58%	0,3%	-2,3%	18,8%	78%	30%	48%	0,9
	adv. +Eq Target -Div	2014	2,6%	13,2%	55%	0,4%	-1,9%	20,2%	78%	35%	43%	1,5
		2015	2,2%	12,8%	55%	0,4%	-2,0%	19,2%	84%	42%	42%	0,9
		2016	3,2%	12,3%	55%	0,3%	-2,2%	17,9%	88%	48%	40%	0,7
	base +Eq Target -Div	2014	2,6%	13,2%	55%	0,4%	-1,9%	20,3%	77%	34%	43%	0,7
		2015	2,4%	12,8%	55%	0,4%	-2,0%	19,5%	79%	37%	42%	0,6
		2016	3,2%	12,3%	55%	0,3%	-2,2%	18,3%	82%	42%	39%	0,6
EE	base	2014	3,5%	8,3%	10%	-0,1%	-0,1%	30,8%	124%	38%	85%	1,1
		2015	3,2%	7,0%	10%	-0,1%	-0,1%	31,2%	124%	35%	88%	0,9
		2016	2,9%	5,7%	9%	-0,1%	-0,1%	31,2%	124%	33%	92%	0,8
	adv.	2014	2,3%	8,7%	10%	-0,1%	-0,1%	29,1%	125%	39%	86%	6,5
		2015	0,7%	7,7%	10%	0,0%	-0,8%	27,1%	127%	38%	89%	3,0
		2016	0,5%	6,9%	10%	0,1%	0,1%	26,1%	129%	37%	92%	1,9
	adv. no SRF	2014	2,3%	8,7%	12%	-0,1%	-2,2%	29,1%	125%	39%	86%	6,6
		2015	0,7%	7,7%	13%	0,0%	-1,2%	27,1%	127%	38%	89%	3,1
		2016	0,4%	7,0%	12%	0,3%	0,2%	26,0%	129%	37%	92%	1,9
	adv. large SRF	2014	2,3%	8,7%	10%	-0,1%	-0,1%	29,1%	125%	39%	86%	6,2
		2015	0,7%	7,7%	10%	0,0%	-0,1%	27,1%	127%	38%	89%	3,0
		2016	0,5%	6,9%	10%	0,1%	0,1%	26,1%	129%	37%	92%	1,9
	adv. +Eq Target -Div	2014	3,5%	8,3%	10%	-0,1%	-0,1%	30,7%	124%	38%	85%	5,8
		2015	3,0%	7,0%	10%	-0,1%	-0,1%	30,9%	124%	36%	88%	2,7
		2016	2,6%	5,8%	9%	0,1%	0,1%	30,7%	125%	33%	92%	1,7
	base +Eq Target -Div	2014	3,5%	8,3%	10%	-0,1%	-0,1%	30,8%	124%	38%	85%	1,1
		2015	3,1%	7,0%	10%	-0,1%	-0,1%	31,1%	124%	36%	88%	0,9
		2016	2,8%	5,8%	9%	-0,1%	-0,1%	31,0%	125%	33%	92%	0,8
LV	base	2014	2,2%	12,0%	38%	1,3%	-0,1%	27,6%	100%	36%	64%	3,4
		2015	2,2%	10,7%	38%	1,3%	-0,1%	27,5%	103%	37%	67%	3,5
		2016	2,6%	9,2%	37%	1,0%	-0,2%	28,5%	105%	34%	71%	3,5
	adv.	2014	1,9%	12,0%	37%	1,3%	-0,1%	27,7%	100%	37%	64%	3,7
		2015	1,4%	11,0%	39%	1,3%	-0,7%	27,6%	104%	36%	69%	3,3
		2016	2,5%	9,5%	40%	1,1%	-2,8%	28,3%	105%	32%	74%	3,2
	adv. no SRF	2014	1,9%	12,0%	38%	1,3%	-0,1%	27,7%	100%	37%	64%	3,7
		2015	1,4%	11,0%	40%	1,3%	-2,2%	27,6%	104%	36%	69%	3,4
		2016	2,5%	9,5%	41%	1,1%	-2,9%	28,3%	105%	31%	74%	3,2
	adv. large SRF	2014	1,9%	12,0%	38%	1,3%	-0,1%	27,7%	100%	37%	64%	3,7
		2015	1,4%	11,0%	38%	1,3%	-0,1%	27,6%	104%	36%	69%	3,3
		2016	2,5%	9,5%	37%	1,1%	-0,2%	28,3%	105%	32%	74%	3,0
	adv. +Eq Target -Div	2014	2,2%	12,0%	38%	1,3%	-0,1%	27,6%	100%	37%	64%	3,6
		2015	2,2%	10,7%	38%	1,3%	-0,2%	27,5%	104%	37%	67%	3,3
		2016	2,5%	9,2%	39%	1,0%	-2,6%	28,3%	105%	34%	71%	3,2
	base +Eq Target -Div	2014	2,2%	12,0%	38%	1,3%	-0,1%	27,6%	100%	37%	64%	3,4
		2015	2,2%	10,7%	38%	1,3%	-0,1%	27,4%	104%	37%	67%	3,4
		2016	2,5%	9,2%	37%	1,0%	-0,2%	28,4%	105%	34%	71%	3,4
SI	base	2014	2,3%	9,4%	66%	-5,5%	-9,0%	19,1%	112%	33%	79%	2,0
		2015	2,0%	9,2%	74%	-5,2%	-9,3%	18,5%	109%	35%	75%	1,8
		2016	2,1%	9,0%	81%	-4,8%	-9,5%	17,1%	105%	38%	67%	1,7
	adv.	2014	0,1%	10,1%	69%	-5,6%	-10,5%	18,3%	115%	33%	82%	4,8
		2015	-0,9%	10,1%	80%	-5,2%	-9,7%	17,1%	118%	34%	84%	2,7
		2016	1,4%	10,1%	87%	-4,7%	-9,9%	15,9%	115%	34%	81%	2,2
	adv. no SRF	2014	0,1%	10,1%	71%	-5,6%	-12,1%	18,3%	115%	33%	82%	4,9
		2015	-0,9%	10,1%	81%	-5,2%	-9,9%	17,1%	118%	34%	84%	2,8
		2016	1,4%	10,1%	89%	-4,7%	-10,1%	15,9%	115%	34%	81%	2,2
	adv. large SRF	2014	0,1%	10,1%	68%	-5,6%	-9,2%	18,3%	115%	33%	82%	4,6
		2015	-0,9%	10,1%	78%	-5,2%	-9,7%	17,1%	118%	34%	84%	2,7
		2016	1,4%	10,1%	86%	-4,7%	-9,8%	15,9%	115%	34%	81%	2,2
	adv. +Eq Target -Div	2014	1,0%	9,4%	67%	-5,4%	-9,0%	16,7%	117%	37%	81%	4,2
		2015	0,5%	9,2%	76%	-4,9%	-9,2%	13,2%	121%	46%	75%	2,4
		2016	8,1%	9,0%	76%	-3,8%	-8,4%	8,1%	115%	63%	52%	1,9
	base +Eq Target -Div	2014	1,0%	9,4%	67%	-5,4%	-9,0%	16,8%	116%	35%	80%	1,9
		2015	0,4%	9,2%	76%	-4,9%	-9,2%	13,2%	116%	41%	75%	1,6
		2016	7,8%	9,0%	77%	-3,8%	-8,5%	7,9%	108%	55%	52%	1,5

Table 13 – Cost and reference values (4)

Tables 10 to 13 show that, apart from the direct effect of increased government debt levels, the overall conclusion of the exercise is that none of the economies we have analysed can avoid another recession, with the labour market usually reacting in a significant way (Luxembourg, Germany and Austria being exceptions).

The larger the banking sector with respect to the country's GDP, the more effective is the implementation of an upward adjusted equity ratio vis-à-vis a tripling of the SRF. This is particularly true for Luxembourg, as already said, but it holds as well for the Netherlands, Ireland, Austria and Belgium.

An interesting phenomenon emerges regarding the resilience of countries. Indeed, the factor that seems to play the key role in determining the size of the drop in a country's macroeconomic performance is the level of the private debt-to-GDP ratio. Countries for which this ratio exceeds 150 % seem to experience a sharper recession, while those where it is below that threshold have less difficulty in weathering the turmoil. By contrast, the public debt-to-GDP ratio is not such a reliable indicator of the country's health: Luxembourg and Malta suffer a sharp drop in GDP even though their public finances are quite satisfactory. This confirms the intuition already referred to in the introduction to this report, namely that high private debt is a more serious threat to a country's economy than public debt. This helps us understand why Ireland is so severely affected by the shock. Despite the popular misapprehension to the contrary, the root of Ireland's fragility is not its public debt (116 % of GDP, arising mainly from the socialisation of the banks' debt in 2010, since in 2007 Ireland's public debt was no more than 25 % of its GDP).

Finally, the subgroup made up of Slovenia, Slovakia, Latvia and Estonia exhibits a specific pattern, as these countries have low public debt ratios and small banking sectors. As a consequence, they turn out to be quite resilient.

On the financial side of our narrative, we may recall from Figure 16 and 17 in Part I of this report that the SRF would be entirely (or almost entirely) absorbed by trying to cope with the shock in a number of countries, namely Germany, France, Spain and the Netherlands. Next, regarding the banking sector, its solidity can be much appreciated through the evolution of its leverage ratio (computed, here, as the quotient of banks' equity and debt⁷³). Indeed, this ratio measures the exposure of banks to a run from their creditors - the main concern during the restructuring process of a troubled bank. Here, we have assumed throughout that such a creditor run would not take place. However, it should be clear that the risk of such a run cannot be overestimated. Thus, the larger our leverage ratio after the shock, the more exposed banks are to such a run. On this issue, three groups of countries emerge from our simulations. First, those for which the risk is minimal: again and unsurprisingly, Slovenia, Slovakia, Latvia and Estonia- Second, the group of countries for which the risk is significant but not exorbitant: for these, the leverage ratio peaks in a range between 6 (Italy) and 11 (Ireland) at the worst phase of the turmoil (generally, the second half of 2014 in our simulations). One may note that this subgroup is somewhat heterogeneous: Italy and Belgium (6-7) are less exposed than the Netherlands, France, Germany and Austria (7-9) or Finland (10). Third, the two countries for which the leverage ratio skyrockets to a rather problematic level: Luxembourg (11) and

⁷³ It should therefore be kept in mind that this ratio coincides neither with the solvability ratio (equity/total liabilities) nor with the weighted average Basel III Tier 1 ratio.

Ireland (11). For these two countries, our analysis suggests that the issue of preserving the liquidity of their creditors would be the main concern in case of an urgent restructuring process.

A last word before we conclude this section: these results are to be seen as rough estimations, giving a sense of magnitude and direction. To further strengthen them, we would need to test their robustness with respect to infinitesimal changes in the parameterisation of our model. This would require applying Bouleau's error calculus (2003), but that would go beyond the scope of the present study.

Chapter 3 – CONCLUSIONS

Key findings

A financial shock would possibly have serious effects on the European economy.

In order to prevent or mitigate these effects we recommend:

1. Increasing the equity ratio target of banks to 9 % or more would suffice to prevent most of the damage we have envisaged and being the most efficient expedient we have found;
2. Increasing the level of the resolution fund (EUR 165 billion) and earlier scheduling of its full capitalisation;
3. Given, however, that our simulations show that such an extension of the SRF will be far from sufficient, recourse to other expedients;
4. Banking separation, i.e. splitting of retail and market businesses;
5. Guarantee mutualisation of European deposits, as probably an essential measure.

III - Concluding comments and policy recommendations

In the first part we found that even on the assumption of the proposed BU framework being already implemented, the euro area banks remain fragile with their sovereign prone to bailouts. In order to assess the long-term economic impacts of such a scenario and test different policies, we simulate the euro area economies in a macroeconomic model. First, we argue for the need of such a model, which incorporates the effect of money on the real economy, is independent of the economy being in equilibrium, avoids emergence phenomena, has a banking system with endogenous money creation, and reflects the impact of private and public debt levels. This rules out commonly used models such as DSGE and justifies our decision to use an innovative evolution of the Goodwin-Keen model incorporating the necessary features.

We calibrate this model in such a way that, in the absence of any exogenous shock, its projection coincides with the Commission's forecasts. The size of the shock itself is calibrated so that the bailout needed from the home sovereign coincides with that obtained in Part I as a result of a 15 % loss in a major systemic bank's assets.⁷⁴

⁷⁴ It should be noted that in Part I we took a microeconomic standpoint, scrutinising the financial impact of the collapse of a single, systemic establishment hit by shocks of various sizes (up to -15 %). Here, we look at the macroeconomic impact of a medium-sized shock (-10 %) conceived as hitting the entire banking sector of a country.

We then come to the following estimations for the euro area in case of a shock and assuming the proposed Banking Union framework to be already in place:

- a EUR 1 trillion cumulated potential loss in GDP $\sim 9.4\%$ of EUR 10,632 billion 2016 GDP – Commission forecast or an EUR 100 billion annualised potential loss in GDP over ten years;
- a 1.91 million potential difference in unemployment, or 1.19% assuming a total workforce of 161.1 million (2016 model forecast) or a 0.19 million potential difference in unemployment per year;
- a EUR 51.4 billion potential difference in government debt in 2016 (EUR 56 billion bailout) $\sim 0.5\%$ of EUR 9 933 billion 2016 government debt – Commission forecast.

We then suppose that the SRF is not yet in place when the euro is hit by the shock; or, on the contrary, that its size has been tripled (to EUR 165 billion). It turns out that, should a shock materialise, the influence of the size of the SRF is insignificant in terms of potential GDP loss, and relatively small both in terms of underemployment and debt-to-GDP ratio. By contrast, an increase in the prudential leverage ratio required from banks to 9% or more would suffice to almost entirely dampen the effect of the shock, provided banks change their business model and reduce their return on equity to their shareholders.

The results at the country level roughly follow the same lines. They vary significantly in terms of the magnitude of the effect on the labour market and whether the impact mainly affects consumption or investment, but the direction is always the same in response to a shock. By way of illustration, we focus on the devastating impact a shock would have on the Spanish labour market as well as on the GDP of Luxembourg.

In order to prevent or mitigate the effects of a possible banking crash, we therefore recommend the following:

1. Increase the level of the resolution fund (EUR 165 billion) and schedule earlier full implementation; but also, as this is far from being sufficient:
2. Increase the prudential leverage ratio of banks to 9% or more;
3. Implement a separation between retail activities and market or investment banking;
4. Establish a European deposit guarantee mutualisation.

The main lessons to be drawn from our numerical experiments are twofold.

First, the relatively modest direct financial impact of a 10% shock on a systemic bank, as simulated in the first part of this report, would mislead if seen in isolation. This is why we estimated the macroeconomic impact of such a financial stress on the real economy. Such a shock could be potentially devastating, not only because of its immediate cost (in terms of GDP), but also because it would condemn some countries to fall into the liquidity trap⁷⁵ – a trap

⁷⁵ This concept originates in the seminal work of Irving Fisher (1933) (see, e.g., Eggertson and Krugman (2010)). The basic idea is that whenever most economic actors are overindebted they may refuse to use liquidity in order to transact (consume or invest), preferring first to try to deleverage. It is known that once an economy has fallen in this kind of trap, pumping more cash into the economy (as most central banks did in recent years) is useless: debtors will borrow this ‘helicopter money’ at zero cost (since, usually, the

where we know when a country enters, but from which no-one knows how or when to exit from.

Second, and as a consequence, the resolution pillar of the banking union is definitely not adequate to prevent a new macroeconomic crisis in case of financial stress. It should be borne in mind that our simulations obviously exclude a number of issues that would only worsen the final picture. Firstly, we have neglected the correlation between countries: only at the euro area level do we capture the overall systemic effect of a financial crisis. Secondly, we have assumed that, for each country under scrutiny, exports and imports remain constant. In reality, it is to be expected that both exports and imports would be reduced after a shock, because neighbouring countries would presumably experience similar difficulties at the same time. Thirdly, we have neglected issues related to the euro exchange rate. It can be expected, however, that a new crisis would provoke mistrust on the foreign exchange markets that would presumably push the Euro down to extremely low levels. Last but not least, we have made the strong assumption that a bank failure would be perfectly managed by clearing houses on markets for financial derivatives, so that no spill over effects would occur through that channel. Should that not be the case, the consequences could be devastating.⁷⁶

Were we to take all the above effects into account, our conclusions would obviously be more pessimistic.

III.1. Policy Recommendations

The preceding sections suggest multiple ways to improve the current situation with the goal of preventing and minimising the damaging costs of a major financial shock.

Since the Single Resolution Fund turns out to be too small and will be put in place too late to withstand a systemic banking crisis on its own (this confirms the conclusion already drawn from Part I of this report), an intuitive reaction would be to increase its size and to speed up its implementation. This would certainly be a useful improvement of the Banking Union. Already the static results of the first part showed that the current level of capitalisation would not be enough to protect all European taxpayers from a medium sized shock to the banking sector. The most effective recommendation from the static analysis was to systematically bail-in senior creditors and big depositors in order to shield governments from the fallout of the shock.

From the analysis of the dynamic model, our recommendation is to triple the size of the Single Resolution Fund, from EUR 55 billion to EUR 165 billion, and to bring forward its implementation from 2023 to 2017. Given such improvements, the link between banks and sovereigns would be weakened. **However, our simulations show that even a tripling of the SRF would diminish the damaging effects of a shock only marginally.** Even more, they

leading interest rate of the Central Bank lies at the zero lower limit) and will return it or, at most, try to deleverage. The only way to get out of this trap consists in a *fiscal* (not monetary) policy in which the only economic agent that is able to postpone the deleveraging task (namely the state) uses its margin of freedom to replace failing private investment. Later on, once the economy has been saved from the trap and private actors have succeeded in deleveraging, the state will be able, in turn, to reduce its sovereign debt.

⁷⁶ Cf. footnotes 37 and 38 above.

suggest that the SRF could start playing its role as a ‘firewall’ only with a size above EUR 500 billion, given also our relatively gentle scenario. As such a size seems unreachable in the near future, our conclusion is the following: **even though expanding the size of the SRF would be useful, this is far from being sufficient to make the European Banking Union efficient and other improvements are needed.**

The policy that turned out to be the most efficient, according to our simulations, consists in increasing the equity ratio target of commercial banks. A target of 9 % or more turns out to be sufficient to significantly dampen the effects of a shock in the medium term, according to our findings. Increasing the leverage ratio is not a new proposal, and having more equity should not be viewed by banks, as being more expensive than debt (despite the disagreements of some professionals on this issue). First, in circumstances where it holds water, the Modigliani-Miller theorem tells us that debt and equity should be entirely equivalent. Second, in circumstances where the latter textbook result does not work, and as recalled by Admati and Hellwig (2013), equity is more risky than debt because of its loss absorption capacity and unlimited profit participation, but the compensation for this risk is historically fair, and equity is part of a bank's capital deployed in its business. Nor is an increase in equity a deterrent to new lending (on the contrary, data and common sense agree in showing that the more equity a bank has, the more capable it is of lending (cf. Admati and Hellwig, op. cit.)). It has only been possible to expand balance sheets to such a large size with so little equity in the past 20 years because banks knew that, *in extremis*, the risks would be underwritten by the state.

As a result of this subsidy and the state's promise of underwriting the banks' risks, banks never have to worry about their solvency: that is warranted. All they have to concern themselves with is their liquidity – whether they have enough cash to satisfy depositors wishing to withdraw it. Here, being the lender of last resort, central banks, with their capacity to print legal tender, can promise to generate the cash that banks need in a crisis, and to a sufficient scale. Then, with solvency underwritten and liquidity on tap, even the worst banking crisis seems to be manageable. At least, this was the mainstream opinion before Lehman Brothers went bankrupt. It is not excluded that some still think this way today, which might explain why they are so confident that the current Banking Union project suffices. However, one actor is forgotten in the above reasoning: the real economy. What we have shown in this study is that a new banking crisis, even if it would seem to be manageable at a strictly financial level (Part I), would have significant impacts on the *real economy* (Part II).

Such a cost can be dramatically reduced by increasing the capital adequacy requirement of banks. Doing so would, at the same time, suppress one of the major incentives for the race to large balance sheets dominated by trading assets that has characterised the last 20 years. A 9% level would be in accordance with the proposals made by Admati and Hellwig (2013) or Finance Watch (2013) (the equivalent level was over 20 % 80 years ago).

Obviously, given the fragility of their own balance sheets, several banks will have difficulty in reaching such a target within a reasonable time schedule. Nonetheless, the June 2012 summit agreement according to which most European leaders agreed to separate the continent's banking crisis from its public debt crisis would probably prove to have pointed out the right way to help fragile banks reach the target.⁷⁷ This agreement consists in nothing else than infusing the banks of the deficit countries with capital from surplus countries and not

⁷⁷ See: https://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/ec/131359.pdf

counting those capital injections as part of the national debt of the countries where the banks are domiciled.

It follows from our study that a third reform would usefully complement the current European Banking Union, namely a true **separation of traditional retail activities from investment banking and trading activities**, including market-making. The EU directive proposed by ex-Commissioner Michel Barnier is certainly a good step in this direction, as is also the Liikanen report (2012).⁷⁸ Such a reform would mean that governments would not be forced to give an implicit public guarantee on unsafe banks just because they combine retail (deposit accounts) and market activities - i.e. an implicit public subsidy for market transactions. The public guarantee would be reserved for retail banks in order to safeguard deposit accounts, while 'pure' market banks becoming insolvent, could be allowed to fail, without asking for public money. The consequences of the failure of a 'pure' market bank can hardly be measured within our framework, as in creating it we assumed that all potential spill over effects on the European interbank market as well as on the markets for financial derivatives would be properly managed and neutralised. As we have said, however, no one can measure such spill overs ex ante, as this would require financial data that is scarcely available and is constantly changing. It is even this lack of knowledge that makes it so dangerous for public authorities to take the risk not to rescue a troubled bank engaged in significant market activities (cf. Finance Watch (2013)). The US administration decided to take that risk on 15 September 2008, by not bailing out Lehman Brothers; and there is now a broad consensus that this should 'never happen again'. However, in the absence of any transparent information about the cost of each decision, the 'never again' slogan is prone to mean 'never let a bank fail without bailing it out'.

A return to some form or another of the Glass-Steagall Act (which prevailed for 60 years, during which time there were only few major banking crisis in Western countries) would enable public authorities to decide to bail out (or not) insolvent retail banks with a reasonably trustworthy knowledge of its consequences, such as those that are estimated in the present study.

It would certainly not help the public decision should a pure market bank become illiquid or insolvent. However, the moral hazard effect of the current implicit public guarantee on market operations led by 'mixed banks' would disappear. Being more risk-averse, market banks should take less risk. As a consequence, troubles should occur less frequently. On the other hand, requiring that the existing 'mixed' banks put a large fraction of their operations on markets for derivatives would make the latter more costly, forcing banks to focus on the less risky ones.⁷⁹

As we have said, our study has neglected the possibility of a bank run, given the difficulty of quantitative measuring of its impacts. This does not mean, however, that bank runs should be considered as curiosities. They occurred in the UK in 2008. The third pillar of the Banking Union, still missing today, should therefore be added as soon as possible: a European mutualisation of the public guarantee on deposits. As already said, this is the only way to make sure that one euro in a deposit account hosted by e.g. Deutsche Bank has the same value as a euro in a deposit account hosted by e.g. Banco Espírito Santo in Portugal. Such a guarantee

⁷⁸ By contrast, the French and German 'separation laws' only ask banks to locate a tiny fraction of some of their risky market operations in a subsidiary. As such, they are highly insufficient (cf. Giraud and Scialom (2013)).

⁷⁹ Cf. footnotes 37 and 38 above.

would avoid bank runs, which have potentially huge economic costs, while a mutualised guarantee at European level entails significant cost benefits due to cash pooling and diversification effects. This mutualisation could be seen as a preliminary step towards European political and fiscal union.

Today, deposits are guaranteed by national funds. The directive regarding deposit guarantee taken in Spring 2014 contributed to more transparency for depositors, faster verification of claims and quicker reimbursement in the event of a bank failure. However, it maintained the EUR 100,000 level of protection without enforcing mutualisation. Mutualisation would mean creating a European fund. How would it be funded? In the same way as national funds or the SRF are funded by banks. This European Deposit Guarantee Fund would also have to be funded by banks. It is to be expected that the banking industry will claim it to be too costly. The question would then become: are the countries of the euro area in a position today to effectively guarantee their deposits (up to EUR 100 000 per depositor and bank)? The figures in Part I of this study suggest that this is not the case (for example, 'small' depositors in France, account for a total of EUR 1 000 billion, while the French Deposit Guarantee Fund totalled EUR 2 billion before it was merged with the French Resolution Fund, in 2013). As long as the European Banking Union does not put into practice a means of funding a European Deposit Guarantee Fund, it will remain exposed to bank runs. Indeed, they could occur simply because people realise that European countries are not able to guarantee their deposits. For instance, a tax on financial transactions could provide the needed cash for such a fund.

Lastly, we offer a final proposal, which also follows from our simulations. It consists in reducing the harshness of the fiscal consolidation programme that is put into practice by each government according to our scenario. It might well be the case that refraining from deleveraging, at least temporarily, is a good way for the state to support an economy that is on the verge of falling into deflation. The reason for such an apparent paradox is easy to grasp: if all economic actors try to deleverage at the same time - and we just saw that all our agents have large amounts of debt, and would need to rapidly deleverage in case of stress - they will all sell their assets in exchange for liquidity. These 'fire sales' may induce a fall in prices (as in Spain in our simulations), which will *increase* the real burden of (private and public) debt. The sole way to avoid such a vicious circle seems to be that the public authorities postpone their deleveraging. By doing so, they would back off the fall in consumer prices, and help the other actors translate their own deleveraging efforts into a reduction of their *real* debt. As a matter of fact, a less pronounced fiscal consolidation programme does slow down the pace at which the state reduces its debt in the first quarters, but by counterbalancing the debt-deflation effect it may foster the GDP rebound, and actually improve the public debt-to-GDP ratio in the medium run.

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APPENDIX I

Systematic Scenario Description (Chap. 1)

In total we have a look at six different scenarios. They depend on how to interpret the 8% limit and how losses are distributed.

Loss taken by home country of HQ

After the applied loss to creditors of 8% of total assets the bank is recapitalised up to 4.5 % equity/total assets.

8% cap

We assume that x% of a bank's balance sheet are bad assets and distribute the losses in the following order:

1. Shareholders and Creditors
 1. Absorb losses up to 8% of total assets; remaining loss is carried over
 1. Equity
 2. Hybrid Capital
 3. Subordinated Debt
 4. Senior Creditors
 5. Big depositors
2. SRF
 1. Pays only after the bail in of minimum 8 % of shareholders and creditors
 2. Maximum 5% of total assets
 3. Maximum 55bln EUR
 4. Pays for recapitalization
3. ESM
 1. Pays only if the government has a sovereign debt yield >6% after absorbing the remaining loss and cost of recapitalization
 2. Maximum 60 bn EUR
 3. Pays for recapitalization
4. Government
 1. Pays whatever loss is left
5. Small depositors, Repos and Other Liabilities
 1. No loss taken

8% floor

1. Shareholders and Creditors
 1. Absorb up to 8% and above of total assets; remaining loss is carried over
 1. Equity
 2. Hybrid Capital
 3. Subordinated Debt
 4. Senior Creditors
 5. Big depositors
2. SRF
 1. Pays only after the bail in of minimum 8 % of shareholders and creditors
 2. Maximum 5% of total assets
 3. Maximum 55bln EUR
 4. Pays for recapitalization
3. ESM
 1. Pays only if the government has a sovereign debt yield >6% after absorbing the remaining loss and cost of recapitalization
 2. Maximum 60 bn EUR
 3. Pays for recapitalization
4. Government
 1. Pays whatever loss is left
5. Small depositors, Repos and Other Liabilities
 1. No loss taken

Loss distributed by GDP

After the applied loss to creditors of 8% of total assets the bank is recapitalised up to 4.5 % equity/total assets.

8% cap

We assume that x% of a bank's balance sheet are bad assets and distribute the losses in the following order:

1. Shareholders and Creditors
 1. Absorb losses up to 8% of total assets; remaining loss is carried over
 1. Equity
 2. Hybrid Capital
 3. Subordinated Debt
 4. Senior Creditors
 5. Big depositors
2. SRF
 1. Pays only after the bail in of minimum 8 % of shareholders and creditors
 2. Maximum 5% of total assets
 3. Maximum 55bln EUR
 4. Pays for recapitalization
3. ESM
 1. Pays for recapitalization
 2. Pays only if the government has a sovereign debt yield >6% after absorbing the remaining loss and cost of recapitalization
 1. This hypothetical remaining loss and the cost of recapitalisation is distributed by national GDP/Euro Area GDP
 3. Pays only for countries meeting this criteria
 4. Maximum 60bln EUR; if the total loss of countries meeting the criteria for ESM bailout >60bln, the payment is distributed by the share of each countries loss meeting the criteria / total loss of countries meeting the criteria for ESM bailout
4. Government
 1. Pays whatever loss is left
5. Small depositors, Repos and Other Liabilities
 1. No loss taken

8% floor

1. Shareholders and Creditors
 1. Absorb up to 8% and above of total assets; remaining loss is carried over
 1. Equity
 2. Hybrid Capital
 3. Subordinated Debt
 4. Senior Creditors
 5. Big depositors
2. SRF
 1. Pays only after the bail in of minimum 8 % of shareholders and creditors
 2. Maximum 5% of total assets
 3. Maximum 55bln EUR
 4. Pays for recapitalization
3. ESM
 1. Pays for recapitalization
 2. Pays only if the government has a sovereign debt yield >6% after absorbing the remaining loss and cost of recapitalization
 1. This hypothetical remaining loss and the cost of recapitalisation is distributed by national GDP/Euro Area GDP
 3. Pays only for countries meeting this criteria
 4. Maximum 60bln EUR; if the total loss of countries meeting the criteria for ESM bailout >60bln, the payment is distributed by the share of each countries loss meeting the criteria / total loss of countries meeting the criteria for ESM bailout
4. Government
 1. Pays whatever loss is left
5. Small depositors, Repos and Other Liabilities
 1. No loss taken

Loss taken by subsidiaries home country

After the applied loss to creditors of 8% of total assets the bank is recapitalised up to 4.5 % equity/total assets.

8% cap

We assume that x% of a bank's balance sheet are bad assets and distribute the losses in the following order:

1. Shareholders and Creditors
 1. Absorb losses up to 8% of total assets; remaining loss is carried over
 1. Equity
 2. Hybrid Capital
 3. Subordinated Debt
 4. Senior Creditors
 5. Big depositors
2. SRF
 1. Bank failure is handled as a single incident by the SRF; Maximum 55bln EUR bailout for all impacted countries; if sum of remaining loss >55bln EUR, then the SRF funds are redistributed proportionate to the share of each countries remaining loss / total remaining loss
 2. Maximum 5% of sum of subsidiaries total assets (data shortcomings have a secondary effect here)
 3. Pays for recapitalization
3. ESM
 1. Pays for recapitalization
 2. Pays only if the government has a sovereign debt yield >6% after absorbing the remaining loss and cost of recapitalization
 3. Pays only for countries meeting this criteria
 4. Maximum 60bln EUR; if the total loss of countries meeting the criteria for ESM bailout >60bln, the payment is distributed by the share of each countries loss meeting the criteria / total loss of countries meeting the criteria for ESM bailout
4. Government
 1. Pays whatever loss is left
5. Small depositors, Repos and Other Liabilities
 1. No loss taken

8% floor

1. Shareholders and Creditors
 1. Absorb up to 8% and above of total assets; remaining loss is carried over
 1. Equity
 2. Hybrid Capital
 3. Subordinated Debt
 4. Senior Creditors
 5. Big depositors
2. SRF
 1. Bank failure is handled as a single incident by the SRF; Maximum 55bln EUR bailout for all impacted countries; if sum of remaining loss >55bln EUR, then the SRF funds are redistributed proportionate to the share of each countries remaining loss / total remaining loss
 2. Maximum 5% of sum of subsidiaries total assets (data shortcomings have a secondary effect here)
 3. Pays for recapitalization
3. ESM
 1. Pays for recapitalization
 2. Pays only if the government has a sovereign debt yield >6% after absorbing the remaining loss and cost of recapitalization
 3. Pays only for countries meeting this criteria
 4. Maximum 60bln EUR; if the total loss of countries meeting the criteria for ESM bailout >60bln, the payment is distributed by the share of each countries loss meeting the criteria / total loss of countries meeting the criteria for ESM bailout
4. Government
 1. Pays whatever loss is left
5. Small depositors, Repos and Other Liabilities
 1. No loss taken

The asset base on which to recapitalise is:

Total Assets - min(Bad Assets ; Equity + min(8% of Total Assets ; Hybrid Capital + Subordinated Debt + Senior Creditors + Big Depositors))

Data (Chap. 2)

We use the ECB, OECD and Eurostat as sources for this second part of our study. The quarterly data covers the time frame from 1999 Q4 until 2014 Q2 (varying per country). For the calibration of the Vlasios estimations in the model, we use the whole time series of GDP, salaries, GDP and final consumption expenditure deflator, investment, consumption, unemployment and firm profits.

For certain countries, deseasonalised data, as well as data without working day adjustments are not available. Others don't publish data on taxes, subsidies and interest payments. For such countries, we had to manually adjust for the shortcomings in the availability of public data, when calibrating the model. All data is publicly available and we used only one data source per variable and country treated in this report. The code underlying our simulations is also available upon request.

For each country, our model is calibrated so that our baseline scenario (i.e., the macro-economic scenario that would follow absent any shock) remains as close as possible to the European Commission forecast. We assume that a shock hits the banking sector of the country (or zone) under scrutiny in 2014 Q2, and is followed by two other shocks, of smaller magnitude in 2014 Q3 and Q4.

Monetary macro-economic dynamics (Chap. 2)

By contrast with the flaws just emphasized, the approach adopted here,

1. Treats the economy as inherently monetary;
2. Does not impose as a built-in hypothesis that the economy is already at equilibrium, and models the latter dynamically;
3. Models aggregate behaviours according to empirical observations;
4. Models the endogenous creation of money by the banking sector in a pure credit economy; and
5. Gives credit and private debt a pivotal roles in economic theory that the last decade has shown they have in the real world.

Let us now describe the basic mechanism at work in our modelling approach in more details⁸⁰. There are three pillars whose interplay drives our macro-economic model.

Pillar A: Investment, consumption and the Phillips curve.

The first one is a phenomenological treatment of the main aggregate behaviours (see point 3 in the last list *supra*): investment, consumption and the dynamics of wages. In other words, what drives an economy, in our model, is the decision to invest, the decision to consume and the impact of these two decisions on the way wages evolve. For the time being, and for explanatory purposes, suppose we deal with a real economy, where money is just a unit of account, while trades are barter. (Money will be introduced as our next pillar.)

Here, for simplicity, and in order to stay as close as possible to the theoretical framework studied in the literature quoted above, we assumed that investment is a function of the profit share (i.e., of the ratio corporate profit/GDP) while consumption is a function of the wage share

⁸⁰A technical description of our model can be found in the Appendix.

(the ratio wages/GDP). This double dependency is responsible for stabilizing the dynamics towards a market equilibrium: Indeed, if the profit share increases, then, usually and *ceteris paribus*, investment will increase. At the same time, however, a higher profit share will induce a lower wage share, so that consumption should decrease.

How should the functional dependency between investment (resp. consumption) and profit (resp. wage) share be captured? Here, we used a statistical approach originating in the work by Rigby et al. (2005, 2013) and Vodouris et al. (2012) and which consists in approximating this relationship by means of some polynomial, using non-necessarily Gaussian residuals⁸¹. Thus, by contrast with some familiar approaches used in several applied macro-economic model, we do not restrict our empirically estimated functions to be linear.

The third function that is empirically estimated is a short-run 'Phillips curve' following, e.g., Mankiw (2001, 2014), and most neo-Keynesian models. We assume that there is a functional relationship between the change rate of real wages (not inflation) and the current unemployment rate. That such a relationship still exists today, in the short run, has been subject to some debate but is supported by many scholars.⁸² It can be easily interpreted in terms of bargaining power on the side of employees: the larger the rate of unemployment, the more difficult it is for employees to bargain real wage increases. One could claim that, at least in Germany, the Hartz IV agreement (2002), by imposing constant real wages, implies a flat 'Phillips curve'. But recent years have seen this agreement put into question, even in Germany. On the other hand, we also deal with other European countries where, obviously, wages did evolve in quite a contrasted way in the recent past (think of Greece !). Thus, we proceeded by estimating the short-run Phillips curve separately for each country under scrutiny and for the entire euro-zone. For the sake of consistency, we estimated investment and consumption in a country-specific way as well⁸³.

Figure 29 shows an example of a short-run Phillips curve estimated through the GAMLSS procedure for the euro area.

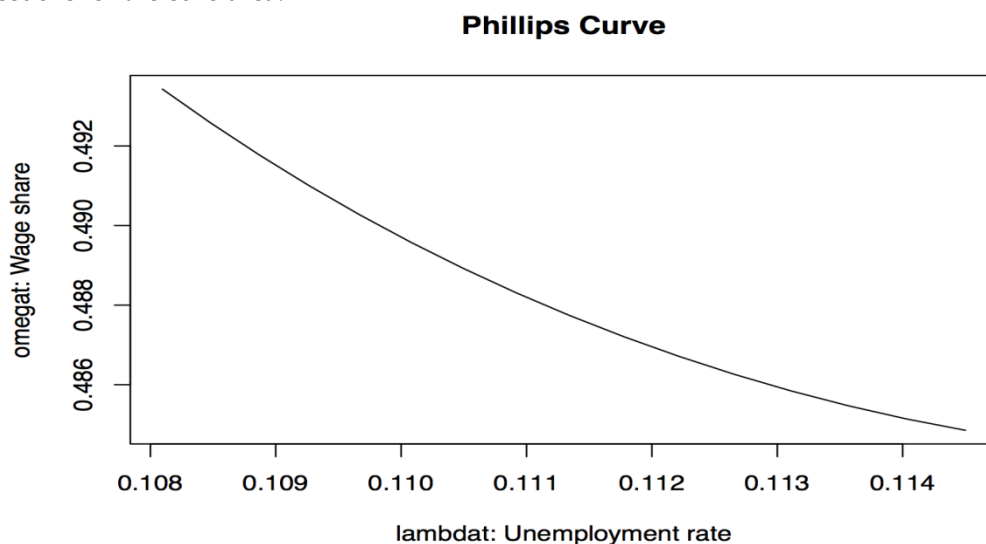


Figure 29 - Short run Philips curve

⁸¹Actually, the GAMLSS procedure introduced by Vodouris enables to perform a much finer stochastic approximation, but for simplicity, we refrained from striving for the utmost empirical accuracy. The statistical robustness of our model (i.e., its sensitivity in terms of error calculus) will be checked in a subsequent work. The preliminary investigations provided in this report suggest that our findings do not heavily depend upon the precise specification of the investment and demand functions.

⁸²Cf. Mankiw (2001, 2014) and the references therein.

⁸³Our data

Taken together, investment and the short-run Phillips curve drive the dynamics as follows: suppose the profit share increases. This means that investment will increase, hence production. Absent any major substitution effect in terms of, say, a forthcoming 'digital revolution', this output growth will increase employment.⁸⁴ Thanks to the short-run Phillips curve, new job creation will increase the bargaining power of employees, hence the growth of wages. The latter, however, will provoke an increase of the wage share, hence a decrease in the profit share. This way, it is easily observable that the model generates an endogenous business cycle.

This can be observed in the following graphs. Suppose, for simplicity, that consumption automatically adjusts to output supply (in other words, that Say's law - 'supply creates its own demand' - is in force).

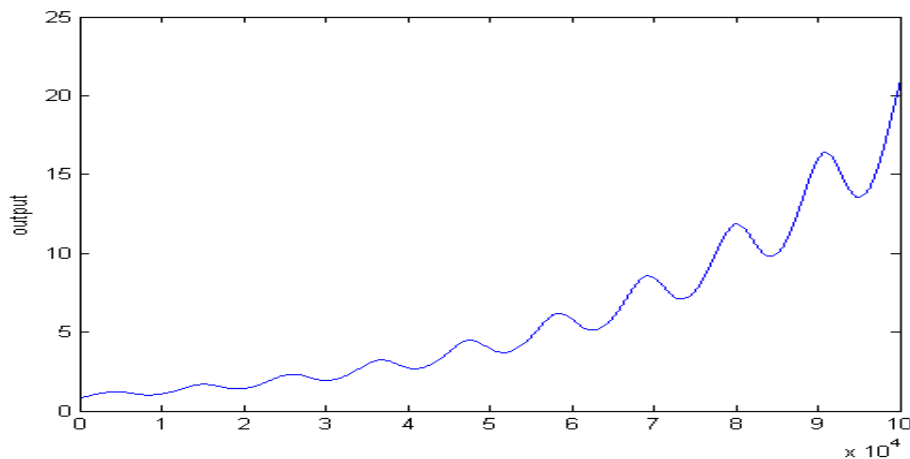


Figure 30 - Endogenous business cycle

In Figure 30 the endogenous cycle emerges around a positive (even exponential) growth trend of GDP. Figure 31 exhibits the reason for this endogenously cyclic behaviour, namely the dynamic trade-off between employment and wages: as the employment rate, λ , increases, the wage share, ω , first decreases and, later on, increases. Then, however, the employment rate decreases, etc.

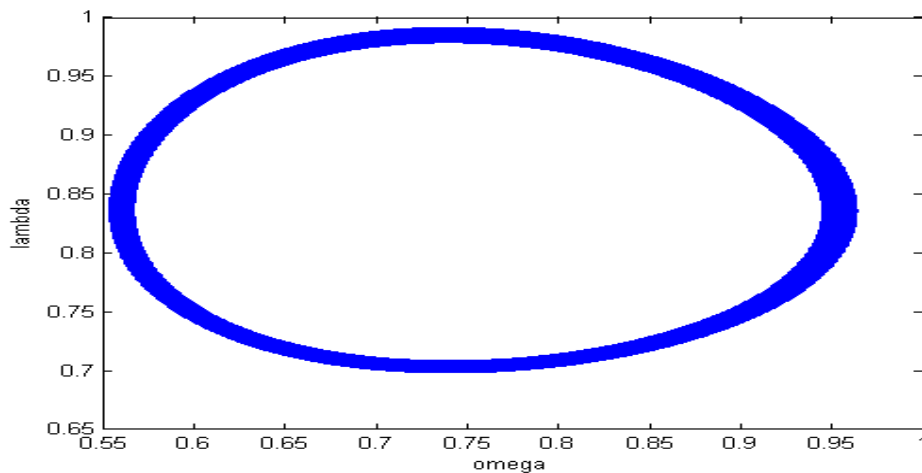


Figure 31 - Endogenous trade-off between wages and unemployment

⁸⁴ Regarding, technological progress, we simply assume an exogenous growth calibrated over the historical trend of the last 14 years in the eurozone.

Now, what happens when we combine our first two ingredients - investment and a short-run Phillips curve- with a demand function that depends non-trivially upon the wage share? As long as Say's law is fulfilled, as we just saw, demand plays no role. Thus, modelling demand becomes interesting as soon as it can be potentially decoupled from supply. Thus, instead of assuming that total consumption adjusts to investment decision by firms in order to guarantee that sales demand always equals output, we shall specify investment and consumption independently (as in Grasselli-Costa-Lima).

The first consequence is the possible appearance of inventories, and the participation of the latter in total output. The second consequence is that the simplistic 'Real Business Cycle' logic sketched above can be disturbed by a lack of demand. Suppose, again, that output grows, so that employment increases. The additional increment in wage share will not only foster the wage growth rate, it will also increase demand for consumption goods. Now, two cases can occur. If the initial situation was that of an excess of supply (hence, a positive stock of inventories), the further increase of demand is good news for both households and firms: the additional flow of demand will be fulfilled and the decline in profit share (due to the increase of wages, cf. Phillips) will be reduced. As a result, the business cycle itself should be smoothed. If, on the other hand, the initial situation was that of an excess of demand (zero inventory), the additional demand will not be satisfied, and nothing will prevent the profit share from falling.

Pillar B: debts and money.

Minsky's Financial Instability Hypothesis links the expansion of credit with the rise of asset prices and the inherent fragility of the financial system. Despite his use of a persuasive verbal style aided by convincing diagrams and incisive exploration of data, Minsky refrained from presenting his ideas as a mathematical model. This task was taken up by Keen (1995, 2003), where a system of differential equations is proposed as a simplified model incorporating the basic features of Minsky's hypothesis.

The way Keen captures Minsky's arguments consists in dropping the assumption, implicit in most models with no credit banking, according to which new investment equals profits. If, now, investment can exceed profit, it must be financed by debt. If corporates reinvested all their net profit and nothing more, debt levels would remain constant over time. The key insight provided by Minsky is that current cash-flows validate past liabilities and form the basis for future ones. In other words, high net profits lead to more borrowing whereas low net profits (possibly negative) lead to a deleveraging of the economy. This is where the somewhat restrictive way we introduced investment as a function of the profit share enters into play: a higher profit share will now potentially imply higher private debts in the corporate sector. Similarly, a higher wage share will provide an incentive for households to spend more and, if needed, to borrow more money from the banking sector in order to finance this additional spending.

As shown by Grasselli and Costa-Lima (2012), this leads to a much richer set of possible outcomes, likely to tell a more compelling economic story and provide a better description of observed data. More specifically, this new ingredient makes it very easy to understand how a crash can occur in a market credit-economy (a very complicated task in equilibrium models, as already said). Let us first begin by a hypothetical situation where no crash occurs.

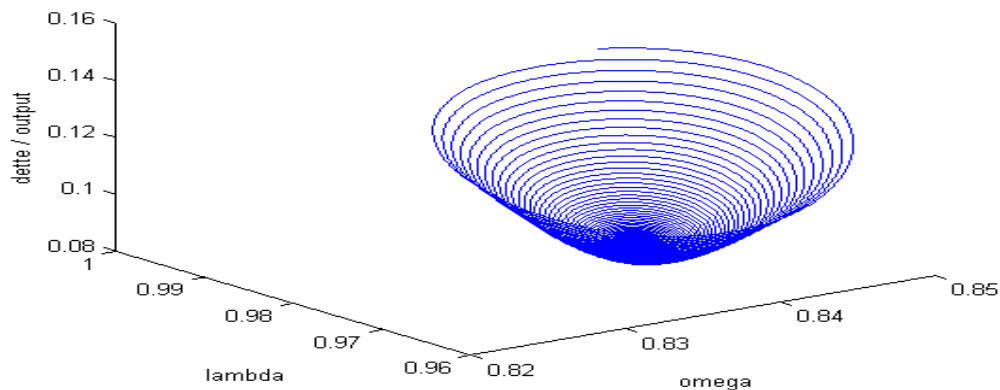


Figure 32 - Convergence towards a finite ratio private debt/GDP (1)

Figure 32 shows a situation where, starting at the top of the spiral, the economy converges towards a finite ratio of private debt over output (near 0.1), while employment (λ) and wage share (ω) still cycle. Physicists will have immediately recognized in Figure 32 *supra* the distinguishing feature of a conservative dynamical system: nothing is lost, nor gained during the economic process. Indeed, it is only the introduction of debt that enables to introduce some dissipation into the system. In Figure 32 this dissipation leads to the convergence of the economy towards a finite debt/output ratio. This can also be seen in Figure 33, which plots this very ratio against time.

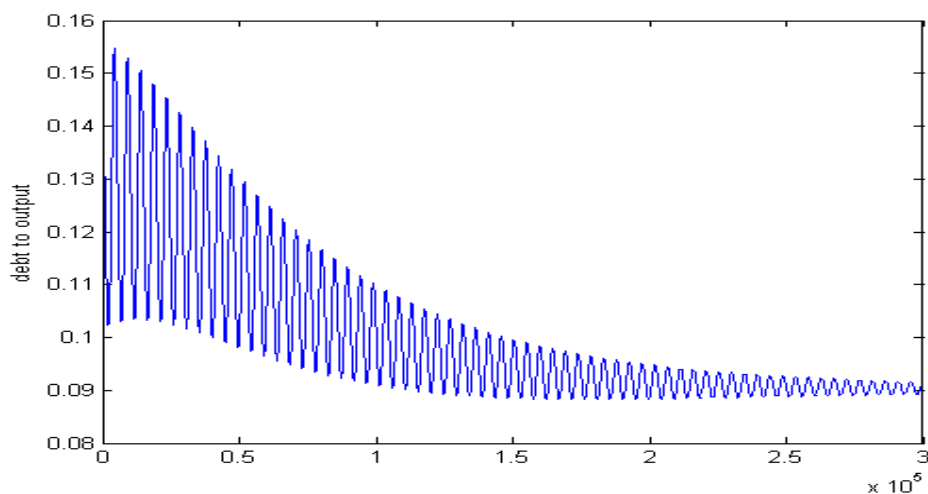


Figure 33 - Convergence towards a finite ratio private debt/GDP (2)

Now, dissipation may have a much more dramatic effect: Indeed, as exemplified by the following graphs, if the production sector accumulates debt at too high a speed, it may become incapable of redeeming it thanks to its profits. It is then tempted to borrow money in order to pay back its debt, hence entering tentatively in a Ponzi scheme. If, however, the real economy cannot follow such a fast moving race, then, all profits will soon be absorbed in the repayment of debts, so that investment will fall down. As a consequence, output will also decline, and so will profits (this is the 'Minsky moment'), pushing the corporate sector to bankruptcy.

In Figure 34, around period 8 (10^5), the 'Minsky moment' provokes a free fall in output. The turning point corresponds to the very moment where the ratio private debt/output starts exploding, as seen in Figure 35 *infra*.

So far, these are theoretical simulations, which aim at helping understand the mechanism at stake. Empirically calibrated simulations appear in the next subsection.

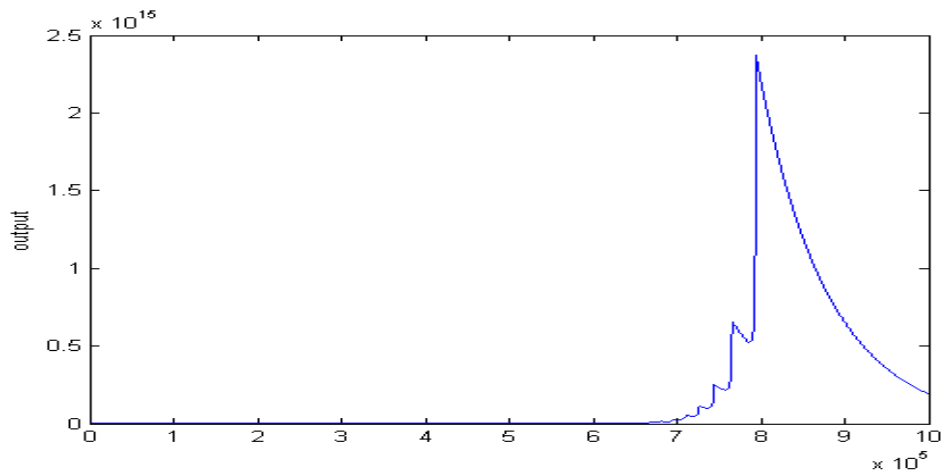


Figure 34 - Crash due to an over-accumulation of private debt

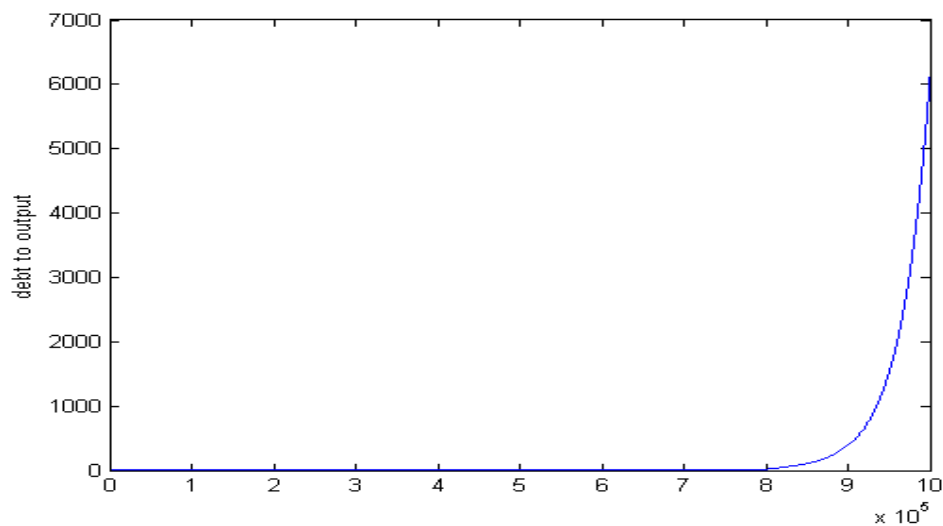


Figure 35 - The Minsky moment

The second ingredient of our second pillar consists in dropping the restriction to real economies by explicitly adding money in the model. Prices can now enter the picture, whose dynamics needs to be defined. We follow Blinder (1998) among others by considering a price-wage dynamics where the long-run equilibrium price is given by a markup⁸⁵ times unit labour and capital cost, whereas observed prices converge to this through a lagged adjust with a relaxation time. In addition, price fluctuations will be influenced by the size of inventory stock. If inventories increase (excess supply), prices will tend to decrease, and vice-versa. As a consequence, prices will tend to fluctuate along a long-run value, which depends both upon the production cost and the market demand and supply. Therefore, both familiar explanations of inflation (cost-push and demand-pull) can be observed in our model. Because prices are specified without the need to clear the market for goods at all times, inventories shall play the role of the accommodating variable between supply and demand instead.

⁸⁵The market for consumption goods is therefore assumed to be imperfectly competitive.

The Phillips curve now becomes a relationship between the change rate of nominal wages and employment. Moreover, it must be completed by a second factor that obviously influences the wage dynamics, namely inflation. As for inventories, and following Grasselli and Costa-Lima, we price them at their average production cost.

Pillar C: Banks and the Government

As already said, by allowing corporates and households to increase their debt, we have already introduced a banking sector. But, as observed in section I, commercial banks are not just financial intermediaries. They can create money *ex nihilo* provided they fulfil a number of prudential constraints.

In Grasselli and Costa-Lima (2012), it is shown that a dynamics analogous to the one described so far usually exhibits two economically meaningful equilibria, one with finite debt and strictly positive employment (the 'good equilibrium') and another with infinite debt and zero employment (the 'bad equilibrium'). They identify quite reasonable and general assumptions under which both equilibria are locally stable --meaning that small perturbations do not prevent the economy to converge back to such an equilibrium. This opens the door for a renewed understanding of the role of public authorities, namely stabilising the economic dynamics through taxes and subsidies. This is further analysed in Costa-Lima et al. (2014). Here, we content ourselves with a very crude description of the behaviour of public authorities.

Absent any crash in the banking sector, taxes and public spendings are constant fractions of GDP, wages or gross profits. In case a crash hits commercial banks, the government hosting the banks (more details on which government will be involved in the next section) is asked to immediately recapitalize the bank, so that the latter's equity reaches the threshold of 3% of the (new) total balance sheet of the problem bank (in line with current minimum Capital regulation). The induced increase in public debt has an immediate impact on the government debt yield of the country. Furthermore, fiscal consolidation measures are taken in order to stabilize the Debt to GDP ratio (as could be observed in the case of Greece for example). More precisely, as soon as the public debt/GDP ratio reaches 100% (provided it was lower than this threshold before the shock), an fiscal consolidation programme is put into practice, where taxes increase at a rate of 1% and public expenditures decrease at the same rate, each year. We chose this abrupt policy response so that our results cannot be interpreted as arising from a fiscal laxism on the side of public authorities. These measures are upheld until the pre shock debt to GDP ratio is reached again.

Banks receive interest on the credit they have issued and pay dividends to their shareholders. Their primary task is to set the interest rate in the economy (i.e., the cost of borrowing money faced by the real economy) and to decide the flow of credit supply they make available on the capital market. In normal times they set the interest rate in order to reach a predetermined equity ratio target and pay dividends to households so as to reach a their individual Return on Equity.

In case of crisis, they are bailed out back to a 3% equity ratio, which is far away from their target and thus they increase the interest rate for the economy, so as to raise their profitability. This is the first channel through which a banking stress impacts the real economy.

The second channel is the possibility of a credit crunch analogous to the one currently observed in the Euro zone. In our model, the credit crunch is triggered by leverage ratios for households and firms separately. The leverage ratio, here, refers to the ratio between an economic actors' private debt and the bank's equity. Let us consider households, for the sake of concreteness: As long as the households' private debt in relation to bank equity remains above the level seen just before the shock, we assume that banks refuse to finance the (possible) gap of disposable

income to consumption for households. In other words, as long as the relative size of the credit issued the banking sector for households in comparison to the banks' equity is higher than it was before the shock, then banks will refuse to lend more to households. The same logic applies for firms. This mechanism forces households and firms to diminish their spending (Investment and consumption) in order to diminish their respective leverage. Notice, that, according to these assumptions, firms (resp. households) may face a credit rationing while households (resp. firms) don't, depending upon the speed at which they succeed in deleveraging.

As we shall see shortly, the fiscal consolidation policy measures, the raise in the cost of credit and the possible credit crunch may have a significant effect on economic activity, in line with what could be observed in the past 5 years in several countries, especially in Southern Europe.

Wrapping up the dynamics in 'normal times'

The basic causal cycle in our model can be summarized as follows. It provides a narrative for the way a shock initially hitting the banking sector will spread into the whole economy.

1. The current level of the physical capital stock determines the level of physical output (supply) per quarter;
2. Output per quarter determines unemployment;
3. The rate of unemployment determines the rate of change in wages, thus linking the physical sector to the monetary sector;
4. The wage share consequently determines consumption by households;
5. Taxes are levied and subsidies are spent between the government, banks, firms and households;
6. Government bonds yields are modified by the change in Debt/GDP ratio and interest is paid on the sovereign debt to their holders;
7. Banks receive interest payments on their debt holdings (households, firms and the government) and pay interest for their own debt as well as dividends on equity. Consequently they set the interest rate for the real economy so as to reach their equity ratio and profit target
8. The unit labour cost and interest rate to the real economy (cost of capital) determine the inflation rate.
9. The level of inflation determines the short-run interest rate set by the ECB according to a Taylor rule with an inflation target of 2% for the Euro zone
10. Expected firm profit is the output less wages and taxes, subsidies and interest and determines the investment in the economy
11. Banks and firms pay dividends to their shareholders (households)
12. Banks finance the economy (households, firms and government) according to credit demand as long as they operate under normal conditions. For each new credit to the real economy, banks have to hold a certain reserve of money with the ECB on which they pay the interest set by the Central Bank
13. Together with Exports and Imports, Investment and Consumption determine the aggregate demand in the economy;
14. Whatever is produced is either consumed, invested or, if the aggregate demand for these goods is too weak, enters the stock of inventories. If aggregate demand exceeds supply, inventories will diminish by that amount;
15. Effective sales take place at the minimum between supply and demand;

16. Given the disposable income of governments, households and firms, each of them needs to increase or decrease its debt in order to finance, respectively, its primary balance, consumption or investment. This is the point where debt deflation comes into play;
17. Investment minus capital depreciation determines the stock of productive capital. At this point, a new causality cycle begins.

Now, what happens when a shock hits the assets of the banking sector? Here is the basic causal mechanism.

Absent any crash in the banking sector, taxes and public spendings are constant fractions of GDP, wages or gross profits. In case a crash hits commercial banks, the government hosting the banks is asked to immediately recapitalize the bank, so that the latter's equity reaches the threshold of 3% of the (new) total balance sheet of the problem bank (in line with current minimum Capital regulation). The computation of the corresponding costs of such a bail out is borrowed from the first part of the report.

The induced increase in public debt has an immediate impact on the government debt yield of the country. Furthermore, fiscal consolidation measures are taken in order to stabilize the public-debt-to-GDP ratio (as could be observed in the case of Greece for example). These measures are upheld until the pre shock debt-to-GDP ratio is reached again.

Banks receive and pay interest on their deposits, debt, and equity. Their primary task is to set the interest in the economy and credit supply. In normal times they set the interest rate in order to reach a predetermined equity ratio target (6%) and pay dividends to households. In case of crisis, they are bailed out back to a 3% equity ratio, which is far away from their target and thus they increase the interest rate for the economy. The second effect on the economy comes through a credit crunch. The credit crunch is triggered by leverage ratios for households and firms separately. As long as the private debts (households and firms) in relation to bank equity remain above levels seen before the shock, banks refuse to lend new credits, that is, they refrain from financing the (possible) gap of disposable income to investment and consumption for households and firms. This 'friction' forces households and firms to diminish their spending (Investment and consumption) in order to diminish their leverage ratio.

The fiscal consolidation, interest rate and credit crunch mechanisms have a depressing effect on the economic activity as could be observed in the past and which unfolds in our model as follows:

More precisely, we assume that, in case its ratio public debt/GDP would rise above its pre-shock level, the government increases taxes at a growth rate of 1% per annum and decrease subsidies by the same rate. Banks will charge a higher interest rate to the economy, because they are further away from their equity ratio target (as a consequence of the shock to their capital) while they refuse to lend to households and firms (to finance their disposable income to consumption and investment gap) as long as their own leverage ratio did not fall down to its pre-shock level.

Consequently, firm profits will decrease, because of lower net government payments and higher interest payments on their corporate debt. They will be able to invest just as much as they receive in cash-flow. This puts downward pressure on investment and thereby future output, but at the same time it decreases the demand side. Households receive less dividends from banks and firms and less net government payments. The households' disposable income is therefore reduced, which means that the upper bound for consumption decreases (since, in

general, indebted households have no more access to banking credit). This again puts downward pressure on aggregate demand. The short run demand deficit causes an increase in inventories and thereby deflationary pressure on top of a rapidly falling economic activity and higher unemployment.

APPENDIX II

Complementary to the euro area analysis (see second chapter of this research paper), this appendix provides two case studies at country level on the basis of our simulations in the model. It focuses on Luxembourg and Spain, as those two economies are structured very differently. Luxembourg has a modest level of sovereign debt but large exposure to the financial sector. Our simulations show a sharp drop in output and a modest reaction of the labour market. Spain on the other hand faces a substantial impact on the labour market.

The case of Luxembourg

Figure 36 shows a projected two-year decline in output, quite similar in magnitude to the last recession in 2008-2009 but taking place over a longer period. In 2016, GDP growth rebounds significantly and is projected even higher than in the base case. However, despite this rebound effect, the *level* of GDP (not to be confused with its growth rate) remains significantly lower in the adverse case in 2016, owing to the two previous periods of contraction.

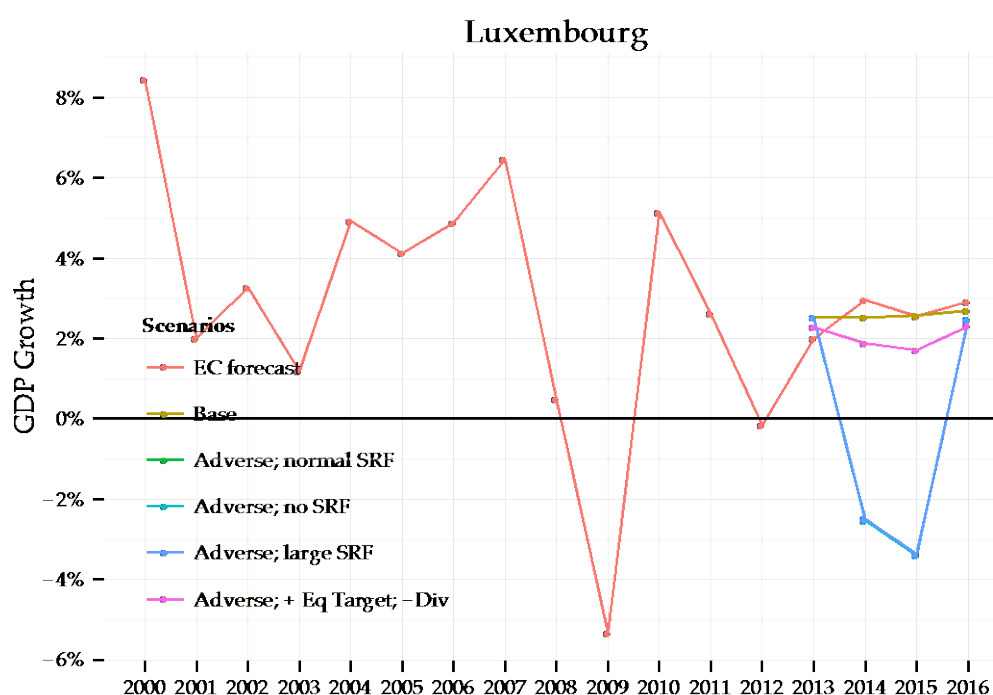


Figure 36: Real GDP growth in Luxembourg

The impact of the shock on the labour market in Luxembourg is very limited: unemployment is projected to be almost unchanged at the end of 2016 compared to our base case. Figure 37 shows that the reaction of the labour market after the last financial crisis was equally muted⁸⁶. Why this is so becomes clear if we analyse the behaviour of credit and investment (see Table 14).

⁸⁶The gap between our baseline simulation and the Commission forecast arises from the fact that we use different labour market data to calibrate our simulations.

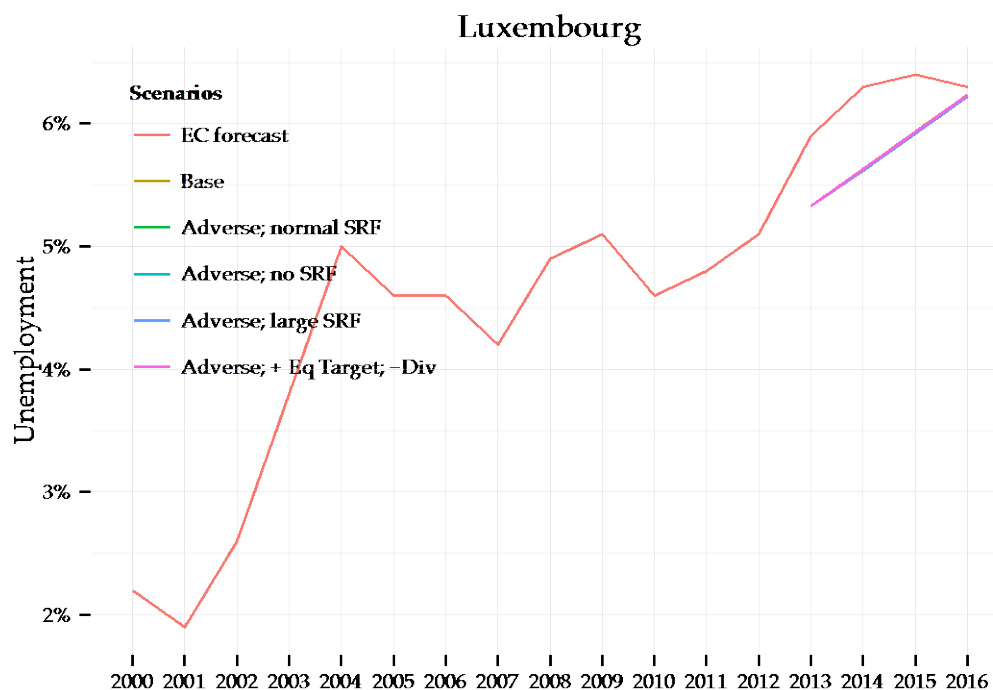


Figure 37 - Unemployment rate in Luxembourg

Government debt is historically very low in Luxembourg, but a shock to its banking sector would pose a significant threat to public finances (Figure 38), as the government debt-to-GDP ratio would rise to 35 %.

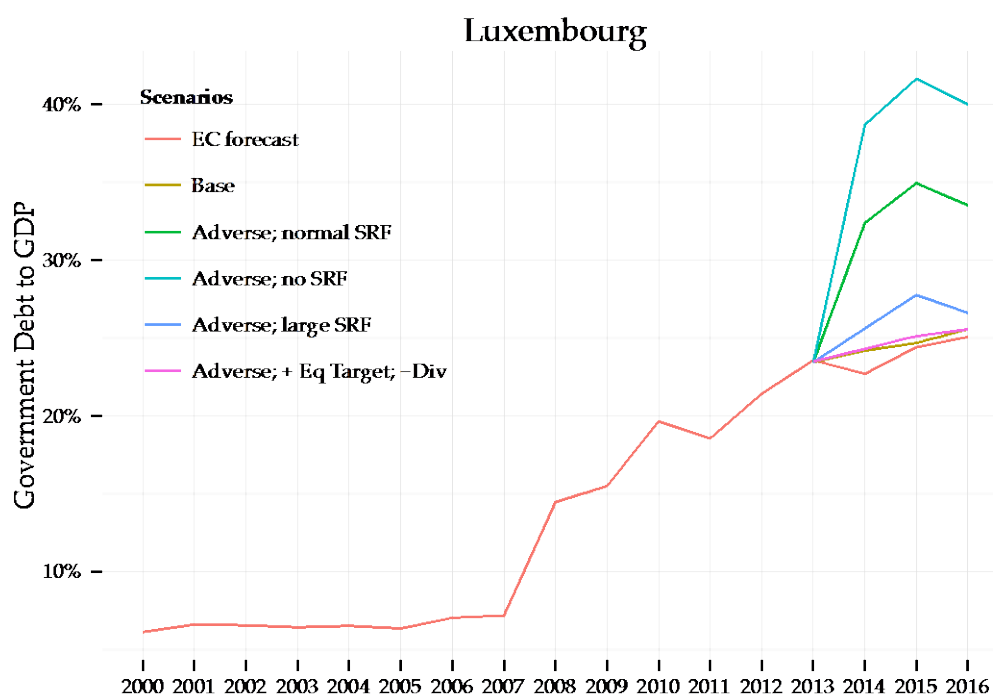


Figure 38 - Government debt-to-GDP ratio in Luxembourg

The significant size of the bailout is clearly a result of the very large size of the banking sector in such a small country (a phenomenon already documented in the first part of the report). This will significantly increase the amount of interest payments for the government in the long term. Nonetheless, the government debt-to-GDP ratio of Luxembourg would still be one of the lowest in the euro area, and well below the Maastricht threshold. In this specific case, the size of the SRF really matters, as it would save a significant fraction of the GDP billed to the taxpayers. Nevertheless, a rise in the equity ratio target of banks clearly shows up as the most efficient solution, as it enables almost entire absorption of the shock (at least in terms of the public debt-to-GDP ratio).

Table 14 helps explain the extreme reaction of output and the muted reaction for unemployment in the case of Luxembourg. Investment as a share of GDP drops sharply, accounting for the greater part of the fall in GDP along with the prolonged recession. Once the financial sector leverage returns to more modest levels in 2016, credit flow restarts and the rebound in GDP takes place. The government lowers its primary deficit to a surplus of +0.2 % in 2016 (from -1.4 % in 2014), in order to stabilise the government debt-to-GDP level. Such a fiscal effort is necessary due to the higher interest payments implied by the bailout.

Country	Scenario	Time	real GDP Growth	Unemployment	Debt to GDP	Primary Deficit to GDP	Deficit to GDP	Investment to GDP	Private Debt to GDP	HH Debt to GDP	Firm Debt to GDP	Financial Sector Leverage
LU	base	2014	2,5%	5,6%	24%	-1,3%	-1,8%	18,9%	181%	61%	120%	4,6
		2015	2,6%	5,9%	25%	-1,3%	-1,6%	18,3%	184%	62%	122%	3,5
		2016	2,7%	6,2%	26%	-2,0%	-2,3%	17,5%	184%	61%	123%	2,8
	adv.	2014	-2,5%	5,6%	32%	-1,4%	-9,5%	16,8%	193%	64%	129%	11,3
		2015	-3,4%	5,9%	35%	-0,7%	-1,6%	13,9%	212%	63%	149%	6,5
		2016	2,5%	6,2%	34%	0,2%	-0,7%	12,9%	210%	56%	153%	4,5
	adv. no SRF	2014	-2,5%	5,6%	39%	-1,4%	-16,6%	16,8%	193%	64%	129%	11,4
		2015	-3,4%	5,9%	42%	-0,7%	-1,8%	13,9%	212%	63%	149%	6,6
		2016	2,5%	6,2%	40%	0,2%	-0,9%	12,9%	210%	56%	153%	4,5
	adv. large SRF	2014	-2,5%	5,6%	26%	-1,4%	-1,9%	16,8%	193%	64%	129%	11,1
		2015	-3,4%	5,9%	28%	-0,7%	-1,4%	13,9%	212%	63%	149%	6,4
		2016	2,4%	6,2%	27%	0,2%	-0,5%	12,9%	210%	57%	153%	4,4
	adv. +Eq Target -Div	2014	1,9%	5,6%	24%	-1,3%	-1,7%	17,6%	202%	79%	124%	10,4
		2015	1,7%	5,9%	25%	-1,4%	-1,8%	15,9%	223%	95%	127%	5,6
		2016	2,3%	6,2%	26%	-1,4%	-1,8%	14,7%	232%	105%	127%	3,9
	base +Eq Target -Div	2014	2,0%	5,6%	24%	-1,2%	-1,7%	17,9%	197%	75%	123%	4,2
		2015	2,3%	5,9%	25%	-1,3%	-1,6%	17,0%	205%	81%	125%	3,2
		2016	2,5%	6,2%	25%	-1,6%	-1,9%	16,0%	209%	85%	125%	2,6

Table 14 - Simulations for Luxembourg

Table 15 offers further insight into the historical development of the economic indicators mentioned above. One can see the modest reaction on the labour market and the stronger reaction of investment and GDP around 2009. The private debt level increased as a consequence of the crisis but financial sector leverage remained at reasonable levels. When comparing the values for financial sector leverage one has to take into account that we use non-consolidated data from the ECB in our model while the MIP refers to consolidated banking data. This makes a direct comparison of the levels impossible, but the dynamics are nonetheless comparable.

Country	Year	real GDP growth EC	Inflation EC	Unemployment EC	Debt to GDP EC	Primary Deficit to GDP EC	Deficit to GDP EC	Investment to GDP EC	Private Debt to GDP MIP (cons.)	HII Debt to GDP ECB (part. cons.)	Firm Debt to GDP ECB (part. cons.)
LU	2000	8,44%	2,02%	2,2%	6,1%	6,08%	5,74%	19,5%	NA	NA	NA
	2001	2,00%	-0,51%	1,9%	6,6%	6,29%	5,97%	21,6%	NA	NA	NA
	2002	3,28%	2,10%	2,6%	6,5%	2,58%	2,29%	20,4%	NA	NA	NA
	2003	1,19%	2,96%	3,8%	6,4%	0,83%	0,58%	20,3%	NA	NA	NA
	2004	4,93%	1,86%	5,0%	6,5%	-0,85%	-1,03%	20,7%	NA	NA	NA
	2005	4,12%	3,78%	4,6%	6,3%	0,35%	0,18%	19,0%	NA	45,4%	95,5%
	2006	4,88%	6,66%	4,6%	7,0%	1,59%	1,40%	17,6%	NA	45,2%	93,3%
	2007	6,46%	1,40%	4,2%	7,2%	4,46%	4,21%	18,0%	NA	47,5%	124,6%
	2008	0,49%	3,86%	4,9%	14,4%	3,58%	3,26%	19,4%	391,4%	49,1%	351,2%
	2009	-5,33%	1,61%	5,1%	15,5%	-0,13%	-0,50%	18,0%	421,8%	54,8%	340,4%
	2010	5,14%	3,74%	4,6%	19,6%	-0,25%	-0,64%	16,7%	346,1%	53,8%	286,3%
	2011	2,61%	4,98%	4,8%	18,5%	0,75%	0,30%	18,0%	347,3%	54,2%	269,8%
	2012	-0,16%	3,47%	5,1%	21,4%	0,49%	0,06%	18,4%	340,6%	55,6%	120,5%
	2013	1,99%	1,35%	5,9%	23,6%	1,06%	0,63%	17,1%	356,2%	56,8%	299,9%
	2014	2,96%	1,54%	6,3%	22,7%	0,90%	0,52%	16,8%	NA	NA	NA
	2015	2,56%	0,54%	6,4%	24,4%	0,03%	-0,35%	16,8%	NA	NA	NA
	2016	2,92%	2,14%	6,3%	25,1%	0,51%	0,11%	16,8%	NA	NA	NA

Table 15 - Luxembourg - Commission forecast and MIP data

Quantifying the costs for Luxembourg in case of a shock to its financial system, we reach the following conclusions:

1. EUR 14.4 billion cumulated loss in GDP ~ 28% of EUR 51.3 billion 2016 GDP - Commission forecast
2. No difference in unemployment - 2016 model forecast
3. EUR 2.3 billion difference in government debt in 2016 (EUR 3.1 billion bailout) ~ 17.9 % of EUR 12.9 billion 2016 government debt - Commission forecast

Country	Scenario	nominal GDP difference 2014Q3 2016Q4 [bn]	nominal GDP EC forecast FY2016 [bn]	difference in number of Unemployment [tsd]	2016Q4 Workforce Model forecast [tsd]	difference in Unemployment [tsd]	Sov Debt difference [bn]	Sov Debt EC forecast 2016 [bn]	Bailout (from static simulation) [bn]	SRF (from static simulation) [bn]
LU	adv. vs base	14,4		0,0		0,00%	2,25			
	adv. no SRF vs adv.	0,0		0,0		0,00%	3,00			
	adv. vs adv. large SRF	0,1	51,3	0,0	252,5	0,00%	3,21	12,9	3,1	3,0
	adv. vs adv. higher Eq. Target	12,5		0,0		0,00%	2,43			
	adv. +Eq Target -Div vs base	1,9		0,0		0,00%	-0,18			
	base +Eq Target -Div vs base	1,1		0,0		0,00%	-0,22			

Table 16 - Wrapping up the impact of the shock on the economy of Luxembourg

Table 16 explains furthermore the advantage of the scenario with a higher equity ratio target and lower dividends (line 4). Of the EUR 14.4 billion lost in cumulated potential output, due to a shock and given the proposed banking union framework, EUR 12.5 billion can be compensated for, by adopting the higher equity ratio target and lower dividend scenario. The cost of this scenario (line 6) is slightly higher to the economy in Luxembourg compared to the euro area. The sum total is EUR 1.1 billion in cumulated potential output loss. Increasing the size of the SRF has only a minor impact.

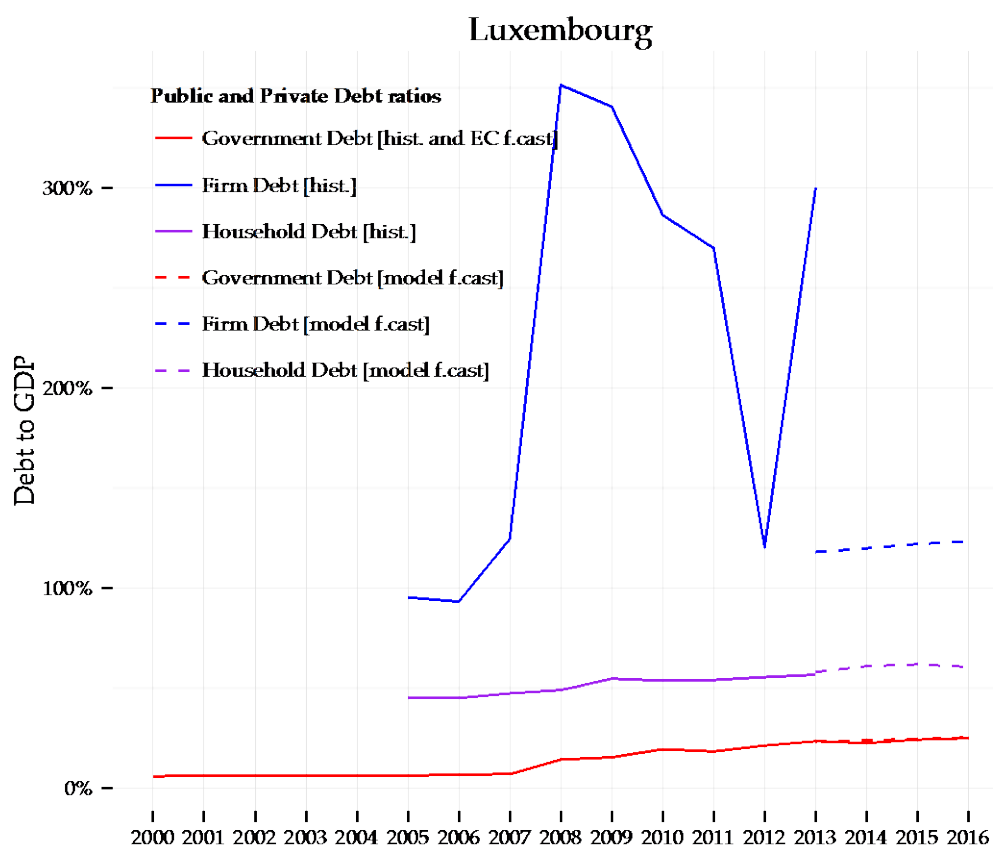


Figure 39 - Debt evolution in Luxembourg

Our model projections suggest that corporate and government debt follow their previous trends in terms of debt-to-GDP ratio. Household debt evolved sharply in 2012 and 2013. From the point of departure at the end of 2012 the model forecasts an almost constant household debt-to-GDP ratio. Luxembourg's public finances are quite healthy. Thus it is especially the very large banking sector and the corporate sector that are hit hard by the shock. Investment falls sharply, and with it long-term growth.

The case of Spain

Turning to Spain, we find a very different picture. Figure 40 shows the evolution of GDP, with a significant first recession immediately after the 2008 crisis and a milder but more prolonged second drop in 2011-2013. This compares to a potentially even more prolonged recession up to 2015, as a consequence of a new shock to the Spanish banking sector. The recession would not be as severe as the first one, but it would have a very negative effect on the labour market..

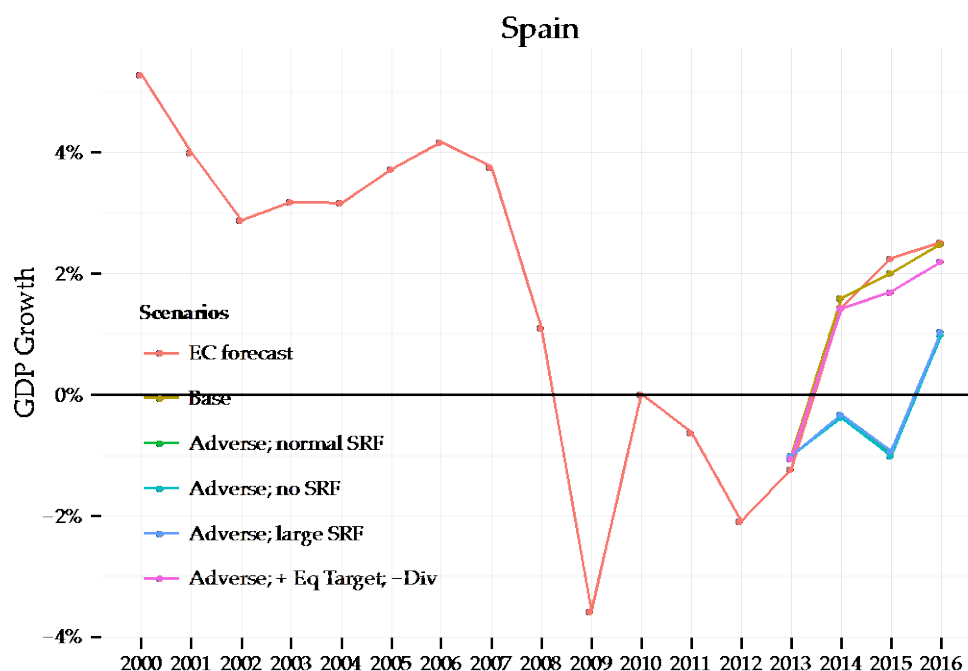


Figure 40 - Real GDP growth in Spain

Spain was at the core of the subprime crisis. The consequences for the labour market were devastating and the situation is still worrying today. A repeated shock would put even more pressure on the already strained labour market, and unemployment would peak at 26% in 2014 if the shock occurred in mid-2014 (see Figure 41). This dynamic would represent just a continuation of the worsening unemployment situation, contrasting sharply with the stabilisation forecast by the Commission and by our model. Again, increasing the size of the SRF would have little effect. On the contrary, increasing the prudential equity ratio of the banks up to 9% would almost completely counterbalance the impact of the shock.

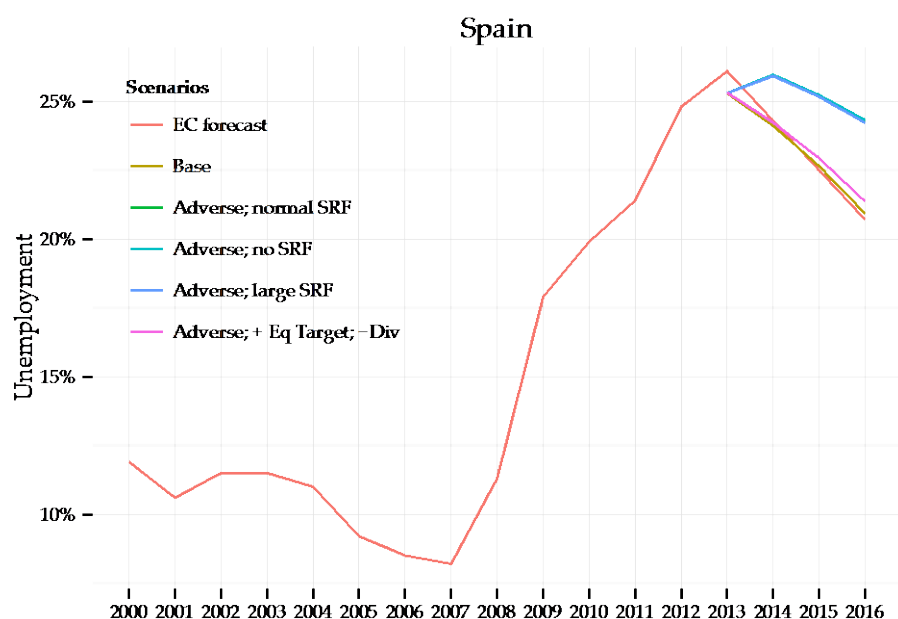


Figure 41 - - Unemployment rate in Spain

Spain's public debt levels increased very sharply after the financial turmoil of 2007-2009 and are projected to stabilise towards the end of 2016 (Figure 42). Another shock would push up the government debt-to-GDP ratio to 112 %, as opposed to 101 % in the base case in 2016.

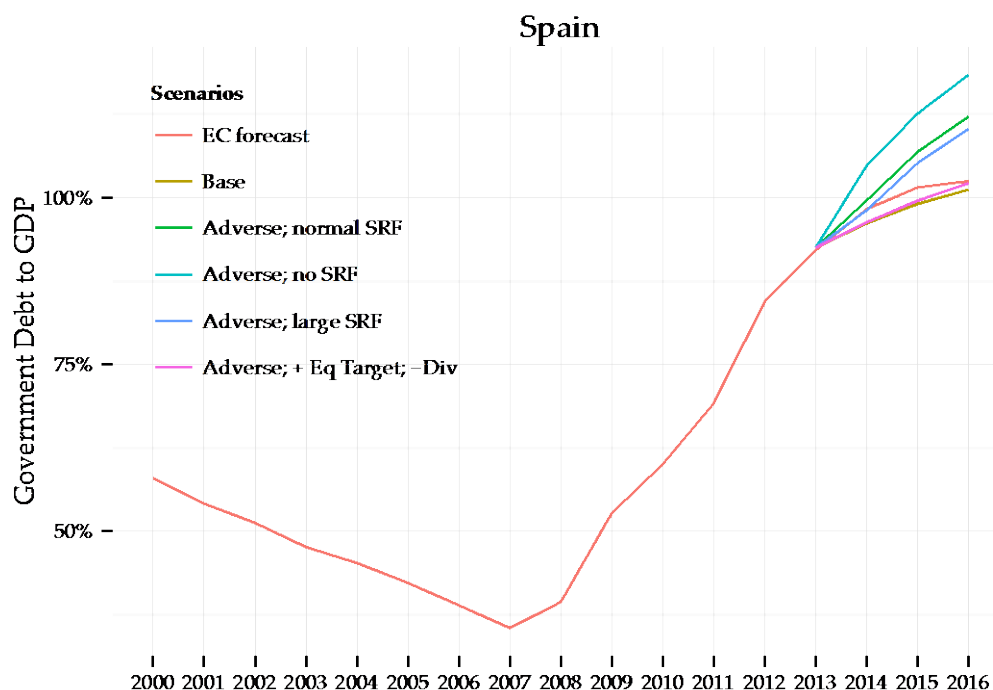


Figure 42 - - Government debt-to-GDP ratio in Spain

Exactly as in the case of the euro area, the size of the SRF matters when we consider the impact of the shock on the public debt-to-GDP ratio. This confirms once again that we cannot conclude that an increase in the size of the SRF within the banking union architecture would alleviate the situation significantly. Our point is that a larger SRF would be far from sufficient to protect the European economy, as the cases of Luxembourg and Spain exemplify.

Table 17 should aid understanding of the violent reaction of the Spanish labour market. The rise in investment as a share of GDP indicates that the drop in economic activity comes from the consumer side. Thus, the crisis that would follow a new shock affecting Spain's banking sector would be due not to a supply shortage but to a demand shortage. This is because of Spain's high level of household debt and reliance on debt financing. Needless to say, the spiral is self-reinforcing in the sense that a higher level of unemployment will put downward pressure on households' disposable income, thus reducing consumption even further. The result is a typical debt-deflation scenario *à la* Irving Fisher.

Country	Scenario	Time	real GDP Growth	Unemployment	Debt to GDP	Primary Deficit to GDP	Deficit to GDP	Investment to GDP	Private Debt to GDP	HH Debt to GDP	Firm Debt to GDP	Financial Sector Leverage
ES	base	2014	1,6%	24,1%	96%	0,0%	-5,2%	21,8%	193%	82%	111%	5,4
		2015	2,0%	22,7%	99%	0,1%	-5,3%	23,6%	190%	79%	111%	4,6
		2016	2,5%	20,9%	101%	0,2%	-5,4%	25,3%	186%	72%	113%	4,1
	adv.	2014	-0,4%	26,0%	100%	0,0%	-6,7%	21,0%	198%	84%	114%	7,2
		2015	-1,0%	25,2%	107%	0,1%	-5,8%	22,0%	204%	82%	122%	5,3
		2016	1,0%	24,3%	112%	0,3%	-6,0%	23,8%	203%	73%	130%	4,4
	adv. no SRF	2014	-0,4%	26,0%	105%	0,0%	-11,9%	21,0%	198%	84%	114%	7,4
		2015	-1,0%	25,2%	113%	0,1%	-6,2%	22,0%	204%	82%	122%	5,4
		2016	1,0%	24,3%	118%	0,3%	-6,5%	23,8%	202%	72%	130%	4,5
	adv. large SRF	2014	-0,3%	25,9%	98%	0,0%	-5,3%	21,0%	198%	84%	114%	7,1
		2015	-0,9%	25,2%	105%	0,1%	-5,7%	22,0%	204%	82%	122%	5,2
		2016	1,0%	24,2%	110%	0,3%	-5,9%	23,8%	203%	73%	130%	4,4
	adv. +Eq Target+Div	2014	1,4%	24,2%	96%	0,0%	-5,2%	21,5%	205%	92%	113%	6,3
		2015	1,7%	22,9%	100%	0,1%	-5,3%	23,0%	211%	96%	115%	4,2
		2016	2,2%	21,4%	102%	0,3%	-5,4%	24,5%	214%	96%	118%	3,3
	base +Eq Target+Div	2014	1,5%	24,2%	96%	0,0%	-5,2%	21,6%	202%	90%	113%	4,3
		2015	1,8%	22,8%	99%	0,1%	-5,3%	23,2%	204%	90%	114%	3,5
		2016	2,3%	21,2%	102%	0,3%	-5,4%	24,8%	203%	87%	116%	3,0

Table 17 - Simulations for Spain

Table 18 shows the strong leveraging through large primary deficits of the Spanish government. At the same time, private debt and financial leverage only began to decrease slowly following the subprime crisis. Investment, on the other hand, fell from its pre-crisis level and is projected to remain low.

Country	Year	real GDP growth EC	Inflation EC	Unemployment EC	Debt to GDP EC	Primary Deficit to GDP EC	Deficit to GDP EC	Investment to GDP EC	Private Debt to GDP MIP (cons.)	HH Debt to GDP ECB (part. cons.)	Firm Debt to GDP ECB (part. cons.)
ES	2000	5,29%	3,28%	11,9%	58,0%	2,14%	-1,02%	26,1%	NA	45,1%	59,7%
	2001	4,00%	4,08%	10,6%	54,2%	2,41%	-0,55%	26,2%	NA	46,8%	64,9%
	2002	2,88%	4,12%	11,5%	51,3%	2,21%	-0,41%	26,6%	NA	50,7%	67,6%
	2003	3,19%	3,92%	11,5%	47,6%	1,93%	-0,37%	27,7%	NA	56,1%	72,5%
	2004	3,17%	3,92%	11,0%	45,3%	1,94%	-0,04%	28,5%	137,8%	62,9%	77,1%
	2005	3,72%	4,15%	9,2%	42,3%	2,95%	1,21%	29,9%	154,9%	70,2%	87,2%
	2006	4,17%	3,98%	8,5%	38,9%	3,79%	2,20%	31,1%	177,8%	77,5%	103,3%
	2007	3,77%	3,33%	8,2%	35,5%	3,56%	2,00%	31,0%	191,9%	81,1%	114,0%
	2008	1,12%	2,14%	11,3%	39,4%	-2,88%	-4,42%	29,2%	196,6%	81,8%	118,8%
	2009	-3,57%	0,25%	17,9%	52,7%	-9,26%	-10,96%	24,3%	202,4%	84,0%	123,0%
	2010	0,01%	0,16%	19,9%	60,1%	-7,51%	-9,39%	23,0%	201,5%	83,5%	123,5%
	2011	0,62%	0,08%	21,4%	69,2%	-6,97%	-9,42%	21,4%	195,3%	81,5%	119,7%
	2012	-2,09%	0,23%	24,8%	84,4%	-7,39%	-10,32%	19,7%	184,8%	79,5%	111,3%
	2013	-1,23%	0,67%	26,1%	92,1%	-3,54%	-6,79%	18,5%	172,2%	75,2%	105,0%
	2014	1,44%	-0,69%	24,3%	98,3%	-2,33%	-5,63%	18,7%	NA	NA	NA
	2015	2,26%	0,20%	22,5%	101,5%	-1,31%	-4,54%	19,2%	NA	NA	NA
	2016	2,52%	0,96%	20,7%	102,5%	-0,51%	-3,68%	19,7%	NA	NA	NA

Table 18 - Spain – Commission forecast and MIP data

Quantifying the costs for Spain in case of a shock to its financial system, we reach the following conclusions:

1. EUR 177.7 billion cumulated loss in GDP ~ 15.9 % of EUR 1 121 billion 2016 GDP - Commission forecast
2. 0.8 million difference in unemployment or 3.4 percentage points assuming a total workforce of 23.8 million in 2016 model forecast
3. EUR 20 billion difference in government debt in 2016 (EUR 13.5 billion bailout) ~ 1.7 % of EUR 1 149 billion 2016 government debt - Commission forecast

Country	Scenario	nominal GDP difference 2014Q3 2016Q4 [bn]	nominal GDP BC forecast FY2016 [bn]	difference in number of Unemploy ed [tsd]	2016Q4 Workforce Model forecast [tsd]	difference in Unemploy ment	Sov Debt difference [bn]	Sov Debt BC forecast 2016 [bn]	Bailout (from static simulation) [bn]	SRF (from static simulation) [bn]
ES	adv. vs base	177,7		798,6		3,36%	20,0			
	adv. no SRF vs adv.	1,9		8,3		0,04%	63,4			
	adv. vs adv. large SRF	3,0	1 121,1	14,6	23 752,0	0,06%	17,7	1 149,0	13,5	55
	adv. vs adv. higher Eq. Target	159,6		693,6		2,92%	19,9			
	adv. +Eq Target -Div vs base	18,1		104,9		0,44%	0,1			
	base +Eq Target -Div vs base	13,0		0,0		0,30%	0,1			

Table 19 - Summarising results for Spain

The cost to the economy of adopting a more shock-resistant scenario with a higher equity ratio target and lower dividends amounts to 1.2 % of cumulated potential output loss versus the forecast GDP for 2016. The effects on unemployment and government debt are negligible. The benefits of such a scenario compared to the proposed banking union set-up are significantly higher. If a shock would cost the economy EUR 177.7 billion in cumulated potential output loss, then EUR 159.6 billion can be compensated for by adopting the higher equity ratio target and lower dividends scenario.

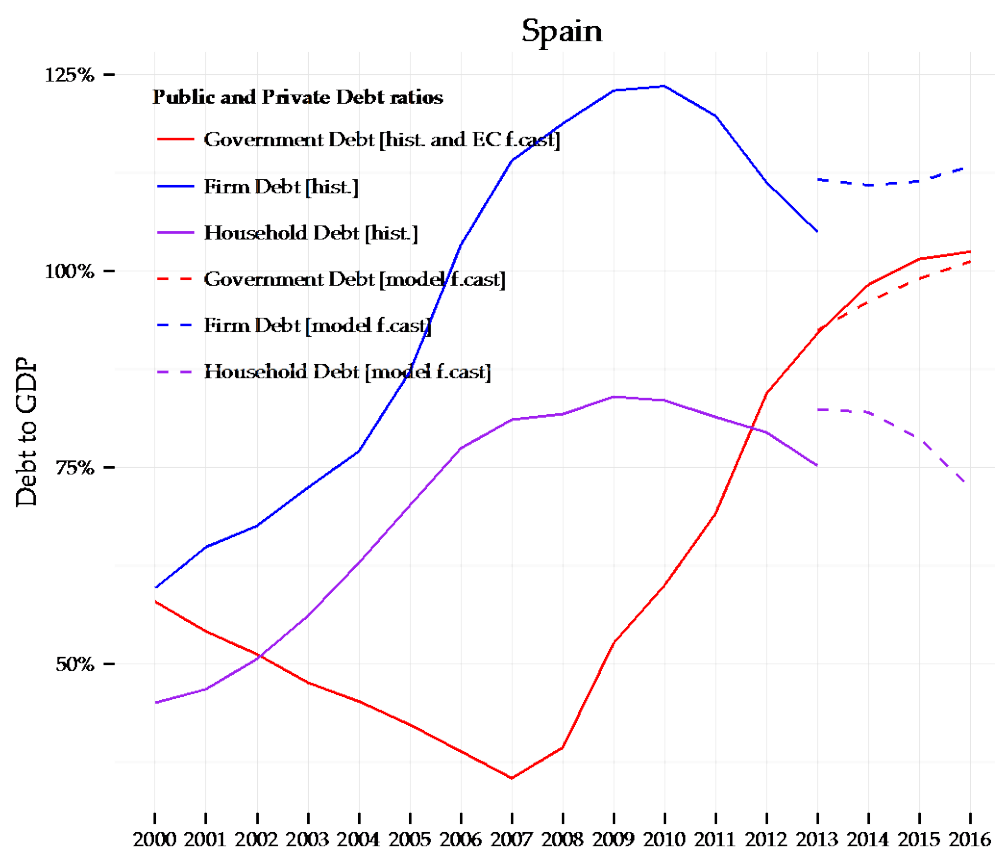


Figure 43 - Debt evolution in Spain

Our model forecast is slightly under the Commission forecast in terms of government debt-to-GDP ratio. Furthermore, we forecast a higher but decreasing corporate debt-to-GDP ratio and a stagnating household debt dynamic.

APPENDIX III

1 Model

We consider a four-sector open economy consisting of corporate firms,¹ commercial banks, households, a government and the rest of the world. The latter is a synthetic entity comprising the ECB, foreign commercial banks that interact with the domestic ones on the interbank market, foreign investors, etc.

1.1 The production sector

Starting with firms, we denote their stock of capital in real terms by K and assume that it changes according to the standard accumulation rule:

$$\dot{K} = I_k - \delta K, \quad (1)$$

where I_k denotes real capital investment and $\delta \in (0, 1)$ is a constant depreciation rate. In the empirical application of the model, δ is estimated for each country under scrutiny, using the productive capital stock and investment data.

We assume that the capital stock determines real output Y_s according to the relationship

$$Y_s = \frac{K}{\nu} \quad (2)$$

where $\nu > 0$ is a constant capital-to-output ratio. Let the nominal wage bill be denoted by W , the total domestic workforce by N and the number of employed workers by L . The link between employed workforce and real GDP is given by:

$$(\alpha L)^\gamma = \text{GDP}_r$$

We then obtain the productivity per worker, α , the employment rate, λ , and the real wage rate, w_r , as

$$\alpha = \frac{\text{GDP}_r^{1/\gamma}}{L}, \quad \lambda = \frac{L}{N}, \quad w_r = \frac{W}{L}. \quad (3)$$

For later purposes, let us denote $\tilde{\lambda} := 1 - \lambda$, the unemployment rate. Labour productivity and workforce (cf. (3)) grow exogenously, according to the dynamics:²

$$\frac{\dot{\alpha}}{\alpha} = \alpha$$

$$\frac{\dot{N}}{N} = \beta$$

The unit cost of production, defined as the wage bill divided by the quantity produced plus the nominal rental rate of capital, is given by

$$c := \frac{pW}{pY_s} + \frac{r}{\nu}. \quad (4)$$

Our departures with Grasselli and Costal-Lima (2012) consist in 1) relaxing the assumption of a linear relationship between employed workforce, L , and output, Y_s (an assumption common to virtually all of the literature based on Goodwin's seminal dynamics); 2) adding

¹Throughout, "corporates", "production sector" and "firms" mean non-financial companies.

²Thus, our approach definitely belongs to the exogenous growth tradition. Since we are interested in the "short-run" impact of a financial shock (over a couple of years), we can neglect the endogenous growth issue.

the rental rate of capital to the labour unit cost of production. Instead, we postulate a Cobb-Douglas-like relationship between real GDP growth and employment depending upon an elasticity factor, γ , that is estimated. Thus, our set-up potentially includes the linear case. The parameter γ turns out, however, to be significantly larger than the coefficients for α and β . As already observed by Solow (1990) and Harvie (2000), the original Goodwin model exhibits a poor fitting to historical data. We believe that this was at least partly due to drawbacks that the shift from a linear to a power relation GDP/labour alleviates this shortcoming.

1.2 Nominal GDP

Let us denote the real consumption of goods by C , which together with capital investment, I_k , exports, X , and imports, IM , determine total real sales demand, faced by the domestic production sector:

$$Y_d := C + I_k + (X - IM) \quad (5)$$

The difference between output and demand determines changes in the real level of inventory held by firms. In other words,

$$\dot{V} = Y_s - Y_d, \quad (6)$$

where V denotes the stock of inventories and $\dot{V}$ denotes investment in inventory. Changes in inventory accommodate any surprises in actual sales, Y_d , compared to output, Y_s . According to standard accounting practice, GDP accounts for inventories. When inventories are added, they are valued at their production cost, c (cf. (4)); if some inventories are sold, they add to the GDP by their added value $(p - c)$, with p being the unit price level for domestic goods (GDP deflator). Thus, real GDP_r is defined as:

$$GDP_r = Y_d + c\dot{V} = Y_s - (p - c)\dot{V}$$

Finally, total real investment in the economy is given by

$$I := Y_s - C - (X - IM) = Y_s - Y_d + I_k = \dot{V} + I_k$$

that is, the sum of capital investment and changes in inventory.

Nominal output GDP_n is calculated by multiplying actual sales with p and inventory changes with cp :

$$GDP_n := pC + pI_k + p(X - IM) + cp\dot{V} = pY_d + cp\dot{V}.$$

1.3 A stock-flow consistent open economy

Let us consider the closed system of accounts shown in Table 1 on page 6, where each entry represents a time-dependent quantity and a dot corresponds to differentiation with respect to time. As usual, balance sheet items are stocks measured in Euro, whereas both transactions are measured in nominal Euro per unit of time.

We can see from Table 1 that the entire economy is subdivided into Households, Firms,

Banks, Government and Rest of the world. Their balance sheet structure is:

$$\begin{array}{rcl}
X_h + L_h = M_h + \tau_h B + E_b, & \text{Households} \\
X_f + L_f = M_f + \tau_f B + pK + cpV, & \text{Firms} \\
X_b + E_b + M_h + M_f + L_b = L_h + L_f + \tau_b B, & \text{Banks} \\
B = X_g, & \text{Government} \\
X_R = L_b + \tau_R B, & \text{Rest of the World} \\
pK + cpV = X, & \text{Sum}
\end{array}$$

$X_h, X_f, X_b, X_g, X_R, X$ describe the net worth of households, firms, banks, government, the rest of the world and the net worth of the open economy. Households hold a share of government debt,³ $\tau_h B$, banks' equity, E , and bank deposits M_h . On the liabilities side they have bank loans L_h . The assets of firms are bank deposits M_f , capital goods, pK , a share of government debt $\tau_f B$, and inventories, cpV . They have liabilities in the form of bank loans L_f . Banks have total deposits $M = M_h + M_f$ and equity E_b as their domestic liabilities and loans to the rest of the world L_b as their international liability (partly due to the ECB, partly to foreign investors). On the asset side they hold loans of households and firms $L = L_f + L_h$ plus a fraction of the public bill, $\tau_b B$.⁴ Public debt, B , is the only liability of the government sector. A fraction, $\tau_R = (1 - \tau_h - \tau_f - \tau_b)$, of this sovereign debt is owned by the central bank or foreign investors. Together with bank loans L_b they make up the assets of the rest of the world.

The flow of funds presented in Table 1 reflect the stock-flow consistency condition: financial balances for each sector are used to change their holdings of balance-sheet items. The financial balances row on Table 1 corresponds to the following *ex post* accounting identity between total nominal savings and investment in the open economy

$$S = S_h + S_f + S_b + S_g + S_R = pI_k + cp\dot{V}. \quad (7)$$

The system of financial balances is as follows:

$$\begin{array}{rcl}
S_h = p(W + G_h - T_h + \text{Div}_b + \text{Div}_f - C) + r_B \tau_h B - r_L^h L_h, & \text{Households} \\
S_f = p(\text{GDP}_r + G_f - T_f - \text{Div}_f - W) + r_B \tau_f B - r_L^f L_f, & \text{Firms} \\
S_b = p(G_b - T_b - \text{Div}_b) + r_B \tau_b B + r_L^f L_f + r_L^h L_h - r_b L_b, & \text{Banks} \\
S_g = p(T - G) - r_B B, & \text{Government} \\
S_R = r_b L_b + r_B \tau_R B - pX + pIM, & \text{Rest of the World} \\
S = pI_k + cp\dot{V} &
\end{array}$$

G and T denote subsidies and taxes from and to the government and Div_b and Div_f are dividends from banks and firms paid to households. Because the interest rate on deposits, $r_d = 0$, we can ignore income on bank deposits for the financial balances. Ultimately, investment: $pI = pI_k + cp\dot{V}$ adds to the net worth of the overall economy.

The financial balances are reflected in the flow of funds and thereby complete the stock-

³For instance, in Italy, $\tau \simeq 60\%$, while in France, $\tau \simeq 30\%$. For simplicity, we assume τ constant throughout.

⁴In recent years, the fact that τ_b significantly increased (partly because of the capital adequacy requirements related to sovereign debt in Basel III) contributed to the "Bank-State conundrum".

flow consistency.

$$\begin{array}{ll}
S_h = \dot{M}_h - \dot{L}_h, & \text{Households} \\
S_f = \dot{M}_f - \dot{L}_f + pI_k + cp\dot{V}, & \text{Firms} \\
S_b = \dot{L} + \dot{B} - \dot{L}_b - \dot{M}, & \text{Banks} \\
S_g = -\dot{B}, & \text{Government} \\
S_R = \dot{L}_b, & \text{Rest of the World} \\
S = pI_k + cp\dot{V} &
\end{array}$$

In our model we postulate that any new issuance of government debt is absorbed by the banking sector. Equally a reduction in debt is subtracted from the banking sector holdings until the initial amount of holdings is reached. Beyond that point they are subtracted according to the relative shares (τ_f, τ_h, τ_b).

The consistency of the table regarding foreign trades can be understood as follows: Suppose that imports increase. This will impact the consumption of households in the transactions part of the table. The additional expenditure will be financed through a loan from the bank. This means that the banking sector will increase its loans L_b towards the rest of the world by the same amount in order to balance its balance sheet.

Furthermore, there is another effect changing the net worth of the open economy. The capital stock and inventories change, not only because of new investment, but as well due to the change in unit prices, unit cost and depreciation:

$$p\dot{K} = pI_k + (\dot{p} - p\delta)K$$

$$cp\dot{V} = cp\dot{V} + c\dot{p}V + \dot{c}pV$$

Central to the Keen model is the fact that firms finance investment using both their financial balance and net borrowing from the banking sector according to the accounting identity

$$\dot{D}_f = \dot{L}_f - \dot{M}_f = p(I_k + pc\dot{V} - \Pi_f - \text{Div}_f) \quad (8)$$

where Π_f stands for real corporate profit:

$$\begin{aligned}
\Pi_f &= \text{GDP}_r - W + G_f - T_f + (r_B\tau_f B - rD_f)/p \\
&= C + I_k + c\dot{V} + (X - \text{IM}) - W + G_f - T_f + (r_B\tau_f B - rD_f)/p
\end{aligned}$$

The gap between nominal capital investment pI_k , change in inventories $pc\dot{V}$, dividends Div_f , and corporate profits Π_f , results in the change of corporate debt $\dot{D}_f$. Net borrowing omits an underlying dynamic for loans and deposits. For simplicity, we assume that a constant fraction, $\mu \in (0, 1)$, of expected profit, Π_{ef} (cf. (12)), is redistributed as dividends to the shareholders (households), $\text{Div}_f = \mu\Pi_{ef}$, while a fraction, $1 - \mu$, is saved to finance investment.⁵ Thus, the change in net worth of the corporate sector (after dividends have been distributed) is:

$$S_f := p(\Pi_f - \mu\Pi_{ef}).$$

As for deposits, loans and debt, the dynamics of the real economy leaves us with one degree of freedom. In (8), the increase of private net debt can equally arise from an additional loan or a reduction in deposit. Intuition suggests however, while firms' loans should

⁵An alternative modelling option would have consisted in assuming that dividends are distributed out of actual profits, i.e., $\text{Div}_f = \mu\Pi_f$.

increase only in order to finance investment (and neither to pay wages, nor to pay back anterior debt⁶). Otherwise, one could be sceptical about the willingness of the banking sector to provide such additional loans. As a consequence, we can define the change in deposits as:

$$\dot{M}_f = p(\Pi_f - \text{Div}_f)$$

and

$$\dot{L}_f = cp\dot{V} + pI_k$$

Thus, investment is always reflected in the loan account.

Here, we depart from Grasselli and Costal-Lima (2012) in another aspect. They stipulate that households do not borrow cash from the banking sector (only firms do) and, moreover, the zero net worth of banks is postulated. This implies that $\dot{D}_f = \dot{L}_f - \dot{M}_f = \dot{M}_h$. Here, we drop these two restrictions, and allow households to borrow cash for consumption purposes, while the net worth of banks is endogenously determined. Households receive real net revenues of R_h :

$$R_h = W + G_h - T_h + \text{Div}_f + \text{Div}_b + (r_B \tau_h B - rD_h)/p$$

which are paid into the deposits account of the bank:

$$\dot{M}_h = pR_h$$

Therefore, consumption is financed via the loan account:

$$\dot{L}_h = pC$$

Total deposits reflect the level of debt of households and firms.

$$\dot{M} = \dot{L} - (\dot{D}_h + \dot{D}_f)$$

Moreover, in order to end up with a consistent matrix, Grasselli and Nguyen-Huu (2014) postulate that the interest rate charged on firms' debt, r , the earning rate on deposits, r_d , and the interest rate on loans, r_L , are all equal : $r = r_d = r_L$. This has the advantage of inducing the following simplifying equation:

$$rD_f = r_L^f L_f - r_d M_f.$$

While this makes perfectly sense in countries where banks pay a significant interest rate on deposits, it is more questionable in the euro area, where r_d is essentially zero. We therefore adopt a slightly different convention. Net firms' debt is still defined by $D_f = L_f - M_f$, but $r_d \equiv 0$ and interest payments are given by:

$$rD_f = r_L^f L_f.$$

We shall assume that r is fixed by the banking sector (cf. (19)) and that r_L^f adjusts so that the latter equation be always satisfied. Similarly, $D_h = L_h - M_h$ and $rD_h = r_L^h L_h$.⁷

Next, we specify a set of state variables and behavioural rules for firms, banks, households and the public sector. Namely, for given values of the state variables, firms decide the level of capital investment, I_k , whereas households decide the level of consumption, C . This in turn determines capital by (1), output by (2), demand by (5), and residual changes in inventory by (6). Further specification of the dynamics for the nominal wage rate, w , employment, λ , and consumption prices, p , complete the model of the private sector.

⁶Borrowing to pay back anterior debt is known as a Ponzi scheme, and would be forbidden by law.

⁷In the sequel, we can therefore neglect r_L^* , which becomes a residual parameter.

	Households	Firms		Banks	Government	Rest of the world	Sum
Balance sheet							
Capital stock	$+E_b$	$+pK$		$-E_b$			$+pK$
Inventory		$+cpV$					$+cpV$
Deposits	$+M_h$	$+M_f$		$-M$			0
Loans	$-L_h$	$-L_f$		$+L_h + L_f - L_b$		$+L_b$	0
Bills	$+\tau_h B$	$+\tau_f B$		$+\tau_b B$	$-B$	$+\tau_R B$	0
Sum (Net worth)	X_h	X_f		X_b	X_g	X_R	X
Transactions		Current	Capital				
Consumption	$-pC$	$+pC + pX - pIM$				$+pIM - pX$	0
Capital investment		$+pI_k$	$-pI_k$				0
Change in inventory		$+cp\dot{V}$	$-cp\dot{V}$				0
Government spending	$+pG_h$	$+pG_f$		$+pG_b$	$-pG$		0
Wages	$+pW$	$-pW$					0
Interest on loans	$-r_L^h L_h$	$-r_L^f L_f$		$+r_L^h L_h + r_L^f L_f - r_b L_b$		$+r_b L_b$	0
Interest on bills	$+r_B \tau_h B$	$+r_B \tau_f B$		$+r_B \tau_b B$	$-r_B B$	$+r_B \tau_R B$	0
Interest on deposits	$+r_d M_h = 0$	$+r_d M_f = 0$		$-r_d (M_h + M_f) = 0$			0
Taxes	$-pT_h$	$-pT_f$		$-pT_b$	$+pT$		0
Dividends	$+pDiv_f + pDiv_b$	$-pDiv_f$		$-pDiv_b$			0
Financial balances	S_h	S_f	$-pI_k - cp\dot{V}$	S_b	S_g	S_R	$S = pI_k + cp\dot{V}$
Flows of funds							
Change in capital stock		$+pI_k$					$+pI_k$
Change in inventory		$+cp\dot{V}$					$+cp\dot{V}$
Change in deposits	$+\dot{M}_h$	$+M_f$		$-\dot{M}$			0
Change in loans	$-\dot{L}_h$	$-\dot{L}_f$		$\dot{L}_h + \dot{L}_f - \dot{L}_b$		$+\dot{L}_b$	0
Change in bills				$+\dot{B}$	$-\dot{B}$		0
Column sum	S_h	$\Pi = S_f - pI_k - cp\dot{V}$		S_b	S_g	S_R	$-pI_k - c\dot{V}$
Change in net worth	$\dot{X}_h = S_h$	$\dot{X}_f = \Pi + (\dot{p} - p\delta)K + \dot{c}pV + c\dot{p}V$		$\dot{X}_b = S_b$	$\dot{X}_g = S_g$	$\dot{X}_R = S_R$	$\dot{X} = +(c\dot{p}V) + pI_k + (\dot{p} - p\delta)K$

Table 1: Stock-Flow consistent model of the economy

1.4 Price, wage and employment dynamics

The employment rate dynamics is:

$$\frac{\dot{\lambda}}{\lambda} = \gamma \frac{\dot{\text{GDP}}_r}{\text{GDP}_r} - \alpha - \beta.^8 \quad (9)$$

where γ is country specific and estimated according to the data. It turns out to be larger than 1.

We follow Mankiw (2010) by considering a short-run real wage dynamics of the form:

$$\frac{\dot{w}_r}{w_r} = \Phi(\tilde{\lambda}) \quad (10)$$

Equation (10) states that workers bargain for real wages based on the current state of the labour market. The function, $\Phi(\cdot)$, is estimated and country-specific. As for prices, we follow Keen (2013) and the Classical tradition:

$$\frac{\dot{p}}{p} = -\beta_1 \left[1 - m \frac{c}{p} \right] - \beta_2 \frac{\dot{\text{GDP}}_r}{\text{GDP}_r},^9 \quad (11)$$

for constants $\beta_1, \beta_2 > 0$ and $m \geq 1$. The unit cost, c , is given by (4).

Equation (11) assumes that the long-run equilibrium price is given by a mark up, m , times unit labour cost c (cf. (4)), whereas observed prices converge to this gravity center through a lagged adjust of exponential form with a relaxation time, $1/\beta_1$. This is the “Classical” part of our price dynamics. The second part is neo-classical in spirit: prices also adjust to clear the market for goods, through the term $\beta_2 \frac{\dot{\text{GDP}}_r}{\text{GDP}_r}$.

Because prices are viscous (consistent with the neo-keynesian perspective), the market for goods does not clear at all times, so that inventories play the role of an accommodating variable instead. In our model prices play a key role in linking the real dynamics to the nominal financial variables. We decided to use real dynamics for the real economy because they exhibited a better fit and the possible misfit is limited to the financial world.

Knowing the real wage per worker, we can determine the total real wage bill in the economy as:

$$W = w_r \lambda N$$

1.5 Investment and Consumption

Firms and households decide on their levels of consumption (households) and investment (firms) based on income proxies. For firms the variable influencing investment is the expected real profit share, π_{ef} . It is determined by the following equations:

$$\Pi_{ef} = Y_s - W + G_f - T_f + (r_B \tau_f B - rD_f)/p \quad (12)$$

$$\pi_{ef} := \frac{\Pi_{ef}}{Y_s}$$

Real capital investment follows the phenomenological, aggregate behavioural rule:

$$\frac{\dot{I}_k}{I_k} = \kappa(\pi_{ef}) \quad (13)$$

⁸In the discrete version, the growth rate of output entering into (9) is lagged by 1 quarter.

⁹In the discrete version of the model, the growth rate of output included in the price dynamics is lagged by 1 quarter.

where $\kappa(\cdot)$ is a function of the expected profit share, π_{ef} . Therefore, the capital accumulation equation (1) becomes:

$$\dot{K} = I_k^{t=0} e^{\int_0^t \kappa(\pi_{ef}(s)) ds} - \delta K.$$

Note that via the interest payments on nominal debt we establish the link between money and the real economy. Here, the influence runs from the interest payment to expected profits to the preferred investment. Hence, the money supply has an explicit link to aggregate demand. Furthermore, there is an impact of elevated debt levels on the investment behaviour via the interest payments. In the same way as we refrain from looking for a micro-founded derivation of the Phillips curve and aggregate consumption demand, investment will be estimated for each country.

The wage share is the driving parameter behind consumption and is given by:

$$\omega := \frac{W}{Y_s}$$

We assume that real consumption depends on the wage share as follows

$$\frac{\dot{C}}{C} = \varphi(\omega) \quad (14)$$

where the phenomenological function $\varphi(\cdot)$ is country-specific and estimated.

1.6 Government

Public intervention is modelled through real expenditures, $G_f(t)$, and real taxes, $T_f(t)$ (resp. $G_h(t)$ and $T_h(t)$, $G_b(t)$ and $T_b(t)$) directed towards the production sector (resp. the households, the banking sector). Their real dynamics are given by

$$T = \begin{cases} T_h = \Theta_1 W, & \text{Households} \\ T_f = \Theta_2 (Y_s - W), & \text{Firms} \\ T_b = \Theta_3 Y_s, & \text{Banks} \end{cases} \quad (15)$$

$$G = \begin{cases} G_h = \Gamma_1 W, & \text{Households} \\ G_f = \Gamma_2 Y_s, & \text{Firms} \\ G_b = \Gamma_3 Y_s, & \text{Banks} \end{cases} \quad (16)$$

Parameters Γ and Θ are estimated on the tax and subsidies time series for each country.

The difference of T and G describes the primary balance and by adding interest payment on government debt $r_B B$ we get to the overall fiscal balance, which drives the debt level:

$$\dot{B} = p(G - T) + r_B B.$$

In order to determine the government debt yield we first calculate the debt to GDP_n ratio, b :

$$b = \frac{B}{GDP_n}$$

and the change in the debt to GDP_n ratio determines the change in yield, alongside the change in the interest rate set by the central bank, r_b (following a Taylor Rule cf. (18)).

$$r_B = \dot{b}/40 + r_b \quad (17)$$

In words, a 1% point increase in the debt to GDP_n ratio leads to a 0.025% point yield increase. Here, we draw on the results of Dell'Erba et al. (2013) for our approach.

1.7 The banking sector

The basic idea underlying the way we introduce the commercial banking sector is the following: each time commercial banks issue new loans, they face two additional costs. On the one hand, the reserve requirement requires the banks to borrow an additional amount of central bank money from the ECB. On the other hand, Basel III capital adequacy ratio implies an increase of the banks' equity. For simplicity, we assume that capital markets are always sufficiently liquid for the capital augmentation to take place.

These two operations (additional borrowing from the ECB and additional capital augmentation) have a cost: the debt of the banking sector increases and the dividends to be paid as well. Consistently with our phenomenological approach, we do not strive for deriving the aggregate behaviour of commercial banks from some underlying optimization programme, since they presumably face the same emergence problems as consumption and investment. On the side of the shareholders, we make the simplifying assumption that the average Return on Equity (ROE) of the banking system as a whole remains constant across time. Bearing in mind the strong competitiveness of international capital markets, such a restriction is not unrealistic (banks offering a lower ROE would be wiped out of the capital market). These choices enable us to define the control variable of the banking sector as being the interest rate, r , charged by commercial banks on their loans to the real economy. Indeed, it suffices then to assume, that the banking sector chooses r so that lending be profitable in the short-run, to be able to define r in an unambiguous way. The endogenous dynamics of r will then have an impact on the financing of investment and consumption (the real economy).

The primary task of the banking sector is to set the interest rate in the economy and to fulfill (whenever possible) the demand for credit, endogenously determined by the real business cycle (i.e., by the fluctuations in investment and consumption). In normal times, banks set the interest rate in order to reach a predetermined equity ratio target and pay dividends to households, while servicing their debt at the same time.

Banks essentially make their profit on financing and refinancing at different interest rates. The interest rates on which they can earn their net profit in our model economy are on government, household, firm and their own bank debt.

Various interest rates are therefore relevant: r_b is the leading short-run interest rate set by the ECB following a Taylor rule with a 2% inflation target, inf_t , and an interest rate floor at 0.05%:

$$r_b = \frac{3}{2} \dot{p} - \text{inf}_t \text{ and } r_b > 0.05\%, \quad (18)$$

The sovereign 10-year bill pays an interest rate, r_B , which is endogenously defined as a function of the governments debt to GDP_n ratio and the central banks interest rate (cf. (17)). Finally, the earning rate of deposits is r_d . Since we are dealing with the euro area, we set $r_d = 0$.¹⁰

Given the interest rates in the economy and with the degree of freedom to set the interest rate to the real economy, banks try to earn a profit in order to reach their equity target. This target has two components: the effective return on equity, ROE^e , and the effective equity

¹⁰Of course, none of the interest rates just alluded to coincides, in general, with the rental rate of capital, ρ . Although we won't make use of it in this paper, let us recall the definition of the latter. There are two ways to define the dividends that are distributed by firms to their shareholders. When put together, they provide the endogenous value of ρ : $\text{Div}_f = \rho K = \mu \Pi_{ef}$. Hence $\rho = \mu \Pi_f / K$.

the return is calculated on, E_b^e . The effective return on equity:

$$ROE^e = \frac{e_{\text{target}}}{\frac{E_b}{E_b + L_b + M}} ROE,$$

is a function of the predetermined return on equity, ROE . The function rises if the banking sector is undercapitalised (below the equity ratio target, e_{target}) and falls if the banking sector moves towards its target ratio or above. Thereby, we implement price mechanism depending on the credit supply capability of banks.

The effective equity ROE^e is paid on the effective equity:

$$E_b^e = \max \left[E_b, e_{\text{target}} (E_b + L_b + M) \right],$$

which is at least the hypothetical equity required by the equity ratio target, e_{target} , or, if higher, the actual equity. By modelling the cost of equity in this way banks set the interest rate relatively high, if they are below their target and relatively low if they are above the target.

Coming back to the prior paragraphs about the different interest rates, one can describe the income statement without subsidies and taxes as follows:

$$r(D_h + D_f) + \tau_b r_B B = E_b \times ROE + r_b L_b$$

If banks would set the interest rate, r , so as to satisfy the above equation, they would have no income adding to their equity, disregarding government transfers. That is why we add the effective return on equity and effective equity to the equation. This gives us:

$$r(D_h + D_f) + \tau_b r_B B = \left(\frac{e_{\text{target}}}{\frac{E_b}{E_b + L_b + M}} ROE \right) \max \left[E_b, e_{\text{target}} (E_b + L_b + M) \right] + r_b L_b$$

Solved for r banks set the interest rate according to:

$$r = \frac{\left(\frac{e_{\text{target}}}{\frac{E_b}{E_b + L_b + M}} ROE \right) \max \left[E_b, e_{\text{target}} (E_b + L_b + M) \right] + r_b L_b - \tau_b r_B B}{D_h + D_f} \quad (19)$$

As mentioned before r can then be translated into r_L , according to:

$$rD_h = r_L^h L_h \text{ and } rD_f = r_L^f L_f,$$

with $D = L - M$.

Coming back to the financial balances we can define the net real profit of the banking sector as given by:

$$\Pi_b = (G_b - T_b) + (r_B \tau_b B + r(D_h + D_f) - r_b L_b) / p$$

The real dividends distributed by the banks to their shareholders are given by

$$\text{Div}_b = E_b \times ROE / p$$

The only way banks can add to their equity is by demanding a higher interest rate to the economy than required by the amount of dividends they actually pay and via government transfers. The equity of the banking sector evolves according to

$$\begin{aligned} \dot{E}_b &= p(\Pi_b - \text{Div}_b) \\ &= p(G_b - T_b) + r_B \tau_b B + r(D_h + D_f) - r_b L_b - ROE \times E_b \\ &= p(G_b - T_b) + ROE^e \times E_b^e - ROE \times E_b \\ &= p(G_b - T_b) + \left(\frac{e_{\text{target}}}{\frac{E_b}{E_b + L_b + M}} ROE \right) \max \left[E_b, e_{\text{target}} (E_b + L_b + M) \right] - ROE \times E_b \end{aligned}$$

Turning to the second mechanism which has an influence on bank balance sheets, we can define reserve requirements as given by:

$$\zeta = \frac{1}{f + v(1 - f)} \simeq 12.6$$

where f is the fraction of money that is converted into fiduciary money (7%, on average) and v , the reserve requirement (1% in the euro area since January, 18, 2012). Therefore any change in loans to the real economy requires a deposit with the central bank according to the following dynamics:

$$\dot{L}_b = \frac{\dot{L}_h + \dot{L}_f + \dot{B}}{\zeta} + \dot{B} - p(X - IM)$$

Keep in mind that the trade balance finds its financial counterpart with bank debt. For simplicity, and also in accordance with the trend to be observed since 2010, banks assume all newly issued government debt.

1.8 Endogenous money creation

This section shall demonstrate formally how endogenous money creation is incorporated in our model. Observe that the accounting identity (7) does not preclude money from being endogenously created by credit origination in the banking sector. To understand this, suppose that the banking sector issues an additional amount, $\Delta > 0$, of loans for households. This created money increases the households' loans L_h . Obviously, households borrowed money in order to spend it for consumption purposes. This translates into an increase of GDP_r by $(1 - c)\Delta$

$$\dot{V} = Y_s - Y_d$$

$$\begin{aligned} GDP_r &= Y_d + c\dot{V} \\ &= (1 - c)(C + I_k + X - IM) + cY_s \end{aligned}$$

The higher GDP_r means that firms see their profit increase by the same amount.

$$\Pi_f = GDP_r - W + G_f - T_f + (r_B \tau_f B - rD_f)/p$$

Dividends on the other hand are not effected because they are paid on the expected profit:

$$\Pi_{ef} = Y_s - W + G_f - T_f + (r_B \tau_f B - rD_f)/p$$

$$Div_f = \mu \Pi_{ef}.$$

Starting with firms, we can see that their deposits will increase by $\Delta(1 - c)$ in real terms and $\Delta(p - cp)$ in nominal terms; because of the link between GDP_r and Π_f

$$\begin{aligned} \dot{M}_f &= p(\Pi_f - Div_f) \\ &= (p - cp)(C + I_k + X - IM) + p(cY_s - W + G_f - T_f - Div_f) + r_B \tau_f B - rD_f \end{aligned}$$

The firms loans are impacted via the change in inventories. Here, loans will change by $-cp\Delta$ in nominal terms

$$\begin{aligned} \dot{L}_f &= cp\dot{V} + pI_k \\ &= cpY_s - cpC + (p - cp)I_k - cp(X - IM) \end{aligned}$$

Debt of firms being the residual of loans and deposits decrease by exactly $p\Delta$

$$\begin{aligned}\dot{D}_f &= \dot{L}_f - \dot{M}_f \\ &= -p(C + X - IM - W + G_f - T_f - \text{Div}_f) - r_B \tau_f B + r D_f\end{aligned}$$

Turning to households, we can immediately see that loans will increase by $p\Delta$, since consumption is loan financed by definition in our model.

$$\dot{L}_h = pC$$

Deposits of households are not influenced by the change in consumption.

$$\begin{aligned}R_h &= W + G_h - T_h + (\text{Div}_f + \text{Div}_b) + (r_B \tau_h B - r D_h)/p \\ \dot{M}_h &= pR_h \\ \dot{M}_h &= p(W + G_h - T_h + \text{Div}_f + \text{Div}_b) + r_B \tau_h B - r D_h\end{aligned}$$

Household net debt shows that households would increase their debt by $p\Delta$

$$\begin{aligned}\dot{D}_h &= p(C - R_h) \\ &= p(C - W - G_h + T_h - \text{Div}_f - \text{Div}_b) - r_B \tau_h B + r D_h\end{aligned}$$

Finally on the aggregate level of the banking sector, we see that deposits will increase by $(p - cp)\Delta$

$$\begin{aligned}\dot{M} &= \dot{M}_h + \dot{M}_f \\ &= (p - cp)(C + I_k + X - IM) + p(G_h - T_h + G_f - T_f + \text{Div}_b + cY_s) \\ &\quad + (\tau_f + \tau_h)r_B B - r(D_f + D_h)\end{aligned}$$

Aggregate loans will equally increase by $(p - cp)\Delta$

$$\begin{aligned}\dot{L} &= \dot{L}_h + \dot{L}_f \\ &= pC + cp\dot{V} + pI_k \\ &= (p - cp)(C + I_k) + cpY_s - cp(X - IM)\end{aligned}$$

Finally, debt is unchanged on the aggregate level due to the increase of Δ

$$\begin{aligned}\dot{D} &= \dot{L} - \dot{M} \\ &= -p(G_h - T_h + G_f - T_f + \text{Div}_b + X - IM) - (\tau_f + \tau_h)r_B B + r(D_f + D_h)\end{aligned}$$

This shall demonstrate, that the banking sector creates a loan by creating a deposit for the household and firm sector. Hence, money creation lies with the banking sector for firms and households. Furthermore, the net worth of banks is not affected by this creation of fresh money. The very fact, that S_b remains independent from Δ helps to understand, why there is a debate about endogenous money creation at all. Indeed, at some aggregate level, money creation cannot be observed on the stock-flow matrix. One needs to decompose S_b into M and L in order to be able to observe money creation at work.

1.9 Shock, fiscal consolidation and credit crunch

In order to capture stress events on the banking sector, we consider an exogenous shock on bank assets (other than L and B): We shall examine the (dynamical) consequences of a sudden loss of value, $\dot{A} < 0$, on the market value of the banking sector's financial assets:

$$l = \frac{-\dot{A}}{E_b + M + L_b}$$

with l being the percentage loss on the total balance sheet of the banking sector. On the liabilities side the shock is absorbed first by equity, E_b , and in case equity is fully absorbed, creditors, L_b , participate up to 8% of the total balance sheet. The restructuring of the banking sector follows immediately, with the funds of the SRF being used first to recapitalise the banking sector back to an equity ratio of 4.5%. Once the funds for the SRF are used up, the government steps in to pay the remaining amount by issuing additional government debt (which is fully absorbed by banks) if necessary.

As a consequence of the shock, the banks will hold less equity and the SRF and/or governments stepped in. These two effects have wide ranging consequences in our model. On the side of banks, this might trigger a credit crunch and increase the interest rate significantly and on the government side, fiscal consolidation might be the reaction. The systems reaction to the shock depends entirely on the magnitude, financial dependence and balance sheet strength of the different agents in the economy.

Starting with governments, absent any crash in the banking sector which forces the government to bail out banks, taxes and public spendings are constant fractions of GDP, wages or gross profits. In case a crash let's public finances deteriorate significantly, fiscal consolidation measures will be adopted in order to lower the debt burden (as could be observed in reality in the case of Greece for example). These measures are upheld until the pre shock debt to GDP ratio is reached again.

We by no means claim that fiscal consolidation measures are the most appropriate policy response in front of a shock hitting the banking sector's assets. In order to remain in line with what would presumably happen (given the current standpoint of European authorities on this issue), we nevertheless assume that the home sovereign will put such a policy into practice.

We assume that governments will raise taxes and lower subsidies by a percentage, a_{aust} every period in order to stabilise their finances and until they reach a debt to GDP ratio equivalent to pre-shock levels. Therefore, we can amend equation (15) and (16) by the fiscal consolidation regime:

$$T = \begin{cases} T_h = \Theta_1 W, & \text{Households} \\ T_f = \Theta_2 (Y_s - W), & \text{Firms} \\ T_b = \Theta_3 Y_s, & \text{Banks} \\ \frac{\dot{T}}{T} = a_{aust}, & \text{Fiscal consolidation} \end{cases}$$

Subsidies:

$$G = \begin{cases} G_h = \Gamma_1 W, & \text{Households} \\ G_f = \Gamma_2 Y_s, & \text{Firms} \\ G_b = \Gamma_3 Y_s, & \text{Banks} \\ \frac{\dot{G}}{G} = -a_{aust}, & \text{Fiscal consolidation} \end{cases}$$

Furthermore, the induced increase in public debt has an immediate impact on the government debt yield of the country (cf. (17)), which increases interest payments to its debt holders.

Turning to the banking sector, their primary task is to set the interest in the economy and credit supply. In normal times they set the interest rate in order to reach a predetermined equity ratio target and pay dividends to households. In case of a shock to the bank assets, they are bailed out back to a 4.5% equity ratio, which is far away from their target and thus they increase the interest rate for the economy. This can be seen in equation (19) via the increase in ROE^e .

Apart from setting the interest rate, we model as well the credit supply in case of a crisis. For the sake of realism, we do not impose that banks automatically fulfil the demand for credit arising from the real economy. Rather, we assume that banks will provide the required credit, given that their customer's leverage ratio be lower than some upper-bound. Indeed, there is now a large body of the literature focusing on the leverage ratio of borrowers as being one key variable.¹¹ Since this upper-bound is quite arbitrary, and depends entirely upon the confidence of the lenders, there is no obvious way to derive it from primary principles. On the other hand, it is clear that, after the banking sector has been hit by an external shock, the lenders become anxious (in the sense of Fostel and Geanakoplos (2013)), so that the leverage ratio that nervous lenders will be ready to consider for lending extra money must necessarily be lower than the one prevailing before the shock. How much lower? Again, there is no theory for the collective psychological anxiety of lenders. Thus, as long as the private debt (households and firms) in relation to bank equity remains above levels seen before the shock, will banks refuse to finance the (possible) gap of disposable income to investment and consumption for households and firms. This mechanism forces households and firms to diminish their spending (investment and consumption) in order to diminish their leverage.

Now, suppose that the banking sector is not willing to lend money for investment. Then, the investment behaviour of firms effectively has an upper-bound provided by the expected profits of the corporate sector or less if they choose so:

$$I_k := \min(I_k^{t=0} e^{\int_0^t \kappa(\pi_{ef}(s)) ds}, (1 - \mu)\Pi_{ef}). \quad (20)$$

For computational reasons,¹² we take the expected firm profit, Π_{ef} , and not the firm profit, Π_f . The difference:

$$Y_s - \text{GDP}_r = (1 - c)(Y_s - Y_d) = (1 - c)(\dot{V}),$$

is what ultimately needs to be financed via debt. Hence, the added value of inventories will be debt financed. In a situation of crisis we are very likely to see demand slump and inventories increase because of a more sluggish reaction of output. Therefore, banks do not stop entirely to lend to firms, but they stop financing capital investment.

On the side of households we do not have this phenomenon, because the disposable income R_h does not depend on household consumption. Therefore, in case of a credit crunch households can consume what they have as disposable income or less if they choose to:

$$C := \min(C^{t=0} e^{\int_0^t \varphi(\omega(s)) ds}, R_h). \quad (21)$$

Indeed, by choosing to consume less than their disposable income, they would even reduce their net debt, because: $\dot{D}_h = p(C - R_h)$.

The equations (20) and (21) above hint at the perfect storm a credit crunch in combination with a higher interest rate and fiscal consolidation would unfold. Not only are firms and households spending on consumption and investment limited by an upper limit of disposable income, but this upper limit further decreases with a higher interest rate, higher taxes and less subsidies. Hence, the economy is deprived of cash and a demand side slump is the consequence. These mechanisms in the model aim to replicate the effects at work during the last financial crisis.

¹¹See, e.g., Geanakoplos (2010).

¹²We actually can't determine GDP_r without knowing I_k . Furthermore, any investment would add to GDP_r and therefore to firm profits. Therefore, we use the computational trick of taking expected profits.

The short run demand deficit causes deflationary pressure on top of a rapidly falling economic activity and higher unemployment. This is the point where the alternative dynamics re-enter the previously described dynamics of the model and diverge from the scenario without a financial shock. Furthermore, the fiscal consolidation and credit crunch regimes are the strongest link of high private or public debt level and sub-par growth.

1.10 Scenarios

Given the model described before, we simulate different scenarios representing shocks and various regulatory regimes. The five scenarios investigated here are:

1. NO SHOCK: our model is calibrated so that this baseline scenario without shock remains as close as possible to the European Commission (EC) forecast
2. SHOCK: corresponds to a shock hitting the banking sector under the assumption that a EUR 55 bn Resolution Fund is already in place (anticipating the 2023 Banking Union) Shock and no SRF: corresponds to the same shock but with no Resolution Fund in place
3. SHOCK AND LARGER SRF: corresponds to the same shock, with a EUR 165 bn SRF
4. SHOCK AND HIGHER e_{target} AND LOWER ROE: corresponds to the same shock hitting the banking sector, but with a higher equity ratio target for banks and lower bank dividends
5. NO SHOCK AND HIGHER e_{target} AND LOWER ROE: corresponds to the baseline scenario with a higher equity ratio target for banks and lower bank dividends

These scenarios allow us to investigate the resilience of the euro area under different regulatory regimes.

2 Data

2.1 Data Source

We use the ECB, OECD and Eurostat as sources. The quarterly data covers the time frame from 1999 Q4 until 2013 Q4. For the empirical estimation of the functions determining wage rate growth, $\Phi(\tilde{\lambda})$ (cf. (10)), investment growth, $\kappa(\pi_{ef})$ (cf. (13)), and consumption growth, $\varphi(\omega)$ (cf. (14)), we use the whole time series (from Eurostat) of GDP, salaries, GDP and final consumption expenditure deflator, investment, consumption, unemployment and firm profits. All data is publicly available and for further details on the exact specifications see the Appendix.

2.2 Estimation

From the sources above, we use certain variables as starting points and other coefficients are estimated from the data. Starting values (2012 Q4) are included for the following variables:

capital stock, K , nominal GDP, GDP_n , investment, I , consumption, C , wages, W , exports, X , imports, IM , firm debt, D_f , households debt, D_h , government debt, B , banking sector debt, D_b , banking sector equity, E_b , and banking sector deposits M . The values just described

are all nominal. Furthermore, starting values are used for the unemployment rate, $\tilde{\lambda}$, total workforce, N , GDP deflator, p , long term government debt yield, r_B , ECB key interest rate, r_b , inflation target, inf_t , the households' share of government debt, τ_h , the firms' share of government deb, τ_f , the banking sectors' share of government debt, τ_b .

Next to the starting values there are coefficients requiring some computation: the coefficient determining the elasticity of employment regarding real GDP growth, γ , is estimated with the following OLS regression:

$$\frac{\dot{\lambda}}{\lambda} = \gamma \frac{\text{GDP}_r}{\text{GDP}_r} + \gamma_1 \alpha + \gamma_2 \beta$$

Furthermore, there are the estimated functions determining wage rate growth, $\Phi(\tilde{\lambda})$, consumption growth, $\varphi(\omega)$, and investment growth, $\kappa(\pi_{ef})$. Here, we use a statistical approach originating in the work by Rigby and Stasinopoulos (2005), Rigby and Stasinopoulos (2013) and Voudouris et al. (2012) and which consists in approximating this relationship by means of some polynomial, using non-necessarily Gaussian residuals. Thus, by contrast with some familiar approaches used in several applied macro-economic models, we do not restrict our estimated functions to be linear.

The GAMLSS procedure introduced by Voudouris et al. (2012) enables to perform a much finer stochastic approximation, but for simplicity, we refrained from striving for the utmost empirical accuracy. The statistical robustness of our model (i.e., its sensitivity in terms of error calculus) will be checked in a subsequent work. Via GAMLSS we estimate polynomials up to the power of 4: $y = a_1x + a_2x^2 + a_3x^3 + a_4x^4 + b$ using the following error distributions: normal, t family, skew t type, Johnson's SU (μ the mean), Box-Cox power exponential, Box-Cox t, Box-Cox Cole and Green.

3 Calibration

Next to the above mentioned parameters, there are multiple degrees of freedom, which allow to calibrate the model. Given the multitude of dimensions, a parameter grid is the best way of exploring the possible calibrations of the model.

Starting with the estimated functions we have some degree of freedom in choosing them. First they are pre-selected by significance of the coefficients and then compared via their worm plots (Q-Q plot). This is the most important criteria for finding a good fitting polynomial. One has to bear in mind that the shape of the function has a major influence on the behaviour of the modelled parameter in the model. When calibrating with the aim of matching a predetermined goal (EC forecast), certain solutions exclude each other. For example, a growing economy might come from rising investment and consumption. Assuming it stems from investment, the function describing investment growth must be upward sloping for the direction of the expected profit share. Lets assume they rise and this causes a rise in investment growth. With wages and output being the dominant variables of the expected profit share, we can safely assume that wages grow faster than output. This implies a falling wage share. Now it depends on the slope of the consumption function, if this leads to a rise or fall in consumption growth. If the overall economy is supposed to grow, the change in consumption must be smaller than the change in investment. Hence, a strongly upwards sloping function for consumption around the starting value for the wage share will most likely not work, given the trajectory of the economy we had in mind.

For the wage component, the calibration can be even more difficult because of the multitude of factors influencing unemployment. Since $\gamma > 0$ GDP growth will let unemploy-

ment fall but depending on γ the effect varies. Assuming a growing economy, unemployment would drop and wage rate growth picks up if we chose the equivalent function. This adds to the growth of wages and will lower expected firm profits, which might trigger lower investment and thereby GDP. Ultimately we might see the GDP decline over time if the reaction of wages is too strong and investment collapses as a reaction to it. Hence, especially when targeting a forecast, calibration of these functions is a sensitive procedure, because of their interdependence. Nonetheless, points of orientation are the statistical quality measures (significance, worm plot) and trial and error when aiming for a predetermined goal.

Next to these signature functions of the economy there are further parameters at play which are closely linked through the dynamics and have a major influence on the direction of the economy.

The productivity growth rate, α , and the workforce growth rate, β , can be estimated as the average of the historical values. The depreciation rate, δ , represents the change in capital which cannot be explained by investment in our model. Hence, historical data can guide us here as well. The capital to output ratio, ν , is a constant ratio determined as the productive capital over GDP at the calibration date.

The government sector is calibrated using historical data for taxes and subsidies of firms. Thereby we can ensure continuity regarding the expected profit share. Households taxes and subsidies can be estimated with one degree of freedom. From the historical values we can estimate the change in debt, which is not due to $C - R_h$. Thereby we know what the difference between taxes and subsidies is and we just calibrate subsidies as being a share of wages $\Theta_h > 0$ and taxes: $\Gamma_h = \Theta_h - (\dot{D}_h - C + R_h)/W$. Taxes and subsidies for banks can be set relatively freely, but one has to bear in mind, that they influence the interest rate to the economy and of course the debt dynamics of the government.

Taxes and subsidies in our model have a secondary function of bridging the gap between the model and reality. By assuming that only households consume and only firms invest, while only households receive wages, paid by only firms, we impose a certain structure on the financial flows in the model, which are not reflected in reality. In a way the calibration of taxes and subsidies has to make up for this shortcoming. Therefore, there are historical values as a point of orientation but afterwards, one has to check the trajectory of the different debts and correct for obvious unrealistic behaviour.

Dividends are another issue touching on the redistribution of funds in the model, not reflected in reality. For firm dividends we have a point of orientation by calculating the dividends as: $\mu = (D_f - (I_k - \Pi_f))/\Pi_f$. Banks pay the predetermined return on equity, ROE, as dividends. The return on equity is set as a multiple of the government debt yield in the respective country. Thereby, we imply a certain mark up for the risk of the banking sector. The equity ratio target, e_{target} , is set above the regulatory benchmark, but should respect the current level of capitalisation of the banking sector. Overall, ROE and e_{target} become more important when calibrating shock responses.

Finally, the inflation dynamics are vital especially for the link between the real economy and the financial representation and debt levels. β_1 and m determine the relaxation time and mark up and one point of orientation is that $m > \frac{p}{c}$ will let inflation rise and vice versa. Furthermore, the relation of β_1 and β_2 are important to balance the effect of inflation inertia and the neo-classical component.

Turning to the shock scenarios, further variables become important. First of all the shock, modelled as a percentage of the banking sectors total assets, needs to be calibrated. Here, we aim for a certain bailout by the SRF and government and calibrate accordingly. In a separate study we determined the government bailout necessary for different shock

scenarios in the euro area. The shock, l , hits the economy over three periods:

$$t_1 : l \times (E_b + M + L_b),$$

$$t_2 : l^2 \times (E_b + M + L_b),$$

$$t_3 : l^3 \times (E_b + M + L_b).$$

Hence, the shock decays over time and lasts over three periods.

The first public institution to take a loss is the SRF fund. Therefore, the size needs to be set according to the maximum possible involvement. We don't go into detail here, but refer to a separate study, where we estimate the SRF involvement for each systemically important bank in the euro area. Here, we draw on the results from that study. Obviously the size of the resolution fund is the variable to change in order to simulate the different scenarios concerning the SRF.

Fiscal consolidation is implemented as a constant reduction in subsidies and increase in taxes for firms and households by a_{aust} per period. There is little guidance on where to set a_{aust} , but a reduction of subsidies (and increase of taxes) by more than 4% per year can be seen as an enormous effort. The trigger for fiscal consolidation is the underlying assumption that following a government bailout we will see fiscal consolidation measures imposed. Hence, we deduct that fiscal consolidation measures kick in and stay in place as long as the debt to GDP ratio, $b > b^{pre-shock}$.

The credit-crunch is equally triggered by thresholds. The credit-crunch regime prevails as long as:

$$\frac{D_h}{E_b} > \frac{D_h^{pre-shock}}{E_b^{pre-shock}}, \text{ for households}$$

and

$$\frac{D_f}{E_b} > \frac{D_f^{pre-shock}}{E_b^{pre-shock}}, \text{ for firms.}$$

In order to model the scenarios with a higher equity ratio target and lower dividends, we change e_{target} and ROE. Apart from the necessity for the different scenarios, these two variables play a key role in shaping the reaction of the banking sector to a shock. The higher the equity ratio target, e_{target} , the more severe the rise in interest rates following a shock to the banks equity. Furthermore, in the scenario with a higher equity ratio target from the beginning on, we will see a higher interest rate to the economy in the beginning, which will push expected firm profits lower and enter into the dynamics there afterwards.

From the description above one can tell that the calibration is a delicate task, but it certainly adds further information to the dynamical system which ultimately result in a realistic simulation. There are degrees of freedom and one has to explore different configurations in order to reach a subjectively realistic version of the model. The best approach in theory is to span a grid as wide as possible and to simulate all possible parameter combinations. Certain outcomes can be immediately discarded. Nonetheless, there are limits to these simulations due to the sheer number of possibilities. With 20 parameters which need to be actively calibrated: l , SRF, e_{target} , ROE, a_{aust} , β_1 , β_2 , m , Θ_h , Θ_f , Θ_b , Γ_h , Γ_f , Γ_b , α , β , δ , $\Phi(\lambda)$, $\varphi(\omega)$, $\kappa(\pi_{ef})$ the number of possibilities goes easily into the millions.

Nonetheless, there is a more systematic approach to calibration of such models. We recommend to start with the employment dynamics, by calibrating α , β and δ first. At the same time the debt dynamics need to be stabilised, which can be influenced via the Γ and Θ parameters. Having fixed these major issues, one can start spanning the grid very wide for the rest of the parameters. Furthermore, the parameters relevant for a shock

can be calibrated in a second step. Thereby, one can significantly reduce the number of possibilities.

A Appendix

A.1 Data

Table 2 provides detailed information about the source and exact specification of the data used for the calibration of the model to the euro area economy. Table 3 provides the descriptive statistics of the data input used in the model. Furthermore, there are a few calculations to be done in order to obtain all the necessary variables:

The Final consumption expenditure (FCE) Deflator is used to calculate real salaries:

$$W = \text{Compensation of Employees} \times \text{FCE Deflator}$$

We calculate the shares of government debt holdings: τ_h, τ_f, τ_b using:

$$\text{Total gov. debt} = \text{Gov. Debt ex gov. holdings} + \text{Foreign holdings of gov. debt}$$

$$\tau_b = \frac{\text{Gov. Debt ex gov. holdings} - \text{Domestic sector ex fin. corp. and gov.} - \text{Central Bank}}{\text{Total gov. debt}}$$

$$\tau_f = 0.1 \times \frac{\text{Domestic sector ex fin. corp. and gov.}}{\text{Total gov. debt}}$$

$$\tau_h = 0.9 \times \frac{\text{Domestic sector ex fin. corp. and gov.}}{\text{Total gov. debt}}$$

Since, there is a lack of data on the partition among households and firms we make the simplifying assumption, that households hold 9 times as much government debt as firms.

Bank debt, L_b , can be calculated as:

$$\text{Consolidated Domestic Banking sector} - \text{Total Liabilities} - E_b - M$$

The capital-to-output ratio, v , is calculated using:

$$v = \frac{K}{\text{GDP}_n}$$

Dataset	Variable	Series Key	Source	Start	End	Frequency	Unit	SA	WDA	Accessed
Government debt yield	r_B	irt_lt_mcby_m - EA	Eurostat	2000 M1	2013 M12	Monthly	Percent	-	-	27.06.14
Gross government debt	B	gov_10q_ggdebt - EA18	Eurostat	2006 Q1	2013 Q4	Quarterly	nominal Euro	no	no	09.03.15
Active Population	N	lfsi_act_q - EA18	Eurostat	2000 Q1	2013 Q4	Quarterly	nominal Euro	no	no	08.03.15
Unemployment rate	$\bar{\lambda}$	une_rt_q - EA18	Eurostat	2000 Q1	2013 Q4	Quarterly	Percent	yes	no	08.03.15
Real labour productivity	α	namq_10_lp_ulc - EA18	Eurostat	2001 Q1	2013 Q4	Quarterly	Percent change	no	no	08.03.15
Gross fixed capital formation	pI	namq_10_gdp - EA18	Eurostat	2000 Q1	2013 Q4	Quarterly	nominal Euro	yes	yes	08.03.15
Compensation of employees	$p_{FCE} W$	namq_10_gdp - EA18	Eurostat	2000 Q1	2013 Q4	Quarterly	nominal Euro	yes	yes	08.03.15
GDP	GDP_n	namq_10_gdp - EA18	Eurostat	2000 Q1	2013 Q4	Quarterly	nominal Euro	yes	yes	08.03.15
FCE	pC	namq_10_gdp - EA18	Eurostat	2000 Q1	2013 Q4	Quarterly	nominal Euro	yes	yes	08.03.15
Exports	pX	namq_10_gdp - EA18	Eurostat	2000 Q1	2013 Q4	Quarterly	nominal Euro	yes	yes	08.03.15
Imports	pIM	namq_10_gdp - EA18	Eurostat	2000 Q1	2013 Q4	Quarterly	nominal Euro	yes	yes	08.03.15
GDP Deflator	p	namq_10_gdp - EA18	Eurostat	2000 Q1	2013 Q4	Quarterly	Index 2010=100	yes	yes	08.03.15
FCE Deflator	p_{FCE}	namq_10_gdp - EA18	Eurostat	2000 Q1	2013 Q4	Quarterly	Index 2010=100	yes	yes	08.03.15
Interest	rD_f	nasq_10_nf_tr - EA18 - non-fin. corp.	Eurostat	2000 Q1	2013 Q4	Quarterly	nominal Euro	no	no	08.03.15
Current taxes on income, wealth, etc.	T_f	nasq_10_nf_tr - EA18 - non-fin. corp.	Eurostat	2000 Q1	2013 Q4	Quarterly	nominal Euro	no	no	08.03.15
Subsidies	G_f	nasq_10_nf_tr - EA18 - non-fin. corp.	Eurostat	2000 Q1	2013 Q4	Quarterly	nominal Euro	no	no	08.03.15
Consumption of fixed capital	$p\delta K$	nasq_10_nf_tr - EA18	Eurostat	2002 Q1	2013 Q4	Quarterly	nominal Euro	no	no	08.03.15
Productive capital stock	K	Economic Outlook No. 95 - sum of EA	OECD	2000	2013	Annual	nominal Euro	-	-	29.08.14
ECB key interest rate	r_b	FM.B.U2.EUR.4F.KR.MRR_FR.LEV	ECB	2000 Q1	2013 Q4	Quarterly	Percent	-	-	26.11.14
Central Bank holdings of gov. debt		GST.A.I7.N.B1210.MAL.B1300.SA.E	ECB	2000	2013	Annual	nominal Euro	-	-	15.01.15
Foreign holdings of gov. debt		GST.A.I7.N.B2000.MAL.B1300.SA.E	ECB	2000	2013	Annual	nominal Euro	-	-	15.01.15
Gov. Debt ex gov. holdings		GST.A.I7.N.B1X13.MAL.B1300.SA.E	ECB	2000	2013	Annual	nominal Euro	-	-	15.01.15
Gov. Debt holdings of domestic sectors ex fin. corp. and gov.		GST.A.I7.N.B1XGF.MAL.B1300.SA.E	ECB	2000	2013	Annual	nominal Euro	-	-	15.01.15
Non - fin. corp. partially consolidated debt	L_f	IEAQ.Q.I7.N.V.LE.FPS11.A1.S.2.PE.Z	ECB	2000 Q1	2013 Q4	Quarterly	nominal Euro	no	no	11.03.15
Households partially consolidated debt	L_h	IEAQ.Q.I7.N.V.LE.F4.S1M.A1.S.2.XE.Z	ECB	2000 Q1	2013 Q4	Quarterly	nominal Euro	no	no	11.03.15
Consolidated Domestic Banking sector - Total Liabilities		CBD.A.I7.67.A.32000.X.1.Z5.0000.Z01.E	ECB	2007	2013	Annual	nominal Euro	-	-	15.01.15
Consolidated Domestic Banking sector - Equity	E_b	CBD.A.I7.67.A.33000.X.1.Z5.0000.Z01.E	ECB	2007	2013	Annual	nominal Euro	-	-	15.01.15
Consolidated Domestic Banking sector - Deposits	M	CBD.A.I7.67.A.32700.X.1.Z5.0000.Z01.E	ECB	2007	2013	Annual	nominal Euro	-	-	15.01.15

Table 2: Data description

Name	Variable	Starting Value	Min.	Median	Mean	Max.
Government debt yield	r_B	0.03090	0.03090	0.04090	0.04188	0.05470
Gross government debt	B	8.900e+12	5.939e+12	7.186e+1	7.229e+12	8.900e+12
Active Population	N	159.1e+6	142.5e+6	154.4e+6	152.8e+6	159.1e+6
Unemployment rate	$\bar{\lambda}$	0.115	0.073	0.09	0.08988	0.115
Real labour productivity	α	-0.003	-0.044	0.007	0.005521	0.031
Gross fixed capital formation	pI	4.907e+11	3.968e+11	4.824e+11	4.720e+11	5.591e+11
Compensation of employees	$p_{FCE}W$	1.178e+12	8.336e+11	1.035e+12	1.029e+12	1.179e+12
GDP	GDP_n	2.457e+12	1.747e+12	2.232e+12	2.172e+12	2.457e+12
FCE	pC	1.894e+12	1.323e+12	1.685e+12	1.659e+12	1.895e+12
Exports	pX	1.068e+12	6.039e+11	8.069e+11	8.174e+11	1.076e+12
Imports	pIM	9.920e+11	5.885e+11	7.779e+11	7.831e+11	1.001e+12
GDP Deflator	p	1.0300	0.8260	0.9430	0.9390	1.0300
FCE Deflator	p_{FCE}	1.0390	0.8190	0.9430	0.9371	1.0390
Interest	rD_f	5.62e+10	5.620e+10	6.400e+10	6.849e+10	1.042e+11
Current taxes on income, wealth, etc.	T_f	6.658e+10	2.054e+10	4.529e+10	4.610e+10	8.567e+10
Subsidies	G_f	2.760e+10	1.183e+10	1.510e+10	1.634e+10	2.888e+10
Consumption of fixed capital	$p\delta K$	4.418e+11	2.963e+11	3.789e+11	3.737e+11	4.418e+11
Productive capital stock	K	2.770e+13	2.131e+13	2.441e+13	2.461e+13	2.770e+13
ECB key interest rate	r_b	0.00750	0.00750	0.04250	0.03211	0.04250
Central Bank holdings of gov. debt		2.145e+11	8.363e+10	1.095e+11	1.234e+11	2.145e+11
Foreign holdings of gov. debt		4.228e+12	1.691e+12	2.897e+12	2.958e+12	4.228e+12
Gov. Debt ex gov. holdings		4.391e+12	2.959e+12	3.039e+12	3.296e+12	4.391e+12
Gov. Debt holdings of domestic sectors ex fin. corp. and gov.		6.819e+11	5.694e+11	6.566e+11	6.453e+11	7.409e+11
Non - fin. corp. partially consolidated debt	L_f	7.666e+12	4.264e+12	6.331e+12	6.317e+12	7.762e+12
Households partially consolidated debt	L_h	6.198e+12	3.258e+12	5.086e+12	4.940e+12	6.210e+12
Consolidated Domestic Banking sector - Total Liabilities		2.801e+13	1.069e+13	2.839e+13	2.601e+13	3.165e+13
Consolidated Domestic Banking sector - Equity	E_b	1.554e+12	5.948e+11	1.506e+12	1.340e+12	1.554e+12
Consolidated Domestic Banking sector - Deposits	M	1.203e+13	3.874e+12	1.196e+13	1.058e+13	1.215e+13

Table 3: Descriptive Statistics of Data

A.2 GAMLSS

The GAMLSS procedure is at the core of our model, because the estimated functions are driving it. Therefore, we will explain in detail the procedure of selecting the appropriate function.

A.2.1 Consumption

Starting with the real consumption function, we estimate polynomials up to the 4th degree combined with the different distributions for the error term, e . The following function is estimated:

$$\frac{\dot{C}}{C} = a_1\omega + a_2\omega^2 + a_3\omega^3 + a_4\omega^4 + b + e$$

We use the data of consumption, wages and GDP up to the calibration date: 2012 Q4. After filtering for functions, which have significant coefficients ($p < 0.05$) we are left with six choices. The function with the lowest AIC value is a polynomial of first degree and skew t type distribution of errors. Figure 1 shows the worm plot and the estimated function. One can see that the worm plot has a few outliers for extreme values, but lies in range overall. The estimated function is downward sloping, which means a rising wage share leads to decreasing growth in consumption. This is counterintuitive and we therefore go on evaluating the other candidates.

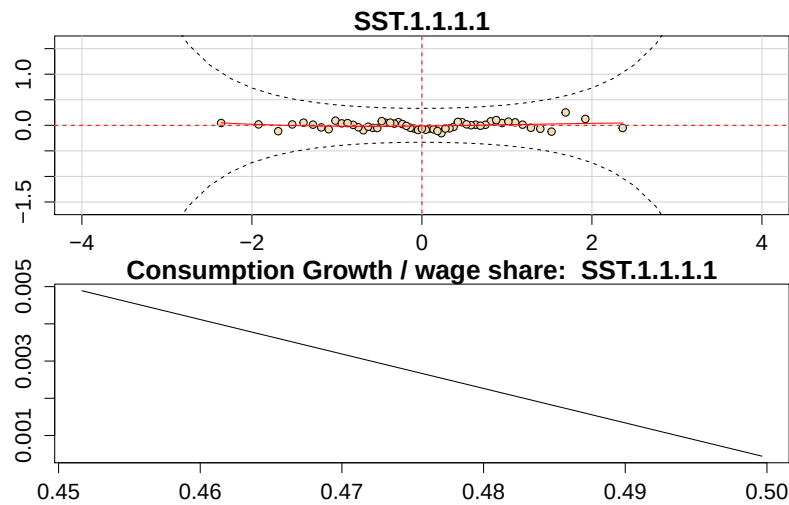


Figure 1: Consumption function: 1st degree polynomial

The other candidates are third degree polynomial functions with higher AIC values. Figure 2 shows the worm plot and estimated function for a third degree polynomial and skew t type error distribution. The worm plot has more outliers in the extremes but is still within the limits (dashed line). The estimated function is mostly downward sloping with a plateau for a wage share between 47% and 48%. Considering that the starting value in our model is a wage share of 47.54% and considering that the EC forecast is above zero for inflation and real GDP growth, this might be a viable option. Inflation demands an increase in unit cost and therefore the wage share (cf. 11). Growth drivers in our model are either consumption, C , or investment, I .

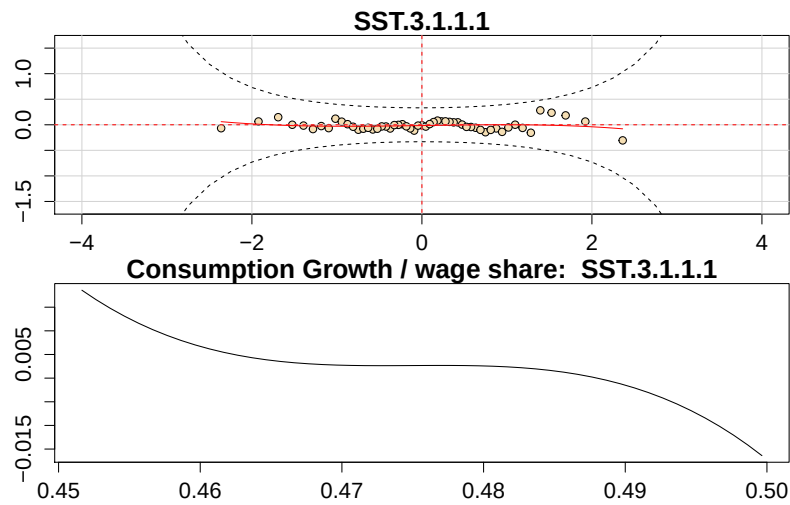


Figure 2: Consumption function 3rd degree polynomial

Looking at the estimated functions of the other polynomials, we find one candidate with a more upward sloping plateau. Figure 3 illustrates the worm plot and estimated function of a 3rd degree polynomial with t family error terms. The worm plot is further off than the others but still within limits.¹³ Nonetheless, the shape of the estimated function seems to be better suited to simulate a growth scenario with positive inflation. To conclude, we select the third presented candidate.

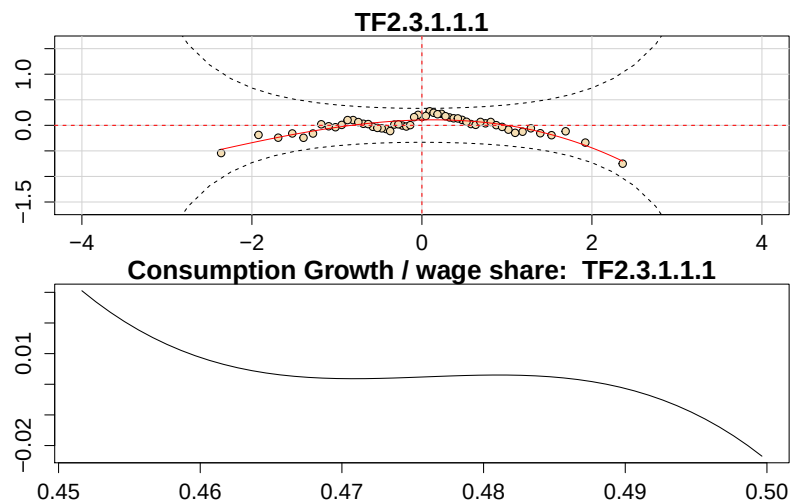


Figure 3: Consumption function 3rd degree polynomial

¹³Choosing a candidate function via the worm plots is clearly a subjective task.

A.2.2 Investment

The real investment function we are looking to estimate is:

$$\frac{\dot{I}}{I} = a_1\pi_{ef} + a_2\pi_{ef}^2 + a_3\pi_{ef}^3 + a_4\pi_{ef}^4 + b + e$$

Following the same investigative approach as for the consumption function, we start with the first of 13 possible functions, sorted by AIC. Figure 4 shows the 2nd degree polynomial with t family errors. The worm plot only has outliers in the extremes, but the estimated function is downward sloping around the likely starting point for the expected firm profit share: 48.57%.¹⁴ Intuitively this is not a desirable outcome and we can rule this candidate out.

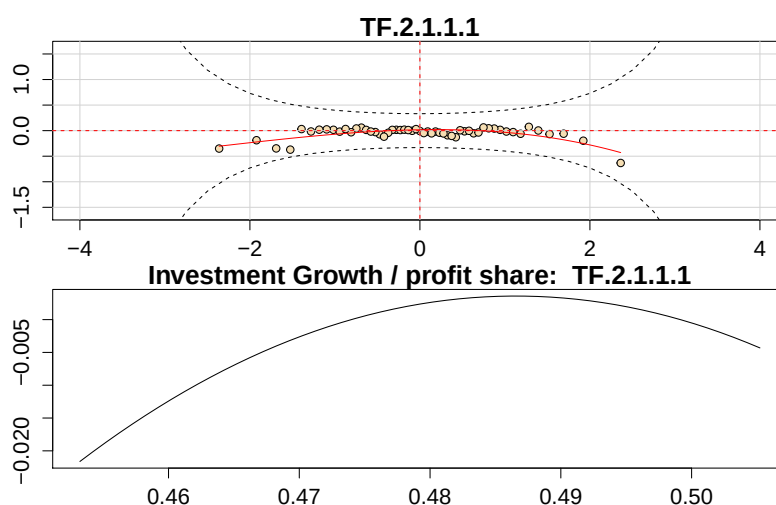


Figure 4: Investment function 2nd degree polynomial

This leads us to the second candidate, a 3rd degree polynomial with t family error distribution. The worm plot in Figure 5 is slightly more spread out, but within the norms. The shape of the estimated function seems very suitable for a growing economy with inflation. The function is mostly upward sloping, with an exception for values just below the starting point. Having in mind positive inflation, which necessitates a wage share growth, we will see downward pressure on expected firm profits. This would lead to stable or slightly rising growth rates in the short term.

Lastly there is one more candidate, which is quite simple and intuitive. Figure 6 shows a first degree polynomial with normal error distribution. The estimated function is upward sloping and therefore a higher expected profit share would lead to a higher investment growth rate. Here, we can exclude this option because the worm plot shows outliers out of bounds.

Finally, we choose the 3rd degree polynomial with t family error distribution.

¹⁴The actual starting point can be marginally off, because interest payments are not automatically calibrated so as to continue the historical time series.

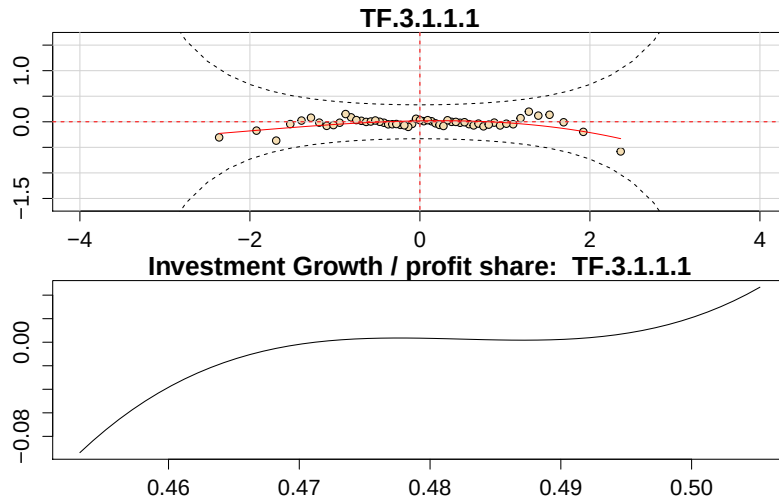


Figure 5: Investment function 3rd degree polynomial

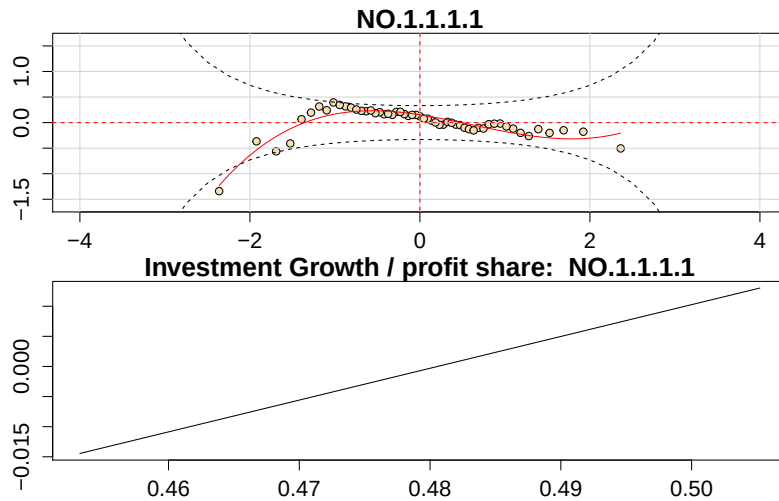


Figure 6: Investment function 1st degree polynomial

A.2.3 Wages

The real wage per person function estimated takes the form of:

$$\frac{\dot{w}}{w} = a_1\tilde{\lambda} + a_2\tilde{\lambda}^2 + a_3\tilde{\lambda}^3 + a_4\tilde{\lambda}^4 + b + e$$

Among the 13 candidates the highest ranked by AIC is a 3rd degree polynomial with normal error distribution. Figure 7 shows that the worm plot has outliers but still within the limits. The estimated function takes a counterintuitive form. Higher unemployment can lead to rising wage growth rates.

This brings us to the second candidate, featuring a 1st degree polynomial and normal error distribution. The worm plot in Figure 8 shows outliers which are less severe than for the previous function. Furthermore, the estimated function is intuitive in so far that a higher unemployment leads to lower wage growth. Therefore, we chose this function.

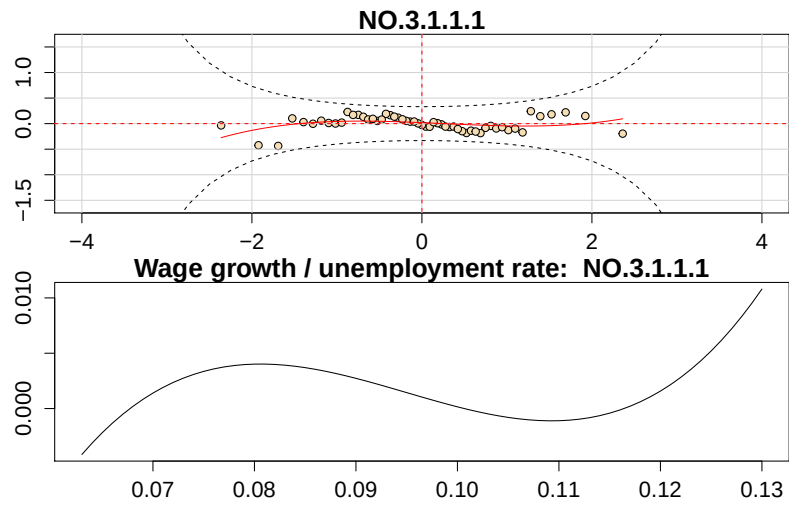


Figure 7: Wage per person function: 3rd degree polynomial

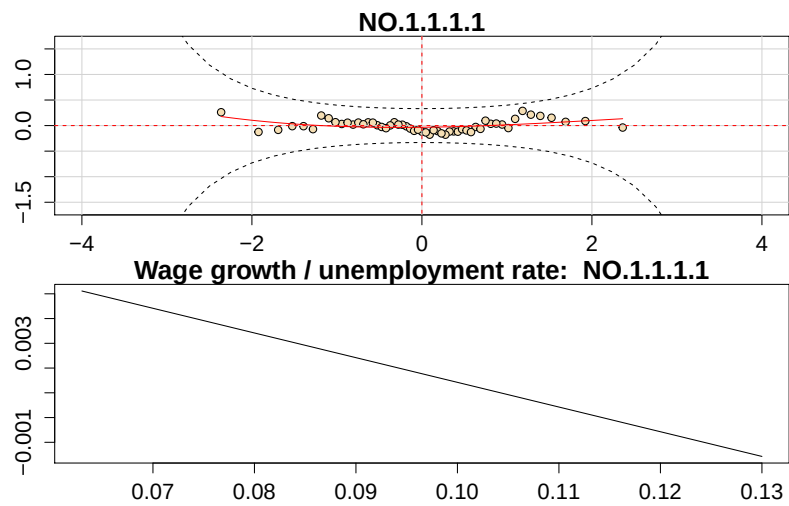


Figure 8: Wage per person function: 1st degree polynomial

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This study seeks to assess the resilience of the banking union framework created in recent year and, in particular, the potential costs that would be induced by different banking shocks, under various scenarios regarding the implementation of the Banking Union's resolution pillar.

Based on a non-linear dynamic model, the potential costs to the euro area economy of a medium-sized financial shock are estimated at a cumulated loss of 1 trillion euro in GDP (approximately -9.4% of the 2016 forecast GDP), job losses amounting to 1.71 million and an increase in public debt of 51.4 billion euro in 2016.

The most effective remedy would be to increase the banking sectors' equity ratio to 9% or more and to lower dividends, on the basis of the simulations in the model. This would make the economy more shock-resistant in the medium term. At the same time, the cost of implementing this increased equity ratio would be offset by the reduction in losses caused by a financial shock. In addition, an augmented Single Resolution Fund with more timely implementation would reduce the cost of a new crash, but would be insufficient to prevent turmoil in the euro area economy.

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