



EUROPEAN CENTRAL BANK

EUROSYSTEM

RESEARCH BULLETIN

No 18, SPRING 2013



HETEROGENEOUS TRANSMISSION MECHANISM AND THE CREDIT CHANNEL IN THE EURO AREA

2

By Matteo Ciccarelli and Angela Maddaloni

The overall impact on the euro area economy of the financial crisis that started in 2007 was considerable, however with different effects across the various different countries and financial intermediaries. This article analyses the way in which the financial fragility of financial intermediaries and borrowers has affected the monetary policy transmission mechanism in the euro area, in particular through the credit channel. The study suggests that the effect of the bank lending channel has been partly mitigated by the non-standard policy measures that the ECB implemented until the end of 2011. At the same time, credit frictions for borrowers, especially from small banks, continued to prevail, particularly in distressed countries.

FIRMS' ADJUSTMENT DURING TIMES OF CRISIS

9

By Ana Lamo

Cutting costs is the prevailing adjustment strategy used by European firms during the early stages of the recent financial crisis, with labour costs being more commonly adjusted than non-labour costs. It is remarkable that not even

in the worst crisis since the Great Depression firms cut base wages in an attempt to protect jobs. How they cut labour costs substantially depends on countries' labour market institutions.

MACROECONOMIC EFFECTS OF LARGE-SCALE ASSET PURCHASE PROGRAMS

12

By Mark Gertler and Peter Karadi

During the recent financial crisis, central banks introduced a variety of non-standard measures to redress impaired financial markets and to influence economic activity when conventional interest rate policy was turning ineffective at the zero lower bound. This article summarises recent research that provides a unified quantitative framework in which the effects of the variety of these new tools can be analysed.

BOX

PROGRESS OF THE MACRO-PRUDENTIAL RESEARCH NETWORK (MARs) TWO YEARS ON

16

PUBLICATIONS

18

HETEROGENEOUS TRANSMISSION MECHANISM AND THE CREDIT CHANNEL IN THE EURO AREA

By Matteo Ciccarelli and Angela Maddaloni



Over the past five years, economic activity and the banking sector in the euro area have shown substantial fragility and a remarkable degree of country heterogeneity. Using detailed data on lending conditions and standards, this article analyses the role of the credit channel and its sub-channels – the bank lending channel and the borrower’s balance sheet channel – in the transmission of monetary policy in the euro area. Results suggest that the bank lending channel has, to a large extent, been neutralised by the ECB’s non-standard monetary policy interventions, primarily the long-term liquidity provisions. At the same time, these measures may still be insufficient to overcome credit availability problems stemming from deteriorated firm net worth and credit risk, especially for small firms in countries under stress.

The crisis that started in 2007 has had a strong overall impact on the euro area, with differing effects across euro area countries and financial intermediaries. Since 2008 the interconnections between market segments have largely broken down, also across borders, and the ECB has operated in an environment of severe heterogeneity and segmentation in money and financial markets.

This article analyses the way in which financial fragility has affected the transmission of monetary policy in the euro area, in particular,

through the credit channel. According to the credit channel theory of monetary policy transmission, informational and contractual frictions in credit markets tend to worsen during periods of restrictive monetary policy and economic and financial stress. The resulting increase in the external finance premium – the

difference in cost between internal and external funding – amplifies the effect of monetary policy on the real economy. In the words of Bernanke and Gertler (1995), the credit channel is not “alternative to the traditional monetary transmission mechanism, but rather a set of factors that amplifies and propagates conventional interest rate effects”. These factors can be either related to bank balance sheet capacity and competitive pressures, and therefore independent of the credit quality of the borrower (the bank lending channel), or linked to borrowers’ creditworthiness and net worth characteristics (the non-financial borrower balance sheet channel).

This article focuses, in particular, on the heterogeneity of this amplification mechanism along the following dimensions: (i) changes over time (at different moments of the crisis); (ii) differences in the impact of monetary policy shocks in countries under sovereign stress (Ireland, Greece, Spain, Italy, and Portugal) and in other euro area countries; (iii) transmission of monetary policy through the broad credit channel and its sub-channels – the bank lending channel and the non-financial borrower balance sheet channel; and (iv) differences due to bank (and firm) size, which are key determinants of credit access.

These issues are analysed by using a flexible vector autoregression (VAR) model estimated recursively over the sample 2008:Q3-2011:Q3 for a panel of 12 euro area countries. The analysis explicitly takes into account credit conditions, measured by lending conditions and standards, from the euro area Bank Lending Survey (BLS).¹ This information has two crucial features that allow the identification of the credit channel of monetary policy and its sub-channels. First, the BLS reports lending conditions for the entire pool of loan applicants, including potential borrowers that are rejected. Second, changes in lending conditions are due either to a reduced capacity of banks to provide credit to the private sector, because of bank balance sheet problems, or to the uncertainty in net worth, credit risk and collateral valuation of borrowers (firms and households).

Since 2008 the ECB has operated in an environment of severe heterogeneity and financial fragmentation with implications for the functioning of the transmission mechanism of monetary policy.

¹ The data on credit conditions and standards are included alongside with the following variables: (i) GDP growth and inflation (macroeconomic conditions); (ii) the EONIA interest rate (the policy rate); (iii) the volumes of transactions in the interbank market (bank funding conditions); (iv) the long-term liquidity provided by the Eurosystem to the banking sector in each country as a fraction of total bank assets (accounting for the heterogeneity of the non-standard measures taken by the ECB during the financial crisis to support financing conditions and credit flows); and (v) the rates on long-term sovereign bonds (country risk). For a thorough discussion on the use of EONIA as the policy rate, see Ciccarelli et al. (2013).

Based on this identification strategy, an assessment can be made with regard to: (i) the extent to which a reduced ability of banks to provide credit to the private sector – bank financial fragility – and the impaired access to credit – the fragility of firms and households – can amplify the impact of monetary policy on the real economy; and (ii) the extent to which the liquidity measures taken by the ECB have affected the bank lending and the borrower’s balance sheet channel and, hence, the transmission mechanism.

The credit channel and the role of financial fragility

The impairment of the transmission mechanism due to the frictions in credit markets that were amplified by the financial crisis can be gauged with the help of counterfactual experiments. Concretely, the responses of GDP growth to an unexpected move in the nominal interest rate are compared with the counterfactual responses featuring only the “direct” impact of the interest rate movement on the economy and neutralising the “indirect” effect through the credit channel (identified by the BLS variables). The difference between the two responses provides an indication of the importance of the credit channel and its sub-channels in the transmission of monetary policy: the bigger the difference, the larger the amplification mechanism due to the credit channel.

Chart 1 reports the results of the counterfactual experiment. The lines represent the responses of annual GDP growth to a 0.25 percentage point increase in the monetary policy rate at selected dates. The black line includes both the “direct” effects of changes in the policy rate and the propagation effect operating indirectly through the credit channel. The red line excludes the propagation effect by shutting down the credit channel. Panels A and B depict the importance of the bank lending

and the balance sheet channel for the countries under sovereign stress (Ireland, Greece, Spain, Italy, and Portugal) and the other countries, respectively. For the countries under stress, the bank lending channel is significant only until the fourth quarter of 2009, whereas the borrower’s balance sheet channel remains significant throughout the selected periods. In the other countries, the amplification effect through both channels is not significant and the credit channel is always less important than in distressed countries.²

Consistent with the credit channel theory, these results confirm that the impact of changes in the monetary policy rate has altered during the crisis in a heterogeneous way across countries and across the different credit channels.

The importance of bank size

As supported by the existing literature in the field, the transmission of monetary policy through the credit channel may differ according to the heterogeneity of borrowers and lenders, notably with regard to firm and bank size.³ In particular, changes in the monetary policy rate should affect more the credit granted by smaller banks to smaller firms, which are typically more financially constrained.

The BLS contains separate answers for lending standards applied by small and large banks. Since small firms tend to borrow from small

banks, a change in lending standards from small banks also proxies for changes in lending conditions for small firms.

A second set of counterfactual experiments, that qualify the previous results,

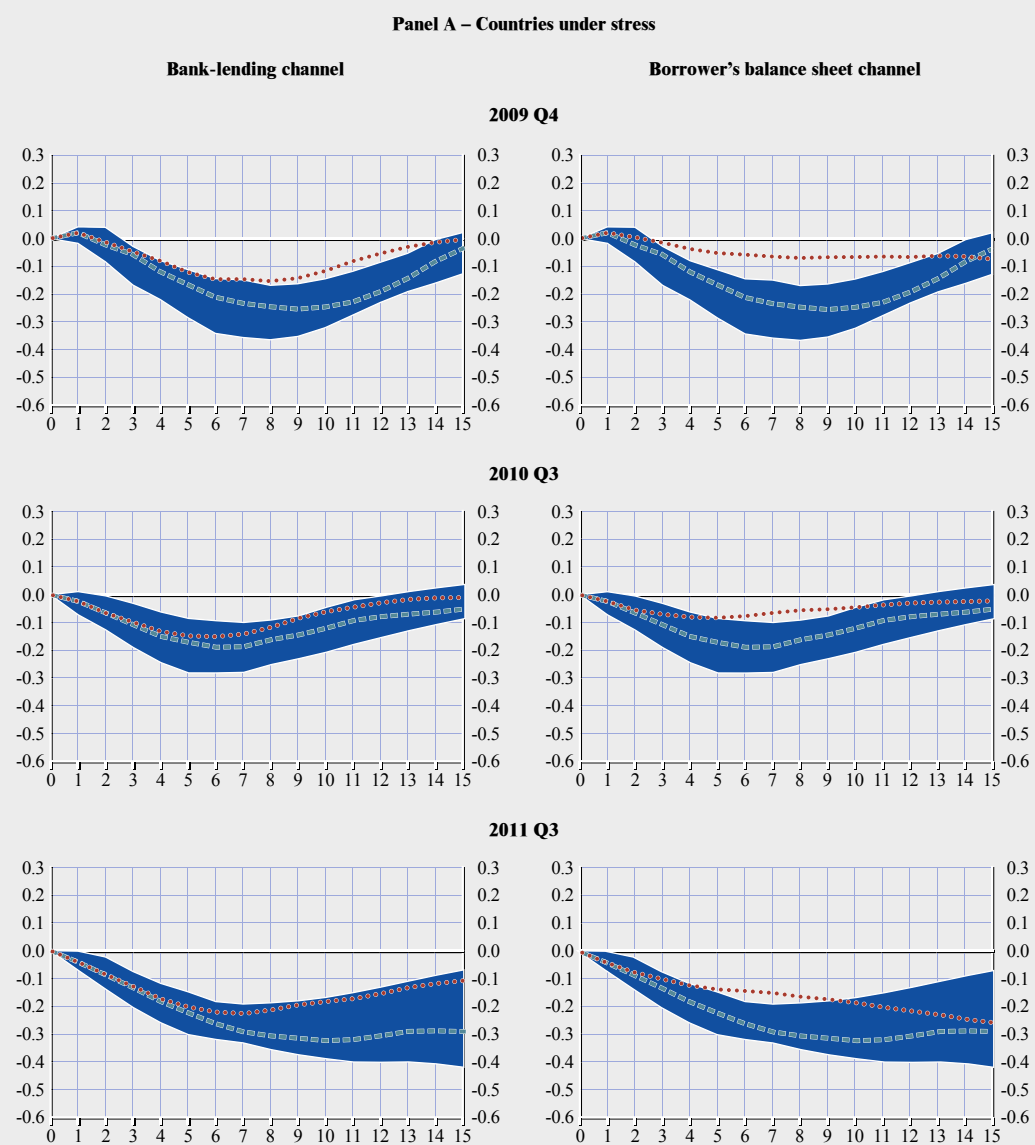
compare the responses of GDP growth from the full system with those obtained when shutting down the various credit channels

² Technical details of the counterfactuals and the full set of results are provided in Ciccarelli et al. (2013).

³ See Gertler and Gilchrist (1994), and Kashyap and Stein (2000).



Chart 1 Monetary policy and financial fragility: the amplification of the credit channel



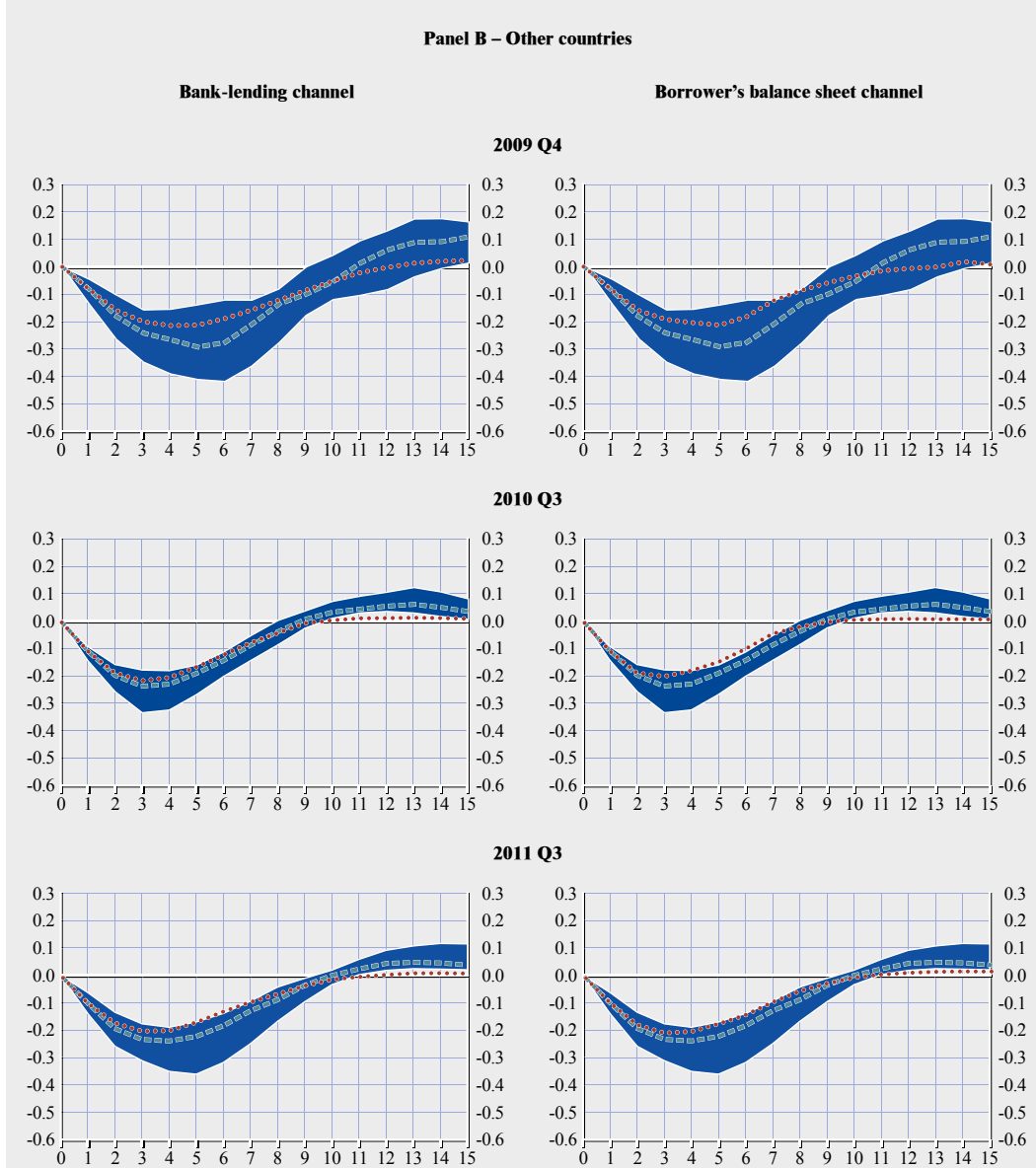
Note: The charts show the estimated impulse response functions of year-on-year GDP growth to a 25 basis point increase in the monetary policy rate at selected quarters for countries under stress (Panel A) and for other countries (Panel B). The green dashed line is the median response estimated from the full VAR system. The blue area is a 68% Bayesian credible set around this median. The red dotted line is the response obtained when closing down the bank lending channel (left-hand side) or the balance sheet channel (right-hand side). The difference between the green dashed and the red dotted lines is the median amplification effect due to the credit channels.

operating through banks of different size (large and small). The results – reported in Chart 2 for countries under stress – show that the amplification of a monetary policy shock has operated mainly through the non-financial borrower

The amplification of the monetary policy transmission through the non-financial borrower balance sheet channel has operated mainly through small banks in distressed countries.

balance sheet channel of small banks. In other words, in distressed countries the low net worth of smaller firms (which mainly borrow from small banks) and their higher risk profile make loans to these borrowers relatively unattractive to banks.

Chart I Monetary policy and financial fragility: the amplification of the credit channel



Note: The charts show the estimated impulse response functions of year-on-year GDP growth to a 25 basis point increase in the monetary policy rate at selected quarters for countries under stress (Panel A) and for other countries (Panel B). The green dashed line is the median response estimated from the full VAR system. The blue area is a 68% Bayesian credible set around this median. The red dotted line is the response obtained when closing down the bank lending channel (left-hand side) or the balance sheet channel (right-hand side). The difference between the green dashed and the red dotted lines is the median amplification effect due to the credit channels.

The effect of non-standard measures

The malfunctioning of financial markets and fragmented financial conditions resulted in the impairment of the transmission mechanism of monetary policy. This was particularly true in countries where government finances were under strain and where funding through the money market, for banks in particular, was restricted.⁴

A complementary analysis based on regressions to compute recursive correlations among credit variables, interbank funding, and central bank liquidity provisions can provide more evidence supporting this claim.

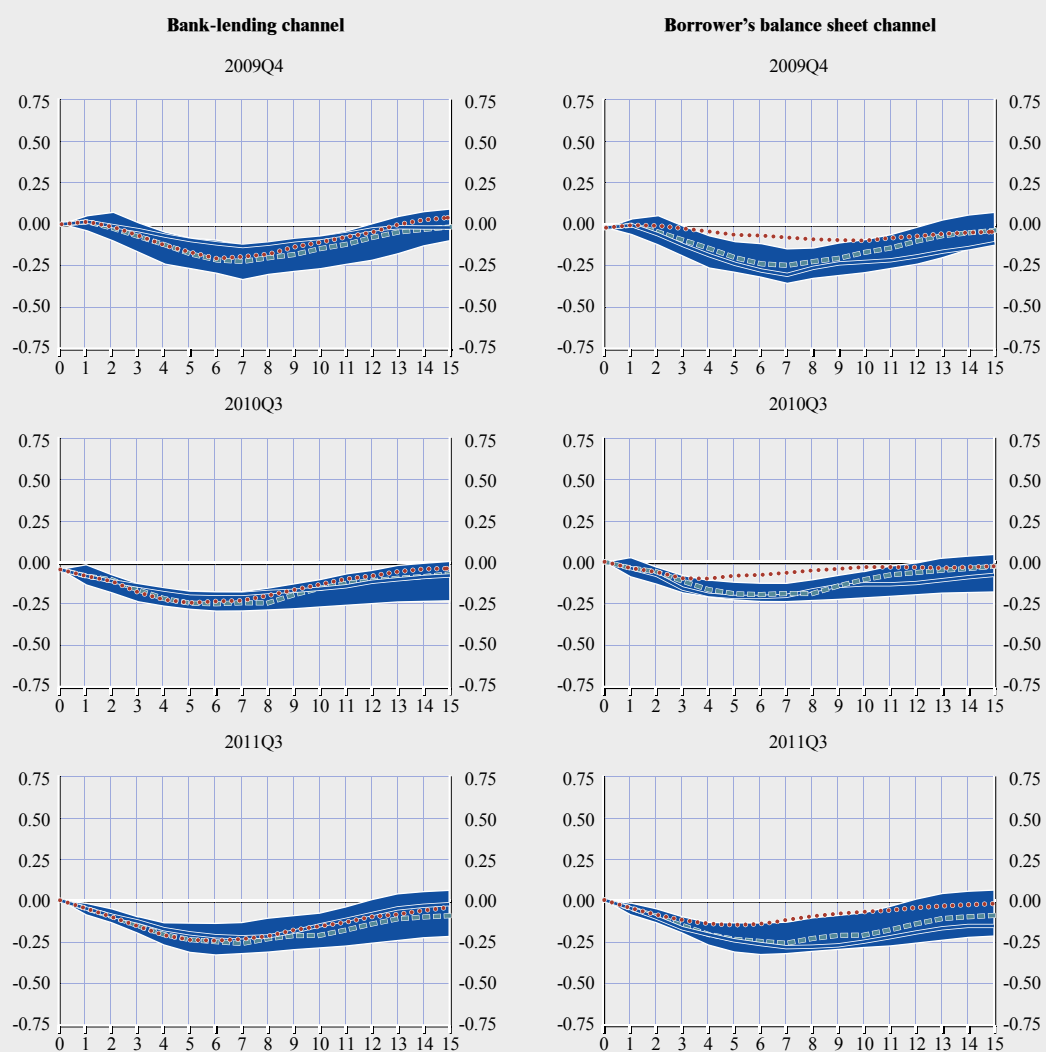
⁴ See Praet (2012).

⁵ Long-term central bank liquidity is defined as the secured liquidity provided to the banking sector with a maturity of between three months and one year. Since the analysis ends in the third quarter of 2011, the two refinancing operations with a maturity of three years (December 2011 and February 2012) are not included.





Chart 2 Decomposing the credit channel of monetary policy: Impact of bank size in countries under stress



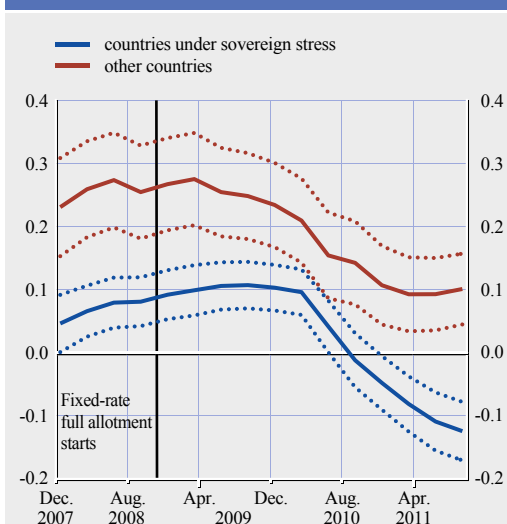
Note: The charts show the estimated impulse response functions of year-on-year GDP growth to a 25 basis point monetary policy shock at selected quarters. The green dashed line is the median response estimated from the full VAR system. The blue area is a 68% Bayesian credible set around this median. The red dotted (blue) line is the response obtained when closing down the bank lending channel (left-hand side) or the balance sheet channel (right-hand side) of small (large) banks. The difference between the green dashed and the red dotted (blue) lines is the median amplification effect due to the credit channels of small (large) banks.

Chart 3 reports the recursive correlation between long-term central bank liquidity and the volumes of transactions in the unsecured interbank market.⁵ From mid-2010, the correlation between (private) interbank volumes and (public) long-term ECB liquidity provision began to decline and became significantly negative for the countries under sovereign stress. In other words, in these countries, a lower access to the private interbank market was related to an increase in central bank liquidity borrowing. This substitution between private and public provision of liquidity occurred at the time when the sovereign crisis

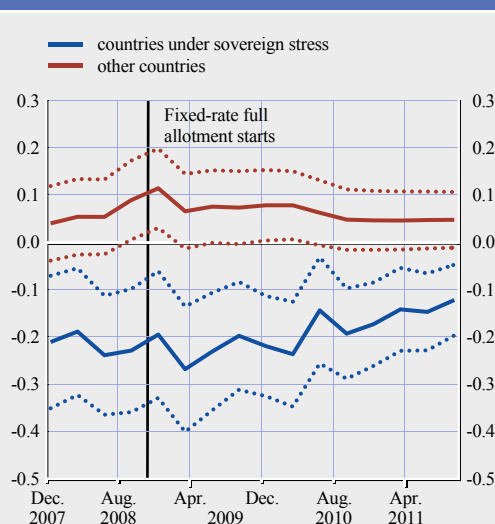
escalated and declines in capital inflows were observed in some euro area countries.⁶ In the other countries, private and public liquidity remained complementary, thus suggesting that bank liquidity needs have been covered using both sources of liquidity.

Chart 4 reports the impact of long-term liquidity provisions on bank lending standards and conditions for the two groups of countries. For the countries under stress, the negative estimates suggest that more

⁶ See Merler and Pisani-Ferry (2012).

Chart 3 Effects of interbank transactions on long-term central bank liquidity

Note: The chart reports the recursive estimates of the coefficients of the interbank transaction volumes in a regression where the left-hand side variable is the liquidity provided in the long term refinancing operations by the central bank. Additional control variables are: GDP growth, inflation, credit demand for the three categories of loans, bank lending and borrower's balance sheet variables for the three categories of loans, EONIA rate and long term-interest rates. All explanatory variables are lagged by one quarter. The dotted lines mark the 68% confidence interval.

Chart 4 Effects of long-term central bank liquidity (LTROs) on lending conditions

Notes: The chart reports recursive estimates of the coefficients of the liquidity provided in the long-term refinancing operations (LTROs) by the central bank in a regression where the left-hand side variables are the net percentage of banks that have changed lending conditions and standards that they apply to borrowers. Additional control variables are as in Chart 3.

central bank liquidity has helped foster better credit conditions for borrowers, with the strongest effect just after the introduction of the fixed rate full allotment policy. For the other countries, however, the relationship is not significant.

In sum, when examining in detail the different transmission channels, the analysis suggests that the effect of the bank lending channel has indeed been partly mitigated by the policy actions, particularly in 2010 and 2011. By providing unlimited liquidity through the full allotment policy and the long-term refinancing operations, the ECB was able to reduce the costs arising for banks from restricted private liquidity funding by effectively substituting the interbank market and inducing an easing of lending conditions.

With the ample liquidity provided the ECB has reduced the costs arising for banks from the restrictions to private liquidity funding by effectively substituting the interbank market and inducing a softening of lending conditions.

Conclusions

The analysis conducted in this article shows that the transmission mechanism of monetary policy has changed with the crisis, with a strong amplification effect of the credit channel in countries under sovereign stress. The ECB's policy measures – which have targeted almost exclusively banks' liquidity – have been effective in mitigating bank liquidity problems,

thus, in great part, neutralising the bank lending channel, and have helped in fostering better credit conditions for borrowers in distressed countries. In the same countries, however, the non-financial borrower balance sheet channel

remained constrained, especially for small banks, until the end of 2011. In this respect, the analysis in this article would support, for example, the decision to enlarge the collateral





framework of the Eurosystem – in particular by accepting loans to small and medium enterprises as eligible collateral – with the explicit objective of meeting the demand for

liquidity from banks in order to promote lending to all type of firms.⁷

⁷ See Draghi (2012).

REFERENCES

Bernanke, B. S., and Gertler, M. (1995), “Inside the Black Box: The Credit Channel of Monetary Policy Transmission”, *Journal of Economic Perspectives*, Vol 9, No 4, pp. 27-48.

Ciccarelli, M., Maddaloni, A., and Peydró, J.L. (2013), “Heterogeneous transmission mechanism: Monetary policy and financial fragility in the Euro area”, *Economic Policy*, forthcoming.

Draghi, M. (2012), *Transcript of the ECB Press Conference*, 5 July.

Gertler, M., and Gilchrist S. (1994), “Monetary Policy, Business Cycles, and the Behavior of Small Manufacturing Firms,” *Quarterly Journal of Economics*, Vol. 109, No 2, pp. 309-40.

Kashyap, A. K., and Stein, J. C. (2000), “What Do a Million Observations on Banks Say About the Transmission of Monetary Policy?” *American Economic Review*, Vol. 90, No 3, pp. 407-28.

Merler, S. and Pisani-Ferri, J. (2012), “Sudden stops in the euro area,” *Bruegel Policy Contribution*, March.

Praet, P (2012), *Heterogeneity in a monetary union: What have we learned?* Speech given at the conference “The ECB and its watchers” in Frankfurt on 15 June.

FIRMS' ADJUSTMENT DURING TIMES OF CRISIS¹

By Ana Lamo

This article summarises research documenting how European firms adjusted to the negative demand and credit shocks they faced during the initial phase of the recent financial crisis, from late 2008 to summer 2009. Cutting costs is the prevailing adjustment strategy, with labour costs being more commonly adjusted than non-labour costs. It is striking that not even in an environment of a sharp economic downturn do firms cut base wages in order to protect jobs. Nevertheless, the behaviour of European firms across countries differs depending greatly on countries' labour market institutions.



How do firms adjust to a deep and sudden fall in demand? Are these reactions different or reinforced when the drop in sales is paired with a credit drain? Prices, output, profit margins and costs are all different margins of adjustment that the firm can use. Among costs, the menu of alternatives is large. Firms can, at least partially, pass on the fall in demand to suppliers by, for example, renegotiating prices of intermediate inputs. In addition, firms can readjust labour costs by lowering either employment or wages. The relative importance of each of these margins of adjustment is likely to depend on the intensity and nature of the shock, as well as on the structural features of the product and labour markets where the firm is operating. This article sheds some new light on these questions, drawing on a wealth of information collected from a large survey of European firms during the initial phase of the recent crisis.²

Incidence of demand and credit supply shocks and firms' primary reactions

In summer 2009, firms in all countries included in the survey perceived the negative demand shock they had faced to be more important than the credit supply shock they were exposed to. Across countries, there was more heterogeneity in the perception of the severity of the demand shock compared to the importance of the credit shock. The most severe demand shock occurred in the Estonian economy. By industry, both shocks fell disproportionately strongly on manufacturing firms; and the credit shock was more strongly felt among smaller firms.³

At the onset of the crisis, firms perceived demand shocks as more important than credit shocks.

Cost reductions were the most common strategy used by firms, with no major differences across sectors or countries.

Firms may react to these negative shocks by adjusting prices, output, profit margins and costs. The evidence from the survey, summarised in Table 1, reveals that cost reductions are the most common adjustment strategy. Not surprisingly, the importance of each of the adjustment strategies increases with the intensity of the shock.

However, these increases are not homogeneous across strategies. While reducing output was the main adjustment strategy for 21.3% of the firms facing weak demand and a weak credit shock, this percentage jumped to 62% among firms confronted with a strong demand shock in conjunction with a weak credit shock. Indeed, reducing output is the strategy with the highest elasticity with respect to the strength of the demand shock.

How do firms cut costs?

When looking at firms' cost-cutting strategies, it emerges that labour costs are more commonly

¹ This article summarises results in Fabiani et al. (2012).

² The survey, carried out in the context of the Eurosystem Wage Dynamics Network (WDN), was conducted in two waves. The first wave was launched in 2007 and covered firms in 17 countries. It contained a wide array of background questions on the characteristics of the firm. The second wave was carried out during the summer of 2009, and was specifically designed to assess the different adjustment mechanisms that firms were using to cope with the global crisis. The findings in this note are based on the nine European countries that carried out the second wave: Belgium, the Czech Republic, Estonia, Spain, France, Italy, the Netherlands, Austria and Poland. Several research papers look at firms adjustment strategies prior to the crises using the first wave of the WDN survey; see Babecký et al. (2012), Bertola et al. (2012), Drurant et al. (2012), and Galuscak et al. (2012).

³ Clearly, the relevance and magnitude of the negative shocks, as perceived by firms, are subjective and depend on the past volatility of the underlying variable. Also, firms' perceptions may differ systematically across the sampled countries. Nevertheless, there is ample evidence that the actual decline in GDP is sufficiently closely correlated with the magnitude of the adverse shocks, as perceived by firms.

**Table 1 Firms' reaction to shocks**

(percentage of firms by type of shock attributing relevance or great relevance to a given reaction)

	Weak demand and weak credit shock	Strong demand and weak credit shock	Strong demand and strong credit shock
Total			
reduce prices	31.5	41.7	50.3
reduce margins	37	46.2	62.2
reduce output	21.3	61.9	66.8
reduce costs	66.5	77.8	93.8

Note: The percentages in this table are employment-weighted and rescaled excluding "do not know" answers.

adjusted than non-labour costs in response to the crisis. On average, some 66% of the surveyed firms responded saying that their main adjustment strategy for cutting costs involved reducing some aspect of total labour costs. This percentage jumps to 78% for those firms facing a strong demand shock in conjunction with a weak credit shock, and it is slightly higher for those confronted with both a strong demand and a strong credit shock (see the first and second columns in Table 2).

With regard to the different channels of labour cost adjustment (see the third to the last columns in Table 2), the most prominent feature is that almost no firms said that cutting base wages was their main cost-cutting

Reductions in labour costs were achieved mostly by adjusting quantities, namely temporary employment.

strategy. In the whole sample, only 1.2% of the firms chose this option, ranging from 0% in the Czech Republic to some 14% in Estonia. When looking at cost-cutting strategies related to labour inputs, namely cuts in permanent employment, cuts in workers employed under a temporary labour contract, and cuts in hours worked, it is evident that cuts in hours worked was the least common strategy of the three. The most common strategy for cutting labour input and, more generally, labour costs was reducing the number of temporary employees. Spain, the country with the highest prevalence of temporary contracts, features prominently in this respect. The findings of the survey further suggest that, indeed, only when shocks become sufficiently large are

Table 2 Firms' cost-cutting strategies

(percentage of firms choosing a given strategy as the main adjustment strategy)

	Non-labour costs	Labour costs	Base wages	Flexible wages	Permanent employment	Temporary employment	Hours worked
Total	33.9	66.1	1.2	9.8	16.9	24.3	13.6
By type of shock							
weak demand shock	42.5	57.5	0.8	9.5	13.2	21.6	11.6
strong demand/weak credit shock	22.6	77.4	1.6	11.9	17.5	29.8	16.1
strong demand/strong credit shock	20.8	79.2	2.4	7	31.2	24	14.6
By country							
Belgium	24.6	75.4	0.9	3.1	16.8	29.6	24.9
Czech Republic	40.1	59.9	0	10.4	27.9	16.4	5.3
Estonia	23.5	76.5	14.3	25.1	24.2	3.7	9.3
Spain	22.8	77.2	1.0	5.5	23.2	41.6	5.9
France	26.2	73.8	0.1	9.9	17.1	33.9	12.4
Italy	33.7	66.3	1.3	8.9	16.6	21.1	18.4
Netherlands	38.8	61.2	1.4	5	8.1	40.5	6.2
Austria	28	72	0.3	12.2	12.2	11.1	36.2
Poland	48.7	51.3	1.9	15.9	16.7	9.1	7.6

Note: The percentages in this table are employment-weighted and rescaled excluding "do not know" answers.

firms willing to start cutting back on jobs of employees with open-ended contracts. For example, 31.2 % of firms facing strong demand and credit shocks did exactly this in order to cut costs.

Labour market institutions

While the patterns outlined above are broadly consistent across sectors, there is significant heterogeneity in the behaviour of European firms across different countries, depending on their labour market institutions.

Not surprisingly, firms in countries where employment protection legislation is more stringent tend to adjust their number of temporary employees, rather than employees with open-ended contracts. Similarly, union bargaining power, as measured by the share of employees covered by union contracts, is found to be positively correlated with

Stringent employment protection is associated with a higher recourse to layoffs of temporary employees.

variations in labour quantities, and negatively correlated with wage adjustments. In addition, the prevalence of centralised collective wage agreements tends to hinder the adjustment of wages, even the flexible components, and induces firms to reduce labour costs through the intensive margin.

Conclusions

European firms have adjusted to the initial phase of the crisis mainly by cutting labour costs. However, firms were reluctant to cut wages, they have instead cut employment. There is great heterogeneity in the behaviour of firms across different European countries, depending on their labour market institutions. Collective bargaining institutions, employment protection laws and product market competition are all important factors for nominal and real rigidities and this shapes the response of wages and employment to economic developments.

References

- Babecký, J., Du Caju, P., Kosma, D., Lawless, M., Messina, J. and T. Rõõm (2012)**, “How do European firms adjust their labour costs when nominal wages are rigid?”, *Labour Economics No 19*, pp.792-801.
- Bertola, G., Dabusinskas, A., Hoerberichts, M., Izquierdo, M., Kwapil, C., Montornès, J. and R. Radowski (2012)**, “Price, wage and employment response to shocks – evidence from the WDN survey”, *Labour Economics No 19*, pp.783-791.
- Druant M., S. Fabiani, G. Kezdi, A. Lamo, F. Martins and R. Sabbatini (2012)**, “Firms’ price and wage adjustment in Europe: Survey evidence on nominal stickiness”, *Labour Economics No 19*, pp. 772-782.
- Fabiani S., A. Lamo, J. Messina and T. Rõõm (2012)**, “Firms’ adjustment during times of crisis”, *mimeo*.
- Galuscak K., Keeney, M., Nicolitsas, D., Smets, F., Strzelecki, P. and M. Vodopivec (2012)**, “The determination of wages of newly hired employees: survey evidence on internal versus external factors” *Labour Economics No 19*, pp. 802-812.



MACROECONOMIC EFFECTS OF LARGE-SCALE ASSET PURCHASE PROGRAMS

By Mark Gertler¹ and Peter Karadi



As the nominal interest rate reached its zero lower bound in December 2008, the US Federal Reserve unveiled the first of its large-scale asset purchase programs (LSAPs), known more generally as quantitative easing (QE). Empirical evidence² supports the effectiveness of the programs in calming financial markets and stimulating economic activity. In this article, we summarise the conclusions of a quantitative framework (Gertler and Karadi (2011, 2013)), which gives a compelling description of the macroeconomic effects of these non-standard measures.

The initial asset purchase program was followed by subsequent programs over the years.³ Empirical evidence, however, suggests that none of these were as effective as the initial QE1, which mostly involved purchases of private assets during tense market conditions. What explains this observed difference in the effectiveness of the programs? And why were they effective in the first place?

The framework

Our starting premise is that through LSAPs, the central bank temporarily substitutes impaired private financial intermediation. Similarly to private intermediation, the central

bank funds its asset acquisitions by issuing interest-bearing short-term claims: excess reserves, which can be thought of as overnight government debt. LSAPs can affect

real activity only to the extent that financial impairments constrain frictionless private financial intermediation. If an abnormal return on a particular asset is present, one would expect private intermediaries to expand their balance sheets to eliminate this premium, as long as they do not face any funding constraints. In this case, LSAPs would be neutral with no effects on yields or on the economy, simply crowding out private intermediation.

If, however, private intermediaries are constrained in their ability to borrow, LSAPs can be important. The advantage the central bank has is that it is able to obtain funds elastically by issuing riskless reserves even under tense market conditions. Net benefits from LSAPs can be positive, even if the central bank intermediation is less efficient than private sector intermediation, provided that this efficiency differential is not “too large”. Along these lines, one can interpret QE1 in the

United States as the Federal Reserve increasing central bank credit provision⁴ in order to offset the disruption of private intermediation brought about by the demise of the shadow banking system following the Lehman collapse.

As the main friction in the framework is the funding constraints of banks, long-term refinancing operations by the ECB, which provide funding to banks for high quality collateral, have comparable effects to direct asset purchases.

A similar logic applies to the purchase of long-term government bonds. In the absence of limits to arbitrage in the private sector, the central bank exchanging short-term reserves for long-term government debt should be neutral. To the extent that credit market frictions give rise to an abnormal term premium in the market for government bonds, however, there is scope for LSAPs to reduce long-term rates. Of course, one should expect limits to arbitrage to be weaker in markets for government bonds than for private securities. This implies that a US dollar purchase of government bonds has a weaker effect on excess returns, and thereby on economic activity, than a US dollar purchase of private sector assets.

This accords with the conventional wisdom that the liquidity of the government bond

Asset purchases in more impaired markets have greater macroeconomic effects.

¹ New York University.

² See, for example, Krishnamurthy, Vissing-Jorgensen, 2011, Gambacorta, Hoffman, Peersman, 2011, Williams, 2011.

³ It involved purchases of mostly private assets (debt and mortgage-backed securities of mortgage refinancing agencies (AMBS)) reaching 12% of the US gross domestic product. The second wave of purchases (QE2) was announced in October 2010, during calmer market conditions. It involved purchases of long-term government debt at around 4% of the GDP. Finally, in September 2011, the Federal Reserve embarked on QE3, a maturity extension program that was essentially a sterilised acquisition of long-term government bonds financed by selling some of its short-term bonds.

⁴ Here it is interesting to note that the Federal Reserve chairman, Ben Bernanke, used the term “credit easing” to describe the first round of LSAPs. We think this is a more accurate term than quantitative easing.

Through large-scale asset purchases, the central bank temporarily substitutes impaired private financial intermediation.

market makes purchases of this asset less effective, everything else being equal, than purchases of less liquid assets, such as AMBSs or commercial paper.

The framework is a standard quantitative macroeconomic model extended by a financially constrained banking sector. As banks are the major providers of credit to the private sector, the balance sheet position of the banking sector becomes a critical determinant of the cost of credit that borrowers face. Through the credit conditions, in turn, banks' financial conditions will influence economic activity. The central bank can conduct monetary policy either by adjusting the short-term interest rate (as long as the zero lower bound allows for further easing) or by engaging in asset purchases. The central bank may purchase long-term government bonds as well as private securities.

Chart 5 presents impulse responses to purchases of private versus government securities in the framework, while keeping the short-term interest rate fixed for a year. The calibration of the model economy is informed by US data. The dotted line illustrates the response to purchases of long-term government bonds, imitating the actual path of purchases during the second round of quantitative easing in the United States (QE2). The solid lines show the counterfactual effects of a similar size purchase of private securities.

The decline in long-term credit rates produces a peak increase in output of 1%, with an increase in inflation and asset prices, roughly consistent with event study evidence. The effects on the main macroeconomic variables mirror those of conventional monetary policy easing.

The similarity between conventional and non-standard easing explains why the LSAP programs are more effective when the zero lower bound is binding: their effect is not offset by the stabilizing effects of standard interest rate policy.

The LSAPs work, ultimately, by reducing excess returns: asset price increases raise the equity value of financial intermediaries, thereby alleviating their funding constraints. This leads to credit easing with a corresponding fall in the term premia of the government bonds⁵ and the yield spread of the corporate bonds. The lion's share of the drop in the ten-year government bond rate – roughly ten out of the overall twelve basis point drops – is due to a decline in excess returns.

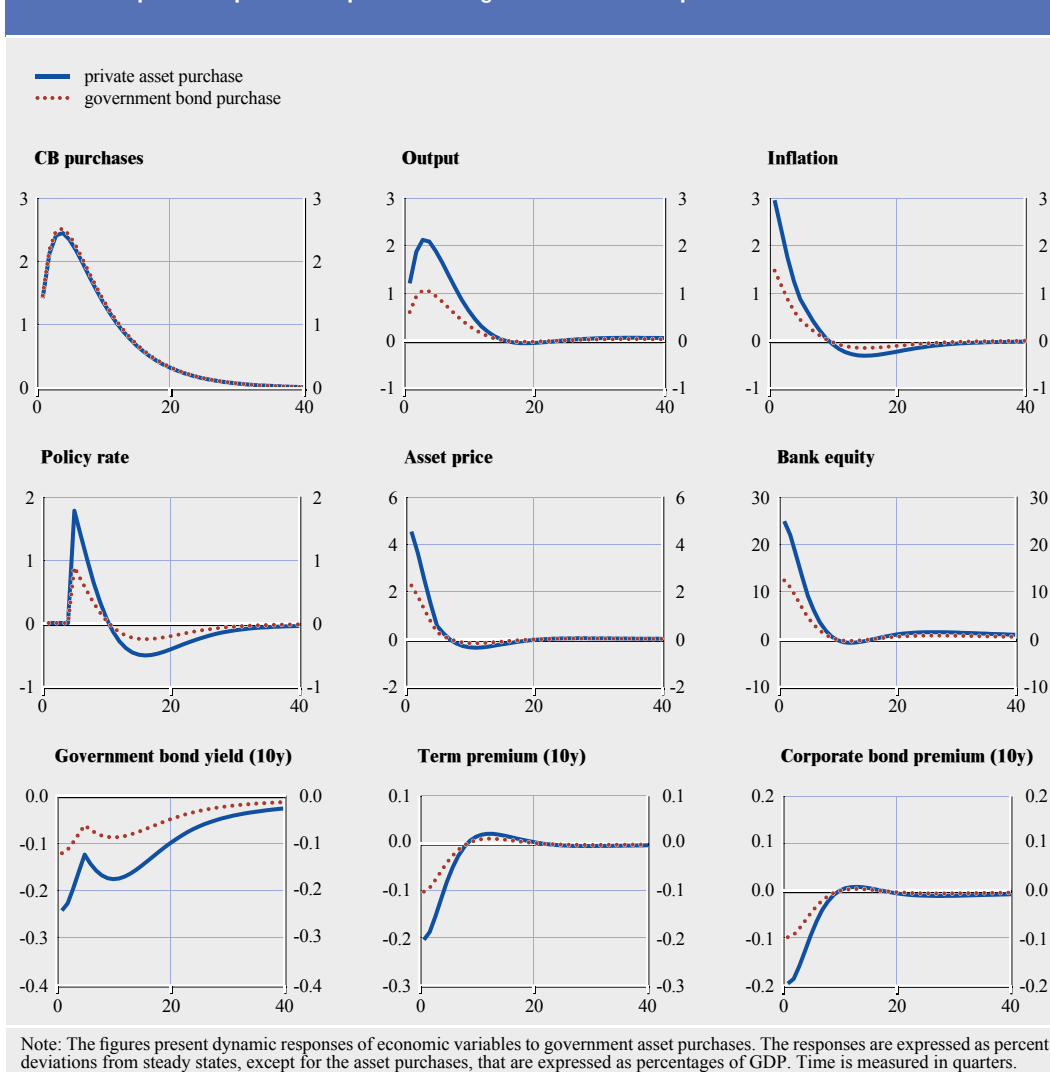
Finally, the figure shows that, broadly in line with the evidence, an equivalent size purchase of the private security has roughly double the effect on long-term bond yields and the rest of the economy. The exact difference depends on the assumption about the strength of the financial friction that inhibits arbitrage in each case. However, provided that the friction is greater for private securities than for government bonds, purchases of the former will have stronger effects than those of the latter.



⁵ The term premium is measured as the spread between the ten-year bond rate and the yield to maturity on the ten-year "risk-free" swap rate (i.e. the rate on a security that pays the short rate each quarter for ten years that would be priced by the household).



Chart 5 Impulse responses to private and government asset purchases



Conclusions

The framework was designed to provide a unified way in which to think about the various LSAP programs that the US Federal Reserve has pursued over the course of the recent crisis. However, this may also prove useful for analysing new programs currently under consideration, as well as some of the LSAPs pursued by other central banks. Though the details differ, the long-term refinancing operations (LTROs) undertaken by the ECB have a similar flavour to the LSAPs that we have been analysing. Under the LTROs,

the ECB does not directly purchase assets: However, it does so indirectly by accepting the assets as collateral for loans to participating banks. In particular, it provides three-year variable rate credit to banks for loans collateralised by assets it deems acceptable, including certain government bonds, certain asset-backed securities and even certain types of bank loans. The haircuts on the collateral vary according to the risk class. As with LSAPs, for LTROs to be effective, private intermediaries must be constrained in their ability to perform the same type of arbitrage as the central bank.

A potential caveat arises from the assumption of cooperative maturity policy by the fiscal authority, postulating that the purchase of long-term government bonds is not going to be reversed by lengthening the maturity of new

issuance. It should be noted, therefore, that uncooperative maturity policy has the potential of fully eliminating the effectiveness of large-scale purchases of long-term government assets.



REFERENCES

- Bernanke, B. (2009)**, *The Crisis and the Policy Response*, Speech given at the Stamp Lecture, London School of Economics, 13 January.
- Gambacorta, L., B. Hoffman, and G. Peersman (2011)**, *The Effectiveness of Unconventional Monetary Policy at the Zero Lower Bound: A Cross-Country Analysis*, unpublished manuscript.
- Gertler, M. and P. Karadi (2011)**, “A Model of Unconventional Monetary Policy”, *Journal of Monetary Economics*, pp. 17-34.
- Gertler, M. and P. Karadi (2013)**, “QE1-2-3: A Framework for Analysing Large-Scale Asset Purchases as a Monetary Policy Tool”, *International Journal of Central Banking*, pp. 5-53.
- Krishnamurthy, A. and A. Vissing-Jorgensen (2011)**, “The Effects of Quantitative Easing on Interest Rates: Channels and Implications for Policy”, *Brookings Papers on Economic Activity*, pp. 215-87.
- Williams, J. C. (2011)**, “Unconventional Monetary Policy: Lessons from the Past Three Years”, *Economic Letter*, 2011-31, Federal Reserve Bank of San Francisco.



Box

PROGRESS OF THE MACRO-PRUDENTIAL RESEARCH NETWORK (MaRs) TWO YEARS ON

Since 2010 the European System of Central Banks (ESCB) has been running the Macro-prudential Research Network (MaRs). By drawing lessons from the financial crisis, the objective of MaRs is to develop core conceptual frameworks, models and tools that can provide research support for macro-prudential supervision in the EU. It is organised in three work streams (WSs):

- Macro-financial models linking financial stability and the performance of the economy (WS1);
- Early warning systems and systemic risk indicators (WS2); and
- Assessing contagion risks (WS3).

In September 2012, the network published a report summarising its progress over the two years that it has been in operation. This box provides a short summary of the report.¹

A central task for WS1 is to develop theoretical and empirical frameworks that integrate realistic characterisations of widespread financial instability into models of the aggregate economy. WS1 researchers have delivered several new developments along these lines, thereby addressing one of the main weaknesses of contemporaneous economics laid bare by the crisis. Following these efforts in relatively fundamental research, work has now turned to the development of a model that can be used to assess a range of macro-prudential regulatory policy instruments. This is a collective project involving several central banks from the ESCB and is aimed at providing an analytical tool that is ultimately used for supporting practical policy-making.

WS2 was designed to conduct relatively practical research, which could be of more immediate use for policy. The research was aimed at improving indicators of current systemic stress and identifying early warning indicators for systemic financial instability and widespread imbalances, both for the EU as a whole and at the individual country level. Accordingly, various measures of the current level of systemic instability have been proposed in the context of WS2, ranging from the application of well-established methodologies to European data to new developments. A cross-country project has led to the establishment of a database of banking, currency and fiscal crisis events that provides a homogeneous basis for assessing the performance of systemic stress and early warning indicators. The database is available online to interested researchers.

One of the main directions of WS3 is to assess the scope for cross-border bank contagion across EU countries. The output included research results relating to relevant interbank market structures, the amplification and non-linear effects of fire sales and macro spillovers derived from euro area financial accounts. Another strand of work delivered several approaches for assessing sovereign contagion effects.

MaRs has made significant progress over the last two years. Its work is becoming even more relevant against the background of the current proposals for establishing a Single Supervisory

¹ The full report, detailing all research contributions, can be downloaded from the ECB's website: <http://www.ecb.europa.eu/pub/pdf/other/macprudentialresearchnetworkreport201210en.pdf>. Ongoing information about MaRs research papers, conferences and related speeches can be found under http://www.ecb.europa.eu/home/html/researcher_mars.en.html.

Mechanism (SSM) in Europe. It is envisaged that the SSM will also have the power to design macro-prudential policies aimed at systemic stability.

Participating central banks would find it desirable to see the wider economics community, in particular academic research and teaching, pursuing more decisively some of the main areas of research currently being explored in the context of MaRs – notably the development of aggregate frameworks incorporating widespread financial instability and their use for the assessment of macro-prudential regulatory instruments. MaRs will continue its work in 2013. A report of its main results is planned for the spring of 2014.



RESEARCH BULLETIN 18

RECENT JOURNAL PUBLICATIONS BY ECB STAFF



Beaupain, R. and Durré, A. (2013), “Central bank reserves and interbank market liquidity in the euro area”, *Journal of Financial Intermediation*, Vol. 22, Issue 2, April, pp. 259-284.

Calza, A., Monacelli, T. and Stracca, L. (2013), “Housing finance and monetary policy”, *Journal of the European Economic Association*, Vol. 11, Issue Supplement s1, January, pp. 101-122.

Dedola, L. and Lombardo, G. (2012), “Financial frictions, financial integration and the international propagation of shocks”, *Economic Policy*, Vol. 27, Issue 70, April, pp. 319-359.

Dedola, L., Lombardo, G. and Karadi, P. (2013), “Global implications of national unconventional policies”, *Journal of Monetary Economics*, Vol. 60, Issue 1, January, pp. 66-85.

Dias, D., Dossche, M. Gautier, E., Hernando, I., Sabbatini, R., Stahl, H. and Vermeulen, P. (2012), “Price setting in the euro area: some stylised facts from individual producer price data”, *Journal of Money, Credit and Banking*, Vol. 44, Issue 8, December, pp. 1631-1650.

Gali, J., Smets, F. and Wouters, R. (2012), “Slow recoveries: A structural interpretation”, *Journal of Money, Credit and Banking*, Vol. 44, Issue Supplement s2, December, pp. 9-30.

Genre, V., Kenny, G., Meyler, A. and Timmermann, A. (2013), “Combining expert forecasts: Can anything beat the simple average?”, *International Journal of Forecasting*, Vol. 29, Issue 1, January-March, pp. 108-121.

Gertler, M. and Karadi, P. (2013), “QE1-2-3 — A framework for analysing large-scale asset purchases as a monetary policy tool”, *International Journal of Central Banking*, Vol. 9, Supplemental Issue 1, January, pp. 5-53.

Giannone, D., Henry J., Lalik M. and Modugno M. (2012), “An area-wide real-time database for the euro area”, *Review of Economics and Statistics*, Vol. 94, Issue 4, pp. 1000-1013.

Goodhart, C., Kashyap, A., Tsomocos, D. and Vardoulakis, A. (2013), “An integrated framework for multiple financial regulations”, *International Journal of Central Banking*, Vol. 9, Supplemental Issue 1, January, pp. 109-143.

Imprint

The opinions expressed in this publication are those of the authors and do not necessarily reflect those of the European Central Bank. Editors: Günter Coenen, Michael Ehrmann, Philipp Hartmann, Geoff Kenny, Manfred Kremer, Filippo di Mauro, Frank Smets and Oreste Tristani. Responsible editor for this edition: Filippo di Mauro. Assistance to editors: Sabine Wiedemann. Contact for general information and subscription to the Research Bulletin: ECB-ResearchBulletin@ecb.europa.eu

© European Central Bank 2013

Address: Kaiserstrasse 29, D-60311 Frankfurt am Main, Germany

Telephone: +49 69 1344 0

Fax: +49 69 1344 6000

Internet: <http://www.ecb.europa.eu>

All rights reserved.

Any reproduction, publication and reprint in the form of a different publication, whether printed or produced electronically, in whole or in part, is permitted only with the explicit written authorisation of the ECB or the author(s).

ISSN 1977-12x (online)

EU catalogue number QB-AB-13-018-EN-N