

THE NATIONAL SEGMENTATION OF EURO AREA BANK BALANCE SHEETS DURING THE CRISIS

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Abstract: This paper analyses balance sheet data for the aggregate euro area banking sector, in conjunction with macroeconomic variables. Our aim is to understand the nature of the instability in financial intermediation over the recent crises. We define “large changes” as significant departures of actual balance sheet variables’ dynamics during the crisis from their historical association with the business cycle. In the course of the global 2008-09 financial crisis, “large changes” were related to cross-border inter-bank flows, both within the euro area and between the euro area and the rest of the world; retail assets and liabilities and also interbank flows among banks from the same country were remarkably stable in their relation with the business-cycle. Since the euro area sovereign crisis, “large changes” have been more pervasive reflecting, in particular, the emergence of a home bias also in the sovereign bond market.

Keywords: Bank balance sheets, non-standard monetary policy, central banks.

JEL codes: E42, E58, F33, F42.

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1. Introduction

The recent crisis had profound implications for the financial system and the wider macroeconomy. In the euro area, in particular, the crisis led to persistent market fragmentation which has been associated with a perceived risk of the survival of the euro. In this paper, we study the evolution of the banking sector balance sheet since 2008. Our focus on banks is motivated by the fact that they represent the most important channels for financial flows in the euro area. For example, roughly three-quarters of external financing for the non-financial corporate sector is intermediated by banks in the euro area, with the remaining quarter provided through securities markets. To draw a comparison, in the United States these proportions are reversed.

We employ a detailed dataset derived from the aggregate balance sheet of the euro area credit institutions. Using the aggregate balance sheet allows us to explore the behaviour of interbank transactions (which are netted out in the consolidated presentation underlying the construction of monetary aggregates and counterparts), as well as transactions with other wholesale and retail counterparties, governments and central banks. This sectoral dimension of the data is complemented by a geographic distinction by residency of the transacting counterparty, where we distinguish domestic, other intra euro area, and extra euro area counterparties.

The latter distinction is not only important in developing a richer description and understanding of the nature of market fragmentation. It also offers important insight for policy design, both in the immediate crisis management phase and subsequently when seeking long-term fundamental solutions. For example, by acting as an “intermediary of last resort” in the manner described by Giannone et al. (2012), the ECB can substitute intermediation across its own balance sheet for cross-border intra euro area bank transactions, via the creation of the notorious intra-Eurosystem TARGET 2 balances between national central banks. But such central bank intermediation cannot substitute for bank transactions with extra euro area counterparties, since the latter do not have direct access to the ECB’s operations and facilities. By implication, the ECB’s balance sheet policies are better able to address tensions in intra euro area markets than tensions in markets that straddle the borders of the euro area.

The literature on the home bias and financial sector fragmentation during the crisis is by now quite rich and we discuss it in the next section. Our approach differs from other studies because we study the joint behaviour of the euro area banking sector (as represented by asset and liability items of its

aggregate balance sheet) and the macroeconomy. The driving idea of our paper is that changes in banks' balance sheet are partly the results of changes in general economic conditions (the business cycle) and partly constitute permanent or persistent changes related to financial stress. The latter are changes which can be defined as “abnormal” with respect to historical regular cyclical behaviour.

In order to identify “abnormal” changes, we estimate a model with balance sheet variables and macro indicators and perform a counterfactual exercise. Our model is a large VAR, estimated by means of Bayesian techniques, in order to cope with the large dimension of our macro/balance sheet model, as suggested by De Mol et al. (2006) and Banbura et al. (2010). We define the “normal” by computing predictions for different items of the balance sheet of a representative bank in the euro area by conditioning on the historical (pre-crisis) correlations and the observed realization of macroeconomic variables during the crisis. Predictions are computed by modelling balance sheet data in concert with macroeconomic variables describing aggregate price and output dynamics. Our findings can be summarized as follows.

First, we show that the stress in the euro area interbank market following the failure of Lehman has been almost entirely driven by a seizing up of transactions with non-domestic wholesale counterparties, in particular banks in other euro area countries. Surprisingly, domestic interbank transactions have been much more resilient. Money market tensions from 2008 are therefore better understood as a consequence of financial dis-integration / cross-border fragmentation within monetary union, rather than just a generalised breakdown in interbank trading. Fortunately for the stability of the financial system and economy as a whole, the ECB's policy actions – as reflected in the emergence of TARGET 2 balances between euro area national central banks – permitted financial transactions that had taken place in integrated private markets to relocate to central bank intermediaries.

Second, credit flows to the private sector were largely insulated from interbank tensions in the first phase of the financial crisis (i.e. in the immediate aftermath of Lehman's failure in September 2008) – a result that we have previously interpreted as signalling the success of the ECB's initial policy response (Lenza et al., 2011) – while, in the second phase of the crisis (from 2011 onwards, as disruptions in the Euro area markets intensified, with sovereign dislocations becoming more central), the flow of loans to the real economy was disrupted. Since 2011, bank loans to households and non-financial corporations have been significantly weaker than the benchmark we establish on the basis of pre-crisis historical regularities.

Third, our richer balance sheet data set allows us to show that banks built-up unusually large holdings of sovereign debt during this second crisis phase, possibly reflecting substitution away from loans to the private sector. Overwhelmingly, this build-up reflected an accumulation of domestic sovereign debt. The deepening of banks' home bias in the sovereign bond market is therefore characteristic of a second wave of financial dis-integration / market fragmentation from early 2011 onwards. This second wave lay behind the emergence of a “diabolic loop” between bank and sovereign balance sheets.

The remainder of the paper is organised as follows. In section 2, we survey the related literature and we frame our contribution in the debate on the adjustment of financial intermediation to financial crises in a monetary union. In section 3, we illustrate the design of the analysis and the related econometric methodology. Section 4 presents the results and section 5 provides a discussion of the results and their implications. A detailed illustration of the data and their transformation is presented in the annex.

2. Related literature

The literature on financial crises in emerging markets has documented how, as a crisis takes hold, a “sudden stop” of capital inflows can lead to a decrease in international financial integration (see Calvo and Reinhart, 2000; McKinnon and Pill, 1997,1998; and Caballero, 2009). The 2008 financial crisis – the first since the start of the European monetary union in 1999 – gives us the opportunity to understand whether such flight from financial integration also affects a union of countries sharing the same currency.

Indeed, many have observed that the segmentation of financial markets along national lines has been one of the most important causes and consequences of the recent euro area crisis. It is important to understand whether this phenomenon is sufficiently sizeable to suggest a specific fragility of the single currency in facing crises and what are the segments of the market being affected. Clearly, the crisis has affected banks' funding and loans in general, but to what extent does this reflect a retreat from financial integration rather than a generic collapse of credit and liquidity?

For this reason, our analysis is based on balance sheet data of euro area banks at a high level of breakdown which, among other things, allow us to distinguish among banks' domestic counterparties, counterparties in other euro area countries and counterparties outside the euro area

countries when analysing banks' transactions. They also allow us to distinguish among retail transactions, wholesale transactions (i.e. inter-bank transactions and transactions vis-à-vis financial intermediaries other than banks) and transactions in sovereign instruments. Notwithstanding the introduction of the common currency back in 1999, the retail banking market in the euro area has remained segmented (Hartman et al., 2003). By contrast, at least before the crisis, the wholesale market had reached a very high level of integration. The sovereign market was also on a trend of increasing integration since the introduction of the euro at least until the onset of financial crisis (Reichlin, 2014).

The inter-bank market plays an important role in the euro area financial system. Traditionally, banks have served the function of intermediating financial flows from savers to investors. With financial innovation, intermediation has become more convoluted, a process that accelerated as the pace of bank credit expansion picked up in 2004-07. Using U.S. flow of funds data Adrian and Shin (2010a,b) demonstrate how intra-financial sector leverage built up over that period. Focusing on the balance sheets of U.S. broker/dealers (investment banks), they show how the low level of short-term interest rates and relatively steep yield curve, in an environment where volatility was perceived as low, encouraged banks to lend to one another so as to extract some of the 'carry' available along the yield curve. Much of this financing took the form of repos of securitised assets (Gorton and Metrick, 2009). In particular, the build-up of intra-banking sector leverage was associated with the creation of longer intermediation chains, i.e. the flow of resources from non-bank savers to non-bank borrowers passed through an increasing number of banks (for a stylised representation, see Figure 1).

INSERT FIGURE 1 HERE

Much the same story can be applied to the euro area, with the important caveat that the structure of the European banking sector – in particular, the predominance of universal banks, which combine the activities of U.S. commercial and investment banks within a single entity – implied that the build-up of intra-financial sector leverage and lengthening of intermediation chains were phenomena that affected the banking sector more broadly. This process has been documented by Altunbas et al. (2009) and Carbó-Valverde et al. (2012), among others. In Europe, the rapid expansion of bank credit in the middle of the 2000s was thus associated with increasing reliance on wholesale sources of funding. And, with deepening financial integration inside the European Union and the wider process of financial globalisation beyond, these wholesale flows were often cross-border (both within the

euro area and between the euro area and other jurisdictions, notably London given its status as an international financial centre).¹

Bank funding thus became less stable in the face of financial and real shocks. Retail deposit holders (households and non-financial corporations) could be relied upon to maintain a steady level of funding to support the financing of bank loans through the business cycle. But wholesale funding from other banks, from the rest of the financial sector (notably shadow banks) and from overseas tended to be more flighty, imparting a pro-cyclical bias to the expansion of financial intermediation (see Shin and Shin, 2011). Moreover, the accumulation of intra-financial sector leverage created systemic vulnerability: if one institution chooses to shrink its balance sheet, the resulting withdrawal of wholesale funding puts pressure on others to do likewise (and so on). A self-sustaining spiral of forced deleveraging could ensue (Brunnermeier and Pedersen, 2009).

In the euro area, prior to the crisis, the inter-bank market accounted for about 50% of banks' funding. If, as a consequence of counterparty risk induced by a banking crisis, inter-bank transactions dry up, the impact on the financial system is potentially massive. However, in the euro area – and as long as the transactions are denominated in euro – the Eurosystem can act as an intermediary of last resort. Writing about the robustness of the euro area to financial stresses about five years before the crisis erupted, Tommaso Padoa Schioppa – one of the first members of the ECB's Executive Board – labelled this the “market operation approach” to the lender of last resort function (Padoa Schioppa, 2003).

In large part, the non-standard policies implemented by the ECB since 2009 represent an attempt to use the central bank as a de facto central counterparty for wholesale financial transactions. By so doing, the ECB replaces the frozen private interbank market, ensures that the flow of resources from private sector savers to borrowers is maintained, and thereby sustains the necessary flow of credit to the real economy. Through these means, the central bank is able to ensure that disruptions to real economic activity caused by a ‘sudden stop’ (Calvo and Reinhart, 2000; Caballero, 2009) in financial flows are minimised.

¹ See Forster et al. (2011).

As all banks within the euro area have access to its facilities, the Eurosystem can expand its balance sheet without limit so as to substitute central bank intermediation for intra-euro area bank-to-bank transactions when financial markets seize up. In this regard, there is little distinction between domestic transactions and non-resident intra-euro area transactions. Indeed, the only difference will be in the impact of such policy actions on inter-national central bank (NCB) positions within the euro area – the so-called TARGET 2 balances. Since banks resident outside the euro area do not have access to the Eurosystem’s facilities, the Eurosystem’s balance sheet cannot be used to substitute for bank transactions with extra-euro area counterparties. This is particularly the case for transactions in other currencies. The Eurosystem is the ultimate creator of euro liquidity, but it cannot create dollars or sterling so as to provide funding in those currencies to euro area banks should their market sources of foreign currency financing dry up.

Let us now turn to the sovereign market. In any jurisdiction the sovereign market plays a key role because sovereign bonds, being liquid and “safe”, are a good source of collateral. For this reason, holding of sovereign bonds is typically counter-cyclical (Reichlin, 2014). Before the crisis the average holding of non-domestic sovereign in euro area MFI was about 50% of their total sovereign holding.

Before 2010, the markets considered a sovereign default within the euro as a very unlikely event and priced sovereign bonds essentially equally across countries, irrespective of differences in their fiscal positions. This perception changed dramatically with the onset of the Greek sovereign crisis in 2010. Since then, not only has the market started to differentiate among countries, at some point it also started to price the possibility of a break-up of euro area or exit of specific countries (introducing so-called redenomination or convertibility risk).²

The reaction to the advent of such risk was an emergence of a strong home bias in sovereign debt holdings. With fear of contagion and the emergence of redenomination risk, the liquidity and safety properties of sovereign bonds in some jurisdictions have disappeared. However, rather than a flight to safer German bonds, banks have opted for their own domestic bonds (Angelini et al., 2014; Battistini et al., 2013; Garicano and Reichlin, 2014), leading to a rising correlation between bank and sovereign risk. Whatever the underlying behaviour, the resulting increased correlation of bank and

² See ECB (2014) for an extensive discussion and survey of the literature on the determinants of sovereign bond yields before and after the sovereign debt crisis.

sovereign risk – an intensification of the “diabolical loop” mentioned above – is another important aspect of the vulnerability of a monetary union to financial crises.

The key implication of the preceding discussion is that understanding and measuring the quantitative importance of home bias in the inter-bank market and the sovereign market and how this changes through time in the course of the crisis is central to analysing the nature of the adjustment in monetary union and, ultimately, to designing appropriate policies tools to meet potential future crises.

3. Data and econometric methodology

3.1 The database

Our analysis exploits data on the aggregate balance sheet of euro area Monetary Financial Institutions (MFI), excluding the Eurosystem. Balance sheet variables are aggregated in such a way as to be able to distinguish assets and liabilities by instrument, sector and area of residency of the counterparties. In terms of area of residency, a distinction is made, when relevant, between domestic and non-resident counterparties, with a further split between intra-euro area and extra-euro area. Intra-euro area positions are then broken down between inter-bank, other wholesale (financial corporations other than banks), retail (non-financial corporations and households) and government, as applicable. In order to study the association of these variables with the rest of the economy, we have included in the model macroeconomic indicators for both the euro area the US. For the euro area, we consider industrial production and unemployment, prices for goods and assets and interest rates at different maturities. For the US, we include industrial production, consumer prices and the Federal Funds rate. The variables are all available at the monthly frequency and the sample ranges from January 1999 to October 2015. The annex provides a more comprehensive description of each item considered, as well as detailed information about data sources and data adjustments.

3.2 The design of the empirical exercise

The aim of our quantitative exercise is to identify those changes in balance sheet’s behaviour since 2008 which are larger in size than what could have been expected given the historical association of the bank balance sheets with the macroeconomic variables. In other words, “large” for us is a change which goes beyond what could be rationalised by the macroeconomic dynamics observed in the great

recession and subsequent sovereign debt crisis and that, therefore, signals an exceptional disruption in financial markets leading to exceptional changes in banks' behaviour. To give a precise meaning to the concept of "large change", we use the pre-crisis part of the sample as a "benchmark" against which we compare the more recent behaviour during the financial crises.

Precisely, we compare the observed path of key bank balance sheet items with predictions based on a dynamic model of the joint behaviour of bank balance sheet and macroeconomic variables in the pre-crisis sample. In constructing the predictions we condition on: (1) the economic relationships prevailing before the Lehman collapse (reflected in the model parameters estimated using the data until August 2008); (2) the pre-crisis history of all variables; and (3) the observed outcomes of the subset of variables representing the macroeconomic environment until the end of the sample (i.e. using as conditioning assumptions macro variables in our data set; these capture real economic conditions, short term interest rates and consumer and production price inflation in both the euro area and the U.S.).

If the observed path of bank balance sheet variables since Lehman's failure lies out of the forecast distributions, the observed developments in the banking sector during the financial crisis are difficult to reconcile with those in the rest of the economy. Potentially, this may be due to structural changes in the financial sector brought about by the crisis. On the contrary, the finding of no significant change is evidence that, although larger in size, the shocks that have affected the economy in the last four years are similar in nature to those that have driven the economy in the preceding ten years. Moreover, the transmission of these shocks has not changed substantially. In other words, if the observed and simulated paths are similar, we interpret this as evidence that the relative importance of real and financial shocks has remained the same through the financial crisis, at least once one has conditioned on policies and, in particular, on the introduction of non-standard monetary policy measures by the ECB.

It is important to notice that, since banks' balance sheets and macroeconomic developments are jointly determined in general equilibrium, the conditional predictions should not be interpreted as solely driven by the macroeconomic shocks but also by those financial shocks that significantly influenced macroeconomic conditions. By conditioning on real economy variables, we ensure that we capture the size of the shocks that would have caused the recent recession, if it were due to the shocks that have typically generated recessions in the euro area. For example, if credit shocks were traditionally associated to a recession, we would be implicitly conditioning on credit shocks

developments from September 2008 onward in order to assess whether such variables have behaved in line with the historical regularities.

As a caveat, it should be stressed that, since our “normal” is based on predictions of a model estimated using only pre-crisis data, uncertainty can be substantial, especially for longer horizons. As a consequence, we will not be able to detect all the abnormal dynamics, but only the very “large” differences between the actual data and the counterfactual.

3.3 The econometric model

Using the data set described in sub-section 3.1 and in the annex, we estimate an empirical model of the euro area economy. Let X_t be the vector including the n variables (all variables are in log-levels, except for variables expressed in rates that are in levels). In particular, we estimate a VAR model with p (=13) lags:

$$X_t = A_0 + A_1 X_{t-1} + A_2 X_{t-2} + \dots + A_p X_{t-p} + e_t$$

where e_t is a normally distributed multivariate white noise with covariance matrix Σ .

The large dimension ($n=34$ and $p=13$) of our VAR model implies that we face an issue of overfitting due to the large number of parameters (“curse of dimensionality”). We address this issue by shrinking the model’s coefficients toward those of the naïve and parsimonious random walk with drift model, $X_{it} = \delta_i + X_{i,t-1} + e_{it}$. De Mol et al. (2008) and Banbura et al. (2010) have shown that this approach reduces estimation uncertainty without introducing substantial bias, hence providing a parsimonious but reliable estimate of the complex dynamic interactions among the macro, monetary and financial variables included in the data set. This is achieved thanks to the tendency for economic time series to co-move over the business cycle, which creates scope for the data to point “massively” in the same direction against a naïve prior model that does not allow for any dynamic interaction.

Inference is based on the framework developed by Giannone et al. (2015). More in details, for Σ , the covariance matrix of the residuals, we specify an Inverse Wishart with scale parameter given by a diagonal matrix. The degrees of freedom are set to $d = (n+2)$, the minimum number that guarantees the existence of the prior mean of Σ , which is equal to $\Psi/(d-n-1) = \Psi$. Conditional on the covariance matrix of the innovations, we specify a Gaussian prior for the constant A_0 and the autoregressive coefficients $(A_1 \dots A_p)$ which is centered on the Random Walk with drift model.

Precisely, we specify a flat prior for the constant term, while for the autoregressive coefficients we postulate two priors: the Minnesota and the sum-of-coefficients priors originally proposed by Litterman (1979) and Doan et al. (1984) respectively. For the Minnesota prior, the means and variances are defined as follows:

$$\begin{aligned}
 & - E[(A_1)] = I_n, \text{ while } E[(A_2)] = \dots = E[(A_p)] = \mathbf{0}_{n,n} \\
 & - \text{Cov}[(A_s)_{ij}, (A_r)_{hm}] = \lambda^2 \Sigma_{ih} / (s^2 \Psi) \text{ if } m = j \text{ and } r = s, \text{ zero otherwise.}
 \end{aligned}$$

The factor $1/s^2$ is the rate at which the prior variance decreases with increasing lag length, capturing the prior belief that dependence is less strong for longer lags. The ratio Σ_{ij}/Ψ_{ii} accounts for the different scale and variability of the data. Finally, the key hyperparameter is λ , which controls the scale of all the prior variances and covariances, and effectively determines the overall tightness of this prior. For $\lambda = 0$ the posterior equals the prior and the data do not influence the estimates. If $\lambda \rightarrow \infty$, on the other hand, posterior expectations coincide with the OLS estimates. In order to understand the intuition underlying the “sum-of-coefficient prior”, it is useful to rewrite the VAR equation in error correction form:

$$\Delta X_t = A_0 - (I_n - A_1 - \dots - A_p) Y_{t-1} + B_1 \Delta Y_{t-1} + \dots + B_{p-1} \Delta Y_{t-p+1} + e_t$$

The prior for $\Pi = (I_n - A_1 - \dots - A_p)$ is centered around zero and can be easily implemented using dummy observations. The tightness of this additional prior is controlled by the hyperparameter μ . As μ goes to infinity the prior becomes flat. If, instead, μ goes to 0, the prior becomes dogmatic and we approach the case of a model with data transformed in differences, which implies the presence of a unit root in each equation. Intermediate cases imply a sort of “inexact differencing”.

Summing up, the setting of these priors depends on the hyperparameters λ , μ and ψ , which reflect the informativeness of the prior distribution for the model’s coefficients. These parameters have been usually set on the basis of subjective considerations or rules of thumb. We instead follow the theoretically grounded approach proposed by Giannone et al. (2015). This involves treating the coefficients of the prior as additional parameters, in the spirit of hierarchical modelling. As hyper priors we use proper but

almost flat distributions.³

The counterfactual exercise described in broad terms in sub-section 3.2, is performed as follows. We simulate the model's parameters from their full posterior density, accounting also for the estimation uncertainty of the hyper-parameters controlling the prior tightness. This approach is implemented using a simple Markov chain Monte Carlo algorithm. In particular, we use a Metropolis step to draw the low dimensional vector of hyperparameters. Conditional on a value of the hyperparameters, the VAR coefficients can then be drawn from their posterior, which is Normal- Inverse-Wishart.⁴ Since we are interested in conditioning on the economic relationships prevailing before the Lehman collapse, the posterior is computed using the data until August 2008.

For any given draw of the model's parameters from their posterior density, the draws from the counterfactual exercise are computed as conditional forecasts in which the conditioning information is given by: (1) the pre-crisis history of all variables in the model; (2) the macroeconomic developments observed during the crisis; and (3) the observed outcomes of the subset of variables representing the macroeconomic environment until the end of the sample in October 2015. The conditional forecasts are obtained using the algorithm developed in Banbura et al. (2015). The procedure exploits the fact that the Vector Autoregressive model can be cast in a state-space form. Hence, the conditional forecasts can be drawn using a simulation smoother.⁵

4. Results

Table 1 reports the results of our exercise. We focus on a few important dates in our sample. As a reference, we provide a picture of our stylised bank balance sheet in 1999 (average levels over the year, in terms of euro billions), the outset of monetary union and the beginning of our sample. We then show the data for the crisis years (2008 – 2015, average levels over the years, in terms of euro billions), which is the sample over which the empirical exercise is carried out. At the bottom of each cell, in parenthesis, the table reports the 2.5% and 97.5% percentiles of the counterfactual forecast distributions. Any development of the variables outside those percentiles is identified as being 'unlikely' given the historical

³ As hyperpriors for λ , μ we choose Gamma densities with mode equal to 0.2, 1 and standard deviations equal to 0.4, 1 respectively. Our prior on ψ , i.e. the prior mean of the main diagonal of Σ , is an Inverse- Gamma with scale and shape equal to $(0.02)^2$.

⁴ See Giannone et al. (2015) for the details of the MCMC algorithm.

⁵ In this paper, we use the simulation smoother described in Carter and Kohn (1994).

regularities estimated in the pre-crisis sample and, hence, it could reflect relevant changes in the nature of financial intermediation. For the sake of easy reading, we mark the observed figures in red when they turn out to be lower than the 2.5% percentile of the conditional forecast distribution and in blue if, instead, they turn out to be higher than the 97.5% percentile of the conditional forecast distribution. The figures 2 and 3 capture the same results in graphical form.

INSERT HERE TABLE 1 and FIGURES 2 and 3

Starting from the liability side, the first striking element is the resilience of retail deposits. None of the two crises seems to have been characterized by a run on bank deposits. The stress in bank funding is revealed by the collapse of debt financing and, as many have observed (e.g. Heider et al., 2009), that of the inter-bank market. The latter, however, is mainly driven by cross-border activity, while the domestic inter-bank flows have remained relatively resilient. This result is in line with what found on the basis of balance sheet aggregate data in Cassola et al. (2010), who show that the decline in transactions volume is mostly due to cross-border activity, and on the basis of micro data analysed by Abbassi et al. (2013). However, remarkably, both the intra and extra euro area inter-bank deposits are declining unusually. Financial integration within the euro has revealed to be as fragile as the global integration.

One issue is to what extent transactions within banking groups influence these results. Data distinguishing intra-group inter-bank positions are available in the same dataset used in this paper only since July 2014 and are thus not used in our model, as they do not cover the key crisis period discussed here. Moreover, these data do not distinguish between positions among banks of the same group within one country and transactions between banks within the same group that take place across euro area borders (i.e. between domestic and intra-euro area non-resident transactions). Data shows that intra-group positions account for about 50% of inter-bank positions in the euro area and have remained rather stable since July 2014. If we take the view that intra-group transactions are less affected by the breakdown of financial integration within the euro area, the implication is that transactions between unrelated institutions were even more adversely affected than what can be argued by looking at our data.

Another apparent trend is that (especially in the immediate aftermath of Lehman's failure) the reliance on the Eurosystem as a source of funding increased. This is consistent with our view that central bank intermediation substituted for the decline in interbank market activity. The ECB balance sheet was able to step in as intermediary of last resort at a cost, however, of large TARGET 2 balances.

The response of asset holdings to the crisis was initially more muted than what seen on the funding side.

The exception to this is in the MFIs loans to non-resident intra- and extra-euro area bank counterparties, but this is simply the other side of the collapse in cross-border interbank transactions. The level of retail loans turns out to decrease under the 2.5% percentile only in 2011, when the sovereign crisis hit the euro area. The unusual collapse of the loan-to-deposit ratio or of the ratio of loans to M3 is a characteristic of the recession experienced during the euro area sovereign crisis. Reichlin (2014) interprets this fact as a signal of the declining effectiveness of ECB liquidity policies to sustain credit to the real economy.

The other striking characteristic on the asset side is the unusual increase of domestic government bonds holding and the decrease of the non-resident component. The motivations behind the strengthening of such home bias are the subject of ongoing debate (Acharya and Steffen, 2015). On the one hand, the ‘risk-shifting’ view sees banks buying the sovereign debt of the country where they are resident on the basis that the correlation of bank and sovereign and bank risk within a single country is anyway so high that a sovereign default would cause the bank to fail. In that context, buying high yielding domestic bonds is a form of ‘gambling on resurrection’: if there is a sovereign default, the bank would anyway fail, but in the absence of a default, the carry yield on the sovereign would pay. On the other hand, the “moral suasion” view sees banks buying domestic sovereign debt under pressure from their own regulators (who at the time of the sovereign and banking crisis in 2011/12 were still national rather than pan-Euro area institutions) at a time when other investors are running on sovereign debt. This represents a form of financial repression, as banks during the crisis are inevitably vulnerable to such regulatory pressures (Becker and Ivashina, 2014).

Taken together, the developments described above reflect how the fragmentation of euro area interbank markets along national lines following the failure of Lehman extended to a fragmentation of government debt markets once the sovereign crisis took root. The response of the banks to these events intensified the vicious interaction between bank and sovereign balance sheets. The consequence of risk aversion is a strong home bias within the currency union, a potential weakness of the euro area financial system. This dynamics obviously affects those segments of the markets which, with the establishment of the euro, had become more integrated: the inter-bank and the sovereign market.

Interestingly, the fragmentation of the inter-bank market along national lines was the consequence of the global recession of 2008 while that of the sovereign market developed later, as a consequence of the euro area specific recession associated to the sovereign debt problem. The 2008 crisis exposed countries to a powerful “sudden stop” reminiscent of emerging market crises even if, in the case of the euro, most of these transactions are in the local currency. The second crisis, on the other hand, caused a crisis of

confidence in the single currency itself (the so-called “redenomination risk”) which induced banks to invest in their own sovereigns.

The ECB was successful in facing the first wave of nationalization which affected the inter-bank market by replacing, via TARGET2, euro area non-domestic transaction and managed in this way to support retail lending activity (see Peersman, 2011 and Giannone et al. 2012, for a quantitative assessment on this point). The second wave of nationalization, affecting the sovereign market, being linked to a crisis of confidence in the currency itself, was harder to fight with the tools available at the time. Although sovereign spreads markedly decreased after the announcement in 2012 that the central bank was ready to implement Outright Monetary Transactions (OMT), the home bias in the sovereign market has persisted and so has the correlation of risk between banks and sovereign. In this situation, loans collapsed more than what would have been expected given cyclical conditions. Facing this problem would require the full implementation of a banking union and the institution of a resolution mechanism for debt crises.

5. Discussion and conclusions

An important message of our paper is to emphasise that the European experience of the financial crisis has two distinct phases, which coincide with the timing of the “double dip” recessions in economic activity. This contrasts with the experience in other areas, such as the United States or the United Kingdom. Financial fragmentation is central to both phases, but takes different forms. The initial sudden stop following the failure of Lehman was associated with bank wholesale liabilities becoming overwhelmingly domestic, as cross-border wholesale transactions dried up. But it was only in the second sovereign phase of the crisis from late 2010 – at which point governments were (in some cases) called upon to support banks while domestic banks increased their holdings of domestic sovereign debt as foreign investors withdrew – that a more vicious interaction between bank and sovereign balance sheets emerged.

From the policy perspective, the distinction between these two phases of the crisis begs an important question. Liquidity and bank funding measures taken to address the first phase may have enabled bank behaviour – notably an accumulation of domestic sovereign debt – that, through exacerbating the “diabolic loop”, deepened the second phase. Of course, that is not to say these measures should not have been implemented: without them, a catastrophic financial collapse threatened immediately post-Lehman. But the experience demonstrates that crisis measures, although necessary, need to be complemented by longer-term structural efforts to deal with the underlying problems. Arguably it

was the failure to use the time bought by the ECB's post-Lehman crisis response to implement deeper regulatory and governance reforms in the euro area (in general, and in the European banking system in particular) that laid the basis for the second phase of the crisis.

References

- Abbassi, P., F. Fecht, and P. Weber (2013). "How stressed are banks in the interbank market?," Deutsche Bundesbank discussion paper no. 40/2013.
- Acharya, V.V. and S. Steffen (2015). "The greatest carry trade ever? Understanding Eurozone bank risks," *Journal of Financial Intermediation* 115, pp. 215-236.
- Adrian, T. and H-S. Shin (2010a). "Financial intermediaries and monetary economics," in B.M. Friedman and M. Woodford (eds.) *Handbook of Monetary Economics* 3(12), pp. 601-650 (Elsevier).
- Adrian, T. and H-S. Shin (2010b). "Liquidity and leverage," *Journal of Financial Intermediation* 19(3), pp. 418-437.
- Altunbas Y., L. Gambacorta and D. Marqués-Ibáñez (2009). "Securitisation and the bank lending channel," *European Economic Review* 53(8), pp. 996-1009.
- Angelini, P., G. Grande and F. Panetta (2014). "The negative feedback loop between banks and sovereigns," Banca d'Italia occasional paper no. 213.
- Banbura, M., D. Giannone and M. Lenza (2015). "Conditional Forecasts and Scenario Analysis with Vector Autoregressions for Large Cross-Sections," *International Journal of Forecasting* 31(3).
- Banbura, M., D. Giannone and L. Reichlin (2010). "Large Bayesian VARs," *Journal of Applied Econometrics* 25, pp. 71-92.
- Battistini, N., Pagano, M., and S. Simonelli (2013). "Systemic risk, sovereign yields and bank exposures in the euro crisis," CSEF University of Naples.
- Becker, B. and V. Ivashina (2014). "Financial repression in the European sovereign debt crisis," Swedish House of Finance research paper no. 14-13.
- Brunnermeier, M.K. and L.H. Pedersen (2009). "Market liquidity and funding liquidity," *Review of Financial Studies* 22(6), pp. 2201-2238.
- Caballero, R.J. (2009) "Sudden financial arrest," IMF Mundell-Flemming lecture, MIT Department of Economics working paper no. 09-29.
- Calvo, G.A. and C. Reinhart (2000). "When capital inflows come to a sudden stop: Consequences and policy options" in P. Kenen and A. Swoboda (eds.) *Reforming the international monetary and financial system*, Washington, DC: International Monetary Fund, pp. 214-265.
- Carbó-Valverde, S., D. Marques-Ibanez and F. Rodríguez-Fernández (2012). "Securitization, credit growth and financial instability: The case of Spain." *Journal of International Money and Finance*, Journal 31, pp. 80-101.
- Carter, C. K. and R. Kohn (1994). "On Gibbs sampling for state-space models," *Biometrika* 81, pp. 541-553.
- Colangelo, A. and M. Lenza (2012), "Cross-border banking transactions in the euro area", *IFC Bulletin* 36.
- De Mol, C., Giannone, D. and L. Reichlin (2008). "Forecasting using a large number of predictors: Is Bayesian shrinkage a valid alternative to principal components?," *Journal of Econometrics*, Elsevier, vol. 146(2), pages 318-328, October.
- Doan, T., R. Litterman, and C. A. Sims (1984). "Forecasting and conditional projection using realistic prior distributions," *Econometric Reviews* 3, pp. 1-100.
- ECB (2014). "The determinants of euro area sovereign bond yield spreads during the crisis". Monthly Bulletin Article, May 2014 (pp. 67-83).
- ECB (2007), Monetary financial institutions and markets statistics sector manual, ECB: Frankfurt, see <http://www.ecb.europa.eu/pub/pdf/other/mfimarketstatisticssectormannual200703en.pdf>
- Forster, K., M. Vasardani and M. Ca'Zorzi (2011). "Euro area cross-border financial flows and the global financial crisis," ECB occasional paper no. 126.
- Garicano, L. and L. Reichlin (2014). "A safe asset for Eurozone QE: A proposal," <http://www.voxeu.org/article/safe-asset-eurozone-qe-proposal>.
- Giannone, D., M. Lenza, H. Pill and L. Reichlin (2012). "The ECB and the interbank market," *Economic Journal* 122, pp. 467-486.

- Giannone, D., M. Lenza and G. Primiceri (2015). "Prior selection for vector autoregressions," *Review of Economics and Statistics* 97(2), pp. 436-451.
- Giannone, D., M. Lenza and L. Reichlin (2012). "Money, Credit, Monetary Policy and the Business Cycle in the Euro Area," Working Papers ECARES ECARES 2012-008, ULB -- Universite Libre de Bruxelles.
- Gorton, G.B. and A. Metrick (2011). "Securitized banking and the run on repo," *Journal of Financial Economics*, forthcoming.
- Hartmann, P., A. Maddaloni and S. Manganelli (2003). "The euro area financial system: structure, integration and policy initiatives," ECB working paper no. 230.
- Heider, F., M. Hoerova and C. Holthausen (2009). "Liquidity hoarding and interbank market spreads: The role of counterparty risk," ECB work paper no. 1126.
- Lenza, M., H. Pill and L. Reichlin (2010). "Monetary policy in exceptional times," *Economic Policy* 62, pp. 295-339.
- Litterman, R. (1979): "Techniques of forecasting using vector autoregressions," Federal Reserve of Minneapolis Working Paper 115.
- McKinnon, R.I. and H. Pill (1997). "Credible economic liberalizations and overborrowing," *American Economic Review* 87(2), pp. 189-193.
- McKinnon, R.I. and H. Pill (1998). "The overborrowing syndrome: Are East Asian economies different?" in R. Glick (ed.) Managing capital flows and exchange rates: Lessons from the Pacific Basin, Cambridge University Press, pp. 322-355.
- Padoa-Schioppa, T. (2003). "Central banks and financial stability: Exploring the land in between," in V. Gaspar, P. Hartmann, O. Sleipjen (eds.) *The transformation of the European financial system* (Frankfurt: European Central Bank), pp. 269-310.
- Peersman, G. (2011). "Macroeconomic effects of unconventional monetary policy in the euro area," CEPR discussion paper no. 8348.
- Reichlin, L. (2014). "Monetary policy and banks in the euro area: The tale of two crises," *Journal of Macroeconomics* 39, pp. 387-400. Shin, H-S. and K. Shin (2011). "Procyclicality and monetary aggregates," NBER working paper no. 16836.
- Shin, H. S. and K. Shin (2011): "Procyclicality and Monetary Aggregates", NBER Working Paper No. 16836.

ANNEX

A.1 Database

Our dataset includes 22 bank balance sheet variables and 12 macroeconomic and financial variables of the euro area. All variables are available at the monthly frequency and the sample ranges from January 1999 to October 2015.

The data on aggregate bank balance sheets

1. *Source data*

The reference source of this paper is the dataset on Monetary Financial Institutions (MFIs) balance sheet statistics compiled by the European Central Bank. This dataset contains monthly information of the balance sheet of MFIs resident in the euro area, that is: the Eurosystem, credit institutions, money market funds and some other institutions that meet the MFI definition.

The statistics are collected and compiled in a fully harmonised manner under Regulation ECB/2013/33 concerning the balance sheet of monetary financial institutions sector.⁶ Data are collected by national central banks (NCBs) from reporting agents resident in their jurisdictions based on the ‘host country’ residency approach and relate to the solo accounts of the institutions. In other words, the focus is not on ‘banks’ but rather on the individual branches and subsidiaries which are operating in euro area countries. NCBs aggregate the data at national level and transmit them to the ECB, which derives the aggregated balance sheet of the euro area MFI sector.

The concepts underlying MFI balance sheet statistics are based on international statistical standards, which guaranty the international comparability of the statistics and ensure a sound methodological background. The data cover asset and liability positions of the MFI balance sheet broken down by instrument categories, with additional information by sector and residency area of the counterpart and original maturity. Statistics are compiled for amounts outstanding at the end of the period and for financial transactions, which measure the flow of financing between MFIs and other sectors and the rest of the world. In particular, on the assets side the reporting scheme covers information on cash, loan and deposit claims, holdings of investment funds shares/units (split between MMF and non-MMF type), debt securities and equity, fixed assets, and remaining assets. On the liabilities side, data are collected for currency in circulation (NCB only), deposit and loan liabilities, MMF shares/unit (MMFs only), debt securities issued, capital and reserves, and remaining liabilities. Breakdowns by sector and residency of the counterpart are collected for asset claims related to loans and holdings of securities, and for deposit liabilities.⁷ The geographical split is required between domestic, other euro area and rest of the world positions. For positions with domestic residents and residents of other euro area countries, the sectoral breakdown consists of a split between MFIs, general government and other residents. In addition, for loan claims and deposit liabilities, other residents are further decomposed in financial intermediaries other than MFIs (with a split between insurance corporations, pension funds, non-MMF investment funds, and other financial intermediaries), non-financial corporations and households. The detailed split of “other residents” into its sub-components for holdings of

⁶ Regulation (EC) No XX/2013 of the ECB of 24 September 2013 concerning the balance sheet of the monetary financial institutions sector (Recast), OJ L 15, 7.11.2013, p. 14.

⁷ The splits are not collected for securities issued by MFIs and MMF shares/units as the holders of the assets are most often unknown to the issuers of the instruments. For securities in M3 (MMF shares/units and debt securities with an original maturity of up to two years), however, the geographical split is estimated at aggregated level by NCBs (or, in some cases, by the ECB) to allow a more correct derivation of M3, however this paper does not take into account these estimated cross-border flows and rather focuses on total issuance for these instruments.

securities (not used in this paper) is collected quarterly. For positions with non-euro area residents, data are collected on a quarterly basis broken down by banks, general government and other resident sectors (this is also not used in this paper). The framework for the compilation of MFI balance sheet statistics is fully documented in the ECB Manual on MFI balance sheet statistics.⁸

It should be underlined that traditionally the framework for MFI balance sheet statistics did not separately identify MFI loan and deposit positions vis-à-vis the Eurosystem. While these requirements have been included in the 2013 update of the legal act underlying the reporting framework, in order to disentangle transactions between MFIs other than central banks and the Eurosystem for the whole period of interest, this paper uses data from the consolidated financial statement of the Eurosystem. The financial statement is published weekly in accordance with Article 284 of the Treaty establishing the European Union and Article 15.2 of the Statute of the ESCB, and presents assets and liabilities held by the Eurosystem vis-à-vis third parties, consolidating out cross-positions between Eurosystem central banks.

2. *Data handling and transformations*

Researchers normally use data on (balance sheet) outstanding amounts to draw their analyses. Specifically, the difference between stock positions at two consecutive ends-of-period is often used as a proxy to measure net transactions within the period. This approach fails to take into consideration the effect of developments that are not the result of transactions and insert breaks in the stock series. These other factors (called flow-adjustments) comprise valuation effects arising from changes in prices or in exchange rates, and what international statistical standards call other changes in the volume of assets, including loan write-offs/write-downs and the impact of reclassifications.

In this paper we make benefit of these ideas and use, instead of outstanding amounts, notional measures of stocks ('notional stocks'). Those are calculated based on financial transactions data, using December 2011 stocks as base value and applying iteratively factors that reflect month-on-month growth rates based on monthly transactions rather than changes in outstanding amounts.⁹

The series are then seasonally adjusted based on a multiplicative decomposition using JDemetra+. While we do not rely on the official ECB seasonally adjusted series as they are normally not available at the level of aggregation that we use in this paper, our approach is consistent with the ECB methodology for seasonal adjustment of MFI balance sheet data, which is also based on a multiplicative decomposition using X-12-ARIMA and includes a day-of-the-week adjustment.

Finally, all balance sheet variables enter the VAR model in terms of annual log-levels (i.e. we take logs and multiply by 12).

3. *Description of variables*

The variables used in this paper represent aggregations of items featuring on the balance sheet of the euro area MFI sector excluding the Eurosystem. These aggregations are performed starting from the main instrument categories of the balance sheet, and grouping sectors of the counterparties to yield information on MFI positions vis-à-vis euro area residents, and specifically the Eurosystem, other MFIs, financial corporations other than MFIs, the government sector, firms and households, and the rest of the world. Special attention is paid to the so-called euro area wholesale lending

⁸ Colangelo and Lenza (2012) also describe the data released by the ECB in this framework, both for the euro area as a whole and for individual euro area countries.

⁹ Let S_t denote the outstanding amounts at the end of month t , and F_t the transactions in month t . Notional stocks are defined as $N_t = S_t - 1(1 + F_t / S_{t-1})$, with $N_{Dec11} = S_{Dec11}$. In other words, our notional stocks can be viewed as a notional measure of outstanding amounts which is consistent with the growth rates calculated by the ECB in the context of MFI balance sheet statistics. For further details, see the technical notes to the statistical chapter of the ECB Economic Bulletin.

market, which is defined as the lending market where MFIs operate along with financial intermediaries other than MFIs. Those consist of insurance corporations, pension funds, non-MMF investment funds, other financial intermediaries (including captive financial institutions and money lenders) and financial auxiliaries.

In addition, MFI balance sheet statistics allow the split between intra-euro area domestic and cross-border positions, and we take these breakdowns into account when studying inter-MFI positions. With this respect it is worth stressing that the operational framework of the Eurosystem provides that monetary policy operations are always conducted via the relevant NCB; the resulting positions are thus to be considered, by definition, domestic.

When analysing developments in MFI loans to firms and households, we also take into account the impact of loan securitisation (and other loan transfers) on MFI balance sheets.¹⁰ Securitisation allows MFIs to transfer a pool of loans (traditional securitisation) or the associated credit risk by means of credit derivatives or guarantees (synthetic securitisation) to another entity (the securitisation vehicle). A detailed description of the securitisation process is beyond the scope of this paper, but it must be stressed that in a traditional securitisation the securitised loans are often removed from the balance sheet of the originator. In particular, these loan transfers represent transactions by a statistical perspective, with the result that both outstanding amounts and transactions relating to MFI loans to firms and households are affected. In line with the official ECB methodology¹¹, to disentangle these effects from economic fundamentals in MFI loans, our notional stocks on loans to euro area firms and households are corrected for the impact of securitisation (and other loan transfers) as follows:

- monthly transactions are adjusted for MFIs' disposals of loans securitised or otherwise transferred which are derecognised from the balance sheet (net of loan acquisitions with similar impact on the balance sheet), and for the ongoing repayments of those loans that are no longer recorded on banks' balance sheets (derecognised loans), insofar as data are available;
- monthly outstanding amounts are also adjusted for the amounts outstanding of derecognised loans insofar as data are available.¹²

The section closes with a detailed review of the variables used in the paper.

Assets

- *Loans to euro area firms and households*

Loans provided by euro area MFIs (excluding the Eurosystem) to euro area non-financial corporations and households (including non-profit institutions serving households). The series covers both domestic and intra-euro area cross-border positions. Data are adjusted for the impact of loan securitisation and other loan transfers, as explained above.

- *Loans to euro area government*

Loans provided by euro area MFIs (excluding the Eurosystem) to the euro area general government sector, including central, state and local governments, and the social security funds of all euro area Member States. The series covers both domestic and intra-euro area cross-border positions.

¹⁰ While loans to other counterparties can also be object of securitisation activities, these are not reflected in the paper as they are assumed to have lower magnitude compared to the impact securitisation has on loans to non-financial sectors.

¹¹ For instance, see Box 4 of the ECB Economic Bulletin, Issue 7/2015.

¹² In mathematical terms, using the notation above, notional stocks are defined in this case as $N_t = N_{t-1}(1 + (F_t + T_t - R_t)/(S_{t-1} + Z_{t-1}))$, with $N_{Dec11} = S_{Dec11}$ and where T_t represents the disposals of loans securitised or otherwise transferred which are de-recognised from the balance sheet (net of loan acquisitions with similar impact on the balance sheet), R_t represents the repayments of those loans that are no longer recorded on banks' balance sheets, and Z_{t-1} represents the amounts outstanding of derecognised loans.

- *Deposit and loan claims on the Eurosystem*

Deposits and loan claims of euro area MFIs (excluding the Eurosystem) on the Eurosystem, including the balances related to their use of the deposit facility and the reserve requirements.

- *Domestic loans to MFIs*

Deposits and loan claims of euro area MFIs (excluding the Eurosystem) on domestic MFIs (excluding the Eurosystem). Intra-euro area cross-border positions (e.g. loans by Italian MFIs to French MFIs) are not included in the series.

- *Intra-euro area cross-border loans to MFIs*

Deposits and loan claims of euro area MFIs (excluding the Eurosystem) on non-domestic MFIs.¹³ The series only reflects intra-euro area cross-border positions.

- *Other euro area wholesale loans*

Deposits and loan claims of euro area MFIs (excluding the Eurosystem) on euro area financial intermediaries other than MFIs. The series covers both domestic and intra-euro area cross-border positions vis-à-vis insurance corporations, pension funds, non-MMF investment funds, other financial intermediaries (including captive financial institutions and money lenders) and financial auxiliaries.

- *Loans to non-euro area residents*

Deposits and loan claims of euro area MFIs (excluding the Eurosystem) on non-euro area residents. The breakdowns by sector of the counterparty are only available on a quarterly basis and are thus not reflected in this paper.

- *Domestic holdings of government debt securities*

Holdings by euro area MFIs (excluding the Eurosystem) of domestic debt securities issued by general government sector, including central, state and local governments, and the social security funds. The series only covers holdings of domestic debt securities by MFIs (e.g. holdings by Italian MFIs of debt securities issued by Italian government entities).

- *Intra-euro area cross-border holdings of government debt securities*

Holdings by euro area MFIs (excluding the Eurosystem) of debt securities issued by euro area non-domestic units of the general government sector, including central, state and local governments, and the social security funds. The series only covers intra-euro area cross-border positions.

- *Holdings of euro area MFI securities*

Holdings by euro area MFIs (excluding the Eurosystem) of securities issued by euro area MFIs, e.g. debt securities, equity and MMF shares/units. The series covers both domestic and intra-euro area cross-border positions.

- *Holding of securities issued by the euro area private sector*

Holdings by euro area MFIs (excluding the Eurosystem) of securities issued by euro area financial corporations other than MFIs (insurance corporations, pension funds, non-MMF investment funds, other financial intermediaries (including captive financial institutions and money lenders) and financial auxiliaries) and non-financial corporations. The series covers both domestic and intra-euro area cross-border positions and relates to holdings of debt securities, equity and non-MMF investment funds shares/units.

¹³ As discussed above, the operational framework of the Eurosystem provides that operations with MFIs are always conducted via the relevant NCB; the specification ‘excluding the Eurosystem’ is thus superfluous here.

- *Holdings of debt securities issued by non-euro area residents*

Holdings by euro area MFIs (excluding the Eurosystem) of debt securities issued by non-euro area residents. The breakdowns by sector of the counterparty are only available on a quarterly basis and are thus not reflected in this paper.

- *Holdings of equity issued by non-euro area residents*

Holdings by euro area MFIs (excluding the Eurosystem) of equity instruments issued by non-euro area residents. The breakdowns by sector of the counterparty are not available and are thus not reflected in this paper.

- *Remaining assets*

This series encompasses the residual items on the assets side of the balance sheet of the MFI sector (excluding the Eurosystem), that is the residual assets not included elsewhere. In particular, the series mainly includes: (i) financial derivative positions subject to on-balance-sheet recording; (ii) accrued interest receivable on loans; (iii) dividends to be received subject to on-balance-sheet recording; (iv) gross amounts receivable in respect of suspense and transit items.¹⁴

Liabilities

- *Deposits of euro area firms and households*

This item is the sum of the deposits of a monetary and non-monetary type. The deposits of monetary type placed with euro area MFIs (excluding the Eurosystem) by euro area non-financial corporations and households (including non-profit institutions serving households) include overnight deposits, deposits with an agreed maturity of up to two years, deposits redeemable with a notice of up to three months, and repurchase agreements, and covers both domestic and intra-euro area cross-border positions. The deposits of non-monetary type placed with euro area MFIs (excluding the Eurosystem) by euro area non-financial corporations and households (including non-profit institutions serving households) include deposits with an agreed maturity of more than two years and deposits redeemable with a notice of more than three months, and covers both domestic and intra-euro area cross-border positions.

- *Deposits of euro area government*

Deposits placed with euro area MFIs (excluding the Eurosystem) by the euro area general government sector, including central, state and local governments, and the social security funds of all euro area Member States. The series covers both domestic and intra-euro area cross-border positions.

- *Deposit and loan liabilities to the Eurosystem*

Deposits and loan liabilities of euro area MFIs (excluding the Eurosystem) to the Eurosystem, including the balances related to their use of monetary policy operations.

- *Domestic deposits from MFIs*

Deposits and loan liabilities of euro area MFIs (excluding the Eurosystem) vis-à-vis domestic MFIs (excluding the Eurosystem). Intra-euro area cross-border positions (e.g. deposits placed by Italian MFIs with French MFIs) are not included in the series.

- *Intra-euro area cross-border deposits from MFIs*

¹⁴ Suspense items are balances which are not booked in the name of customers but which nevertheless relate to customers' funds (e.g. amounts awaiting investment). Transit items represent funds that are in the course of being transmitted between MFIs (e.g. checks that have not been sent for collection to other MFIs).

Deposits and loan liabilities of euro area MFIs (excluding the Eurosystem) vis-à-vis non-domestic MFIs. The series only reflects intra-euro area cross-border positions.

- *Other euro area wholesale deposits*

Deposits and loan liabilities of euro area MFIs (excluding the Eurosystem) vis-à-vis euro area financial intermediaries other than MFIs. The series covers both domestic and intra-euro area cross-border positions vis-à-vis insurance corporations, pension funds, non-MMF investment funds, other financial intermediaries (including captive financial institutions and money lenders) and financial auxiliaries. Long-term deposits vis-a-vis FVCs are however excluded from our exercise as they are usually fictionally imputed to the MFI balance sheet as a balancing liability when loan securitisation activities (or other loan sales) do not result in the de-recognition of the assets.

- *Deposits from non-euro area residents*

Deposits and loan liabilities of euro area MFIs (excluding the Eurosystem) vis-à-vis non-euro area residents. The breakdowns by sector of the counterparty are only available on a quarterly basis and are thus not reflected in this paper.

- *Debt securities issued*

Total issuance of debt securities by euro area MFIs.

The macroeconomic and financial block

The macroeconomic and financial block of the database includes the following 12 variables, all available from the Statistical Data Warehouse of the European Central Bank:

- *Industrial production (euro area)*
- *Harmonized Index of Consumer prices (euro area), HICP*
- *Unemployment rate (euro area)*
- *Producer price index (euro area), PPI*
- *Three months Euribor rates (euro area)*
- *Industrial production (US)*
- *Consumer price index (US), CPI*
- *Federal Funds rate (US)*
- *DJ Eurostoxx (stock prices)*
- *Sovereign bond yields, two years maturity (euro area)*
- *Sovereign bond yields, five years maturity (euro area)*
- *Sovereign bond yields, ten years maturity (euro area)*

The data enter the VAR model in annual log-levels (i.e. $12 \cdot \log$) except the rates (i.e. the Euribor, the Federal Funds rate, the sovereign bond yields and the unemployment rate) which enter the model in levels.

Table 1a: Bank balance sheet items – liabilities and assets

LIABILITIES	1999	2008	2009	2010	2011	2012	2013	2014	2015
Deposits of euro area firms and households	4239.4	6736.6	7044.1	7257.4	7468.1	7673.3	7983.3	8222.2	8423.4
		(6656.0 - 6780.4)	(6629.4 - 7547.8)	(6826.0 - 8199.3)	(6932.4 - 9007.2)	(6977.1 - 9580)	(7207.1 - 10495.0)	(7319.0 - 11622.0)	(7409.0 - 12939.6)
Deposit of euro area government	220.3	390.6	426.4	419.2	462.7	476.6	474.2	474.6	503.3
		(348.1 - 393.7)	(213.8 - 551.4)	(185.2 - 674.3)	(153.3 - 932.3)	(130.9 - 1203.4)	(102.5 - 1408.8)	(79.3 - 1909.7)	(60.6 - 2773.1)
Deposit and loan liabilities to the Eurosystem	195.2	700.6	817	726.7	687.8	1351.5	934.6	684.4	684.1
		(489.1 - 589.2)	(263.5 - 932.0)	(229.4 - 1296.7)	(174.5 - 2048.2)	(164.0 - 3291.9)	(146.5 - 5031.0)	(113.1 - 7728.0)	(78.6 - 12376.1)
Domestic deposits from MFIs	2108.2	3480.6	3689.1	3660.9	3664.8	3642.3	3583.9	3487.6	3344.4
		(3363.2 - 3475.7)	(3258.9 - 4020.8)	(3292.0 - 4404.4)	(3273.1 - 4953.6)	(3343.6 - 5458.5)	(3321.6 - 5946.1)	(3233.0 - 6693.9)	(3119.3 - 7520.9)
Intra-euro area cross-border deposits from MFIs	813.9	2066.4	1744.3	1645.1	1574.3	1419.6	1297.9	1271.3	1290.6
		(2076.0 - 2217.2)	(1969.0 - 2919.0)	(2090.1 - 3581.3)	(1948.5 - 4296.8)	(2115.0 - 5378.9)	(2274.1 - 6920.0)	(2258.4 - 8852.6)	(2205.5 - 11433.1)
Other euro area wholesale deposits	908.7	2589.1	2790.4	2865.7	2969.3	2869.6	2764.5	2593.2	2641.3
		(2504.1 - 2599.4)	(2322.8 - 3121.8)	(2471.4 - 3834.3)	(2599.6 - 4822.5)	(2845.1 - 5619.5)	(2785.3 - 6928.3)	(2830.4 - 8755.9)	(2845.2 - 11166.5)
Deposits from non-euro area residents	1623.3	4209.7	3661.6	3594.1	3403.6	3182.9	2824.5	2665.8	2726.4
		(4190.8 - 4401.4)	(3609.3 - 4910.5)	(3671.2 - 5671.8)	(3711.4 - 6833.2)	(3636.9 - 7520.9)	(3761.7 - 8939.4)	(3800.6 - 10926.0)	(3838.7 - 13684.0)
Debt securities issued	2407.4	5229.9	5306.4	5257.1	5220.1	5232.9	4873.5	4531.6	4222.3
		(5237.6 - 5325.4)	(5178.0 - 5848.0)	(5451.5 - 6523.4)	(5810.6 - 7466.5)	(6146.2 - 8374.2)	(6413.4 - 9223.5)	(6733.2 - 10498.8)	(6939.9 - 11916.8)

Note: Euro billions, yearly averages. Red (blue) indicates figures below (above) the 2.5 (97.5)% percentile of the forecast distribution. 2.5% and 97.5% percentiles in parenthesis.

ASSETS	1999	2008	2009	2010	2011	2012	2013	2014	2015
Loans to euro area firms and households	4525.5	9339.1 (9270.9 - 9350.3)	9596.4 (9223.8 - 9928.7)	9683.7 (9571.4 - 10788.7)	9915.8 (10198.2 - 12083.5)	9965.1 (10632.0 - 13140.8)	9874.5 (11017.1 - 14217.8)	9802.6 (11478.5 - 15793.1)	9894.3 (11852.1 - 17514.7)
Loans to euro area government	972.7	977.3 (961.0 - 985.1)	998.3 (901.9 - 1088.8)	1088.4 (883.0 - 1151.1)	1165.6 (847.9 - 1221.6)	1159.5 (803.1 - 1259.6)	1110.4 (781.0 - 1327.3)	1093.4 (740.1 - 1418.8)	1107.5 (701.4 - 1538.8)
Deposit and loan claims on the Eurosystem	104.2	278.1 (173.5 - 237.6)	326 (58.0 - 553.7)	408.9 (38.6 - 767.1)	452.5 (22.7 - 1677.2)	1020.4 (11.3 - 20154.4)	575.6 (6.5 - 2763.9)	322.9 (3.7 - 5215.9)	467.3 (1.9 - 10166.2)
Domestic loans to MFIs	2094.3	3461.1 (3344.2 - 3458.3)	3669.8 (3219.7 - 3986.2)	3626.5 (3241.4 - 4374.3)	3653.6 (3202.1 - 4931.3)	3664.6 (3247.2 - 5403.7)	3596.3 (3215.3 - 5966.6)	3498.9 (3121.8 - 6647.4)	3361.6 (2989.8 - 7440.9)
Intra-euro area cross-border loans to MFI	796.7	2127.4 (2134.4 - 2276.8)	1823.5 (2021.0 - 2963.9)	1697.6 (2119.9 - 3604.2)	1625.5 (2010.7 - 4314.6)	1490.3 (2198.6 - 5437.4)	1360.1 (2362.1 - 6922.0)	1320.1 (2337.0 - 8862.7)	1354.3 (2282.3 - 11407.3)
Other euro area wholesale loans	358.7	1155.6 (1111.6 - 1172.8)	1169.3 (921.9 - 1377.9)	1189.5 (943.3 - 1675.5)	1244.2 (980.6 - 2194.9)	1249.3 (936.7 - 2502.7)	1259.8 (920.1 - 2935.6)	1206.6 (894.6 - 3655.7)	1248.5 (857.8 - 4679.5)
Loans to non-euro area residents	1208.2	3601.8 (3554.2 - 3754.3)	3093.4 (3434.3 - 4944.8)	3049 (3597.3 - 6040.6)	3105 (3435.2 - 7114.6)	3027.4 (3682.1 - 8847.6)	2908.2 (3984.4 - 11309.0)	3015.6 (4098.6 - 15078.0)	3025.5 (4310.9 - 20779.9)
Domestic holdings of government debt securities	921.3	631.7 (621.0 - 648.3)	765.6 (570.8 - 784.9)	899 (551.5 - 869.8)	975.4 (503.6 - 957.7)	1194.4 (454.4 - 991.5)	1305.6 (439.8 - 1100.3)	1292.9 (390.2 - 1204.1)	1270.7 (342.4 - 1332.9)
Intra-euro area cross-border holdings of government debt securities	302.6	483.6 (476.4 - 507.2)	539.6 (451.3 - 727.6)	518.4 (463.4 - 929.5)	439.3 (428.7 - 1111.1)	375.9 (395.6 - 1272.2)	388.8 (421.6 - 1680.6)	435 (382.3 - 2058.6)	476.4 (335.3 - 2526.8)
Holding of euro area MFI securities	1013.1	2269.2 (2235.7 - 2296.4)	2482 (2072.9 - 2502.1)	2392.7 (2146.6 - 2797.5)	2298.4 (2281.6 - 3329.3)	2448.1 (2330.8 - 3699.8)	2294.9 (2327.3 - 4013.1)	2084.6 (2337.0 - 4505.7)	1888.4 (2304.5 - 5086.4)
Holding of securities issues by the euro area private sector	666.6	2014.9 (1954.2 - 2052.4)	2270.1 (1699.3 - 2425.0)	2288.6 (1720.2 - 2859.0)	2266.5 (1832.1 - 3754.5)	2211 (1737.9 - 4154.8)	2204.1 (1754.1 - 4868.7)	2118.8 (1671.3 - 5797.5)	2086.6 (1563.2 - 6970.7)
Holding of debt securities issued by non-euro area residents	292.9	1224 (1234.7 - 1291.5)	1154.6 (1224.9 - 1729.6)	1078.1 (1322.6 - 2156.5)	970.9 (1406.0 - 2761.0)	916.4 (1548.1 - 3570.1)	855.4 (1652.8 - 4427.8)	877.1 (1772.1 - 5944.1)	932.1 (1879.9 - 8130.8)
Holding of equity issued by non-euro area residents	91.7	298.7 (284.5 - 310.4)	284.6 (192.2 - 402.0)	298.9 (167.9 - 480.9)	301.5 (152.3 - 658.4)	292.5 (144.6 - 890.9)	317.3 (111.5 - 949.4)	316.9 (98.8 - 1360.4)	335.1 (83.9 - 1999.4)
Remaining assets	1611.1	3737.6 (3473.3 - 3661.8)	3829.8 (2911.0 - 4532.9)	3936.4 (2855.1 - 5356.5)	3766 (2781.3 - 6691.2)	4732.3 (2715.0 - 7985.2)	3961.3 (2540.0 - 9057.6)	3555.9 (2476.2 - 11877.1)	4013.8 (2336.1 - 15628.8)

Note: Euro billions, yearly averages. Red (blue) indicates figures below (above) the 2.5 (97.5)% quantile of the forecast distribution. 2.5% and 97.5% percentiles in parenthesis.

Figure 1: Stylised representation of interbank money market

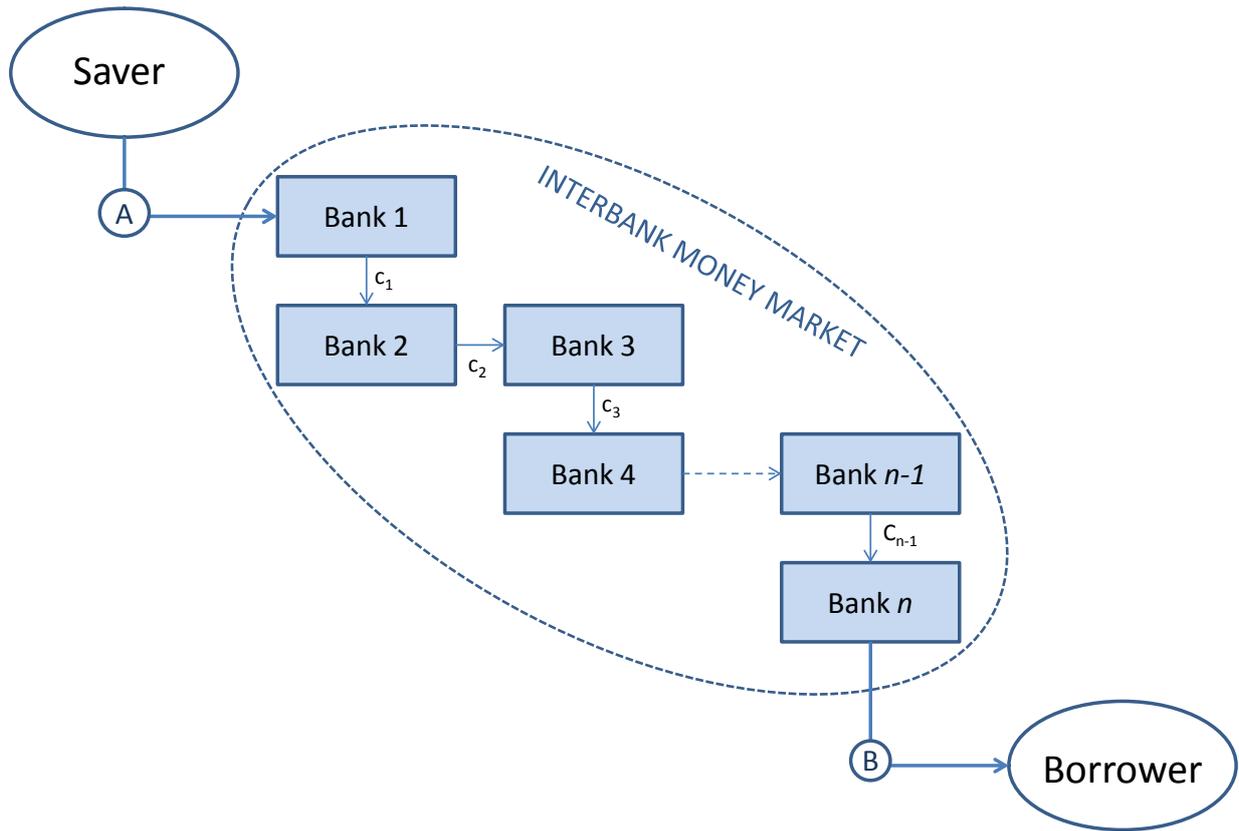
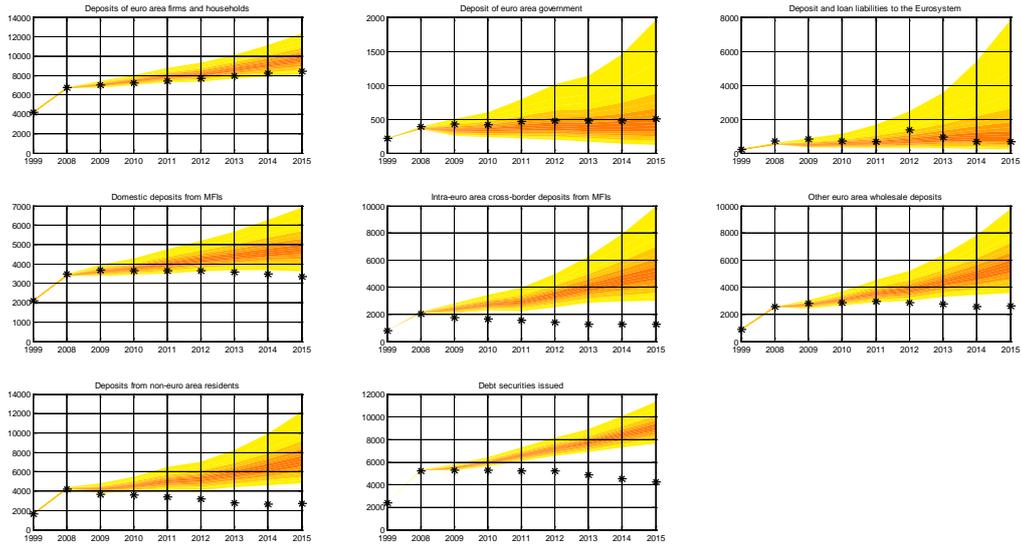
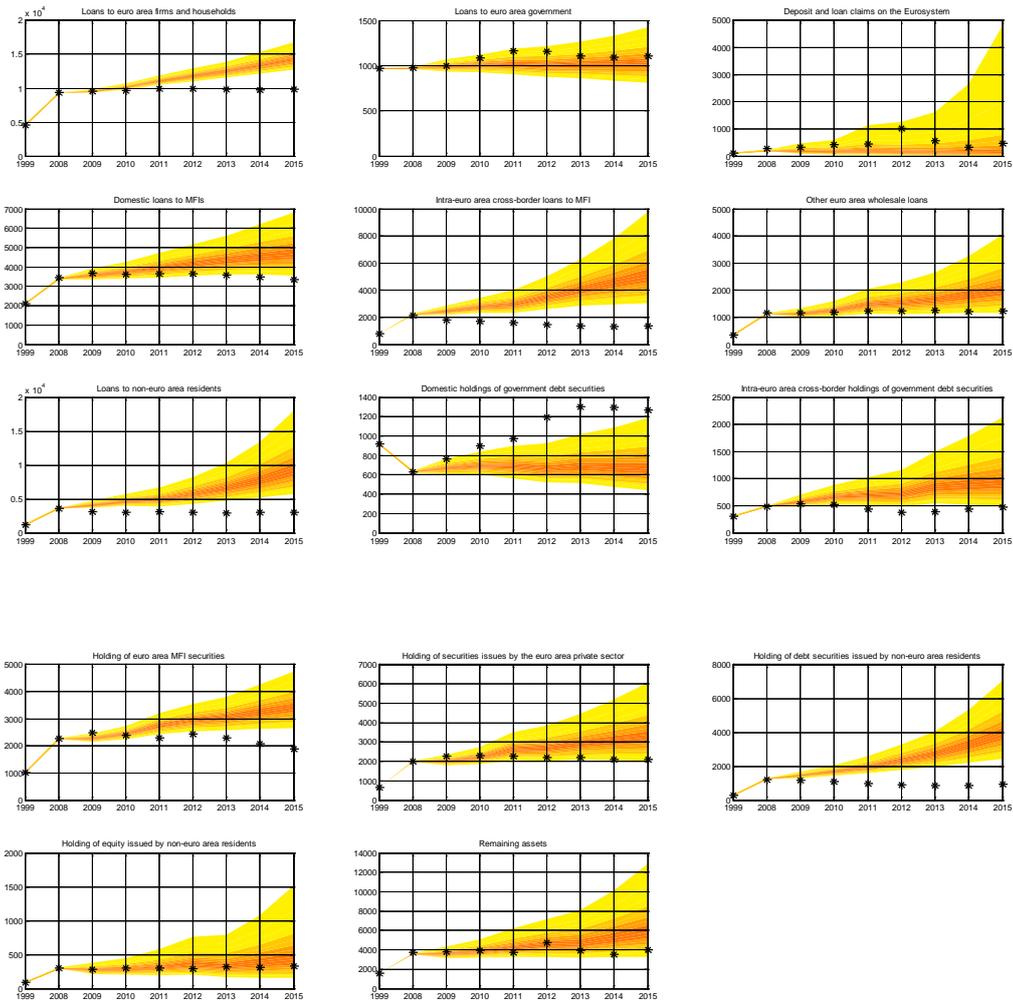


Figure 2: Observed evolution of bank liabilities relative to counterfactual



Note: Euro billions, yearly averages. The stars indicate the observed outcomes. The conditional forecast distribution (trimming the upper and lower 2.5% of the distribution) is represented in shades of orange.

Figure 3: Observed evolution of bank assets relative to counterfactual



Note: Euro billions, yearly averages. The stars indicate the observed outcomes. The conditional forecast distribution (trimming the upper and lower 2.5% of the distribution) is represented in shades of orange.