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Financial instability in macroeconomics: a set of new structural models

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Before the crisis most standard macroeconomic models did not incorporate credit or banking instability. This made such models inappropriate for the analysis of financial crises and macroprudential policies. Parts of the economics profession are now addressing this significant shortcoming. For example, the Macroprudential Research Network (MaRs) of the European System of Central Banks (ESCB), which recently reported its results after three and a half years of work (ECB 2014), has made the integration of realistic characterisations of financial instability into macroeconomic models a key priority.

The MaRs research agenda stresses, inter alia, that in the models financial instability would need to originate from imperfections in the functioning of the financial sector and highlights the significance of three essential features for characterising financial instability in a macroeconomic model: drastic non-linearities, the endogenous building-up and unravelling of credit imbalances, and bank defaults (in equilibrium). A number of MaRs papers have sought to integrate one or more of these features into models – in some cases to explain the origins of severe financial crises, in others to assess their drastic impact on the economy at large, and in still others to assess macroprudential regulatory policies.

This article is a follow-up to the Research Bulletin article of Hartmann et al. (2013a), which provided a concise survey of the emerging theoretical literature on integrating widespread financial instability into macroeconomics and outlined one empirical macroeconomic model, highlighting systemic financial instability and the non-linearities it may cause at the aggregate level. The present article describes in detail four key structural macroeconomic models that incorporate financial instability and were developed in papers produced within MaRs. The first paper incorporates one of the early macro-financial instability theories into a more standard dynamic stochastic general equilibrium (DSGE) model; examines tractable methods for solving the model, capturing non-linearities; and assesses the macroeconomic impact of financial instability. The second paper takes a unique step towards modelling the endogenous build-up of credit imbalances, the non-linear unravelling of which constitutes a crisis. The third and fourth papers build widespread bank and borrower defaults into general equilibrium models and discuss optimal macroprudential policies (capturing both their benefits and their costs). Proceeding in this order, the article moves increasingly away from the pre-crisis macroeconomic paradigm, although all the models build on first principles.

Capturing aggregate non-linearities

There is empirical evidence that the behaviour of the economy changes significantly in a financial crisis, exhibiting non-linearities (Hubrich and Tetlow (2014); and Hartmann et al. (2013b)). Asset prices, credit and output co-move strongly in a way that is not observed during "normal" times. A number of theoretical studies (for example Brunnermeier and Sannikov (2014); and He and Krishnamurthy (2012)) have characterised such aggregate non-linearities by means of occasionally binding financing constraints.[1] One challenge is that, while the global solution methods they apply in order to properly capture the non-linearities can be used to solve relatively stylised macro models with one or two state variables, they are, however, hard to apply to the widely used larger-scale models that have a more elaborate representation of the macroeconomy. The MaRs paper by Dewachter and Wouters (2014) uses a local solution method that is able to capture non-linearities similar to those present in He and Krishnamurthy's model and that is not limited by the number of state variables. In other words, they develop a framework that allows for a richer discussion of the non-linear macroeconomic implications of financial instability.

The He and Krishnamurthy mechanism relies on an endogenously derived amount of financial intermediation influenced by moral hazard in a contracting problem between households and intermediaries. If intermediaries experience negative portfolio investment outcomes, households reduce the equity they invest in them. When intermediaries' equity falls below a certain level, the amount of funds they can invest in risky assets starts to be constrained. Above that level no such constraint operates, hence the non-linearity. The main purpose of He and Krishnamurthy's analysis is to show how intermediary equity and asset prices relate to each other. For example, when the equity constraint becomes binding, the model produces a decline in the risk-free interest rate and an increase in the Sharpe ratio, the risk premium, conditional volatility and the price correlation between different assets, which resemble those observed in financial crises.

A reputation/equity constraint on financial intermediaries can amplify aggregate fluctuations in a large-scale macro model. Moreover, a non-linear solution approach captures the data better than a linear one.

Dewachter and Wouters (2014) approximate the above occasionally binding constraint by using a non-linear but continuous equation that links the investment "reputation" of the intermediaries with the amount of equity provided by households to intermediaries. The equation is non-linear in that, as intermediary reputation declines, there is a disproportionate increase in the constraining effect on intermediary equity.[2] In contrast to He and Krishnamurthy, the DSGE model into which this non-linearity is incorporated also features firms and their real investment, as well as the typical real and nominal rigidities (such as capital adjustment costs, consumption habit effects and Calvo mechanisms in wage and price-setting) that are

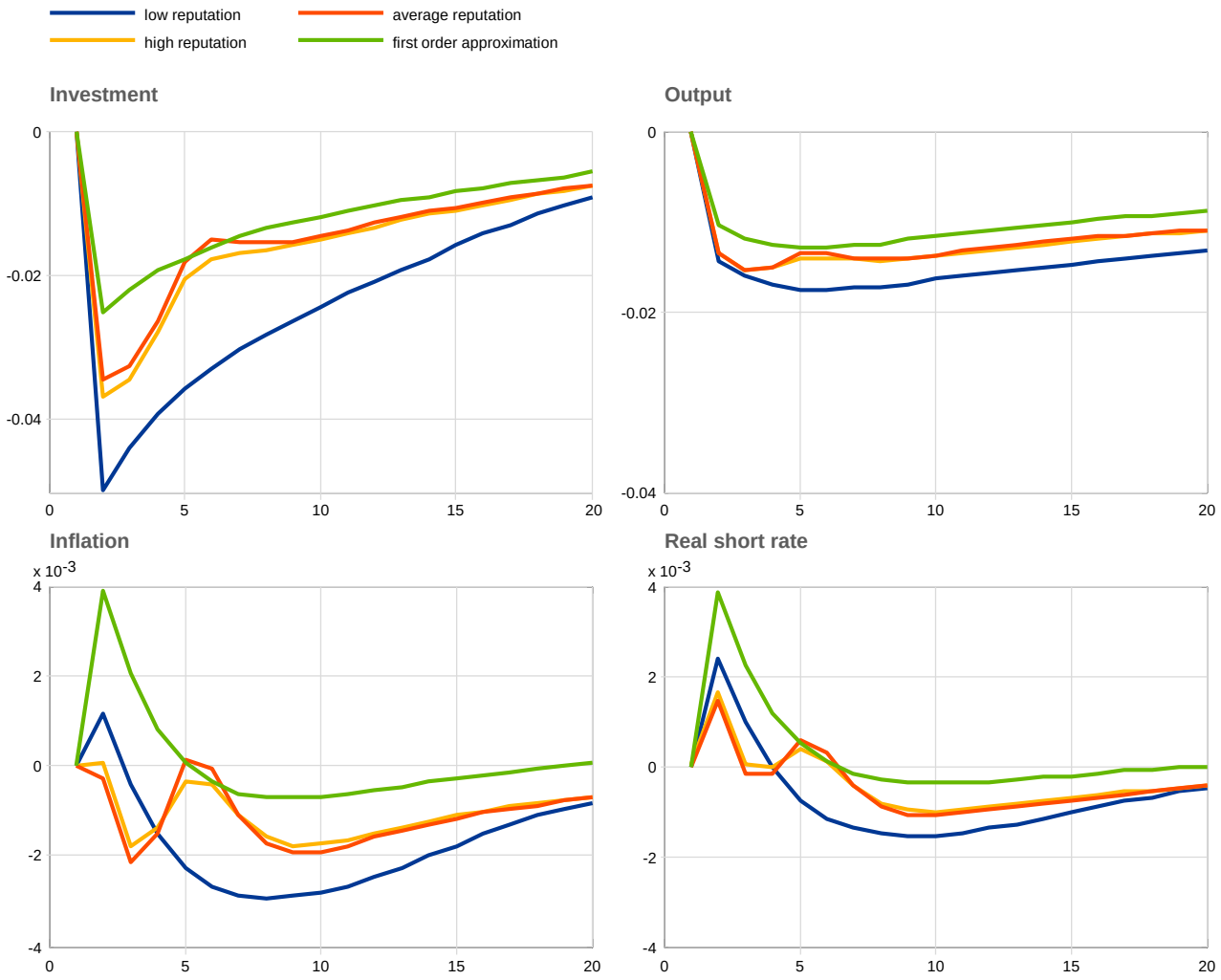
1 For example, Mendoza (2002, 2010), Lorenzoni (2008) and Bianchi (2011) also used such financing constraints to discuss features of crises. The constraints are sometimes binding and sometimes slack. They typically bind after a negative shock of sufficient severity, which makes their impact on the real economy very asymmetric and captures some of the non-linearities that macroprudential policy tries to attenuate.

2 Continuously binding symmetric collateral constraints were introduced in the macro literature by Kiyotaki and Moore (1997). The constraint included in Dewachter and Wouters' paper, however, is not based on tangible collateral, but on the drying-up of funding markets, and is asymmetric between economic upturns and downturns.

included in standard macroeconomic models in order to capture empirical macroeconomic regularities. The baseline model has six crucial state variables and the most elaborate version includes eleven state variables.

Chart 1

Impulse response functions of four macro variables to a negative productivity shock



Source: Dewachter and Wouters (2014), Figure 9.
Notes: All impulse response functions (IRFs) are expressed in terms of deviations from steady state. The vertical axes are scaled in fractions and the horizontal axes in quarters. "first order approximation" refers to a linear approximation. All other IRFs are third order, i.e. non-linear, and are conditional on different levels of intermediary reputation ("high", "low" and "average").

In this way, Dewachter and Wouters not only capture asset price dynamics, but also propose a broad representation of their transmission channels to the real economy. In particular, they identify what they call a "risk channel" through which the reputation/equity constraint on intermediaries can amplify aggregate fluctuations. Moreover, the authors show that, while still an approximation to the "true" non-linear model, their local solution method with third-order approximations can better capture the data than a simple first-order (linear) approximation. Chart 1 illustrates their results for the impulse responses of four macro variables to a negative one standard deviation productivity shock. The impulse response functions (IRFs) shown as a green line correspond to the first-order approximation in which the non-linear risk

channel is essentially shut down. The other three IRFs correspond to third-order approximations for a low, medium and high intermediary reputation/equity respectively. Generally speaking, the risk channel makes downturns more severe and more persistent. It works primarily via real investment of firms (see the upper left panel in Chart 1) and only to a very limited extent via consumption of households (not shown in Chart 1). Finally, it only has a heavy impact on the macroeconomy when the reputation/equity of intermediaries is low (IRFs shown as a blue line).

Bank debt funding liquidity fuels credit boom-bust cycles

In the work by He and Krishnamurthy (2012) and Dewachter and Wouters (2014), the equity of financial intermediaries and how it can act as a binding constraint for the economy as a whole takes centre stage. However, no particular attention is paid to the fact that, historically, financial imbalances – such as credit booms – build up over extended periods of time until they unravel and destabilise the economy.[3] The MaRs paper by Boissay et al. (2013) explains, using a non-linear quantitative macroeconomic real business cycle model, how the dynamics of banks' debt funding can occasionally contribute to the slow emergence of credit booms that subsequently break down and cause a financial and economic crisis.[4]

At the root of these boom-bust cycles, which the authors also term "financial recessions" (as opposed to "non-financial recessions" that are not preceded by a credit boom and are therefore much less severe), is a moral hazard problem between banks in the interbank funding market. There are two types of bank: efficient banks, which lend productively to firms; and inefficient banks, which may invest funds in ways that bring them private benefits but leave their creditors unable to seize the funds. Asymmetric information implies that banks lending in the interbank market do not know which of these two categories their counterparties fall into. A crisis is triggered when the share of inefficient banks borrowing in the interbank market becomes too large, lending banks start to distrust their counterparties and the market breaks down. This drying-up of wholesale funding severely constrains banks' lending to firms.[5]

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3 The notion that banking crises are endogenous and follow prosperous times has already been presented in Minsky (1977) and Kindleberger (1978). For a more recent theoretical exploration, see Danielson, Shin, and Zigrand (2011). Econometric evidence that financial crises follow long credit booms is provided in Schularick and Taylor (2012). ECB (2009) and de Bandt, Hartmann and Peydró (2014) survey the literature on the endogenous build-up and unravelling of widespread imbalances as a source of systemic risk.

4 Another structural macroeconomic model developed in a paper produced within MaRs explains credit boom-bust cycles that feature bubbles on banks' asset side. This paper by Aoki and Nikolov (2012) is not covered in the present article, because it has already been the subject of a previous article (see Research Bulletin No 15, spring 2012).

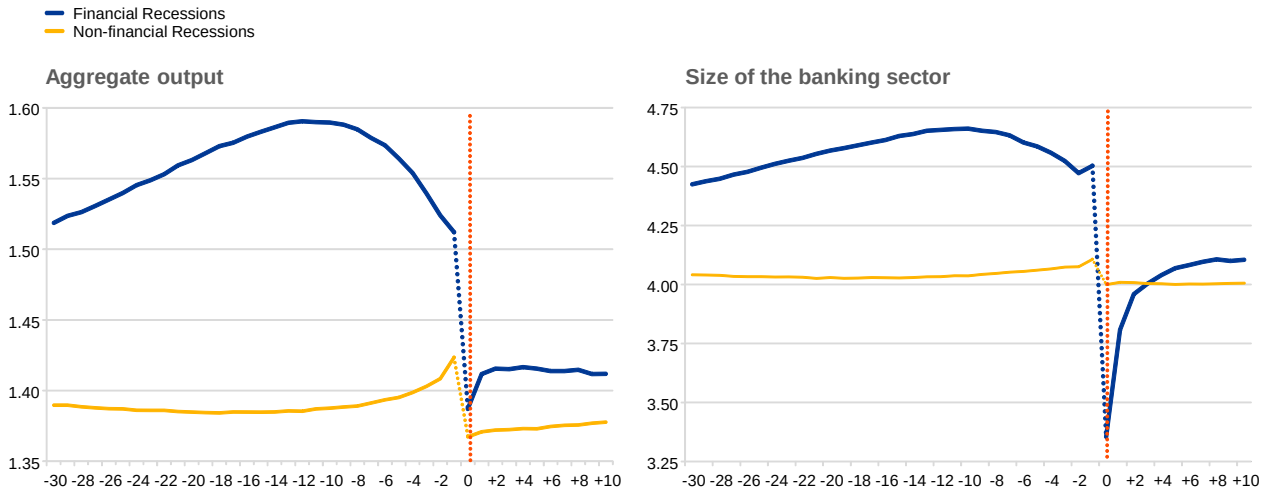
5 Shin (2010, Chapter 8), for example, depicts the demise of British bank Northern Rock in 2007 as primarily originating from its reliance on short-term funding and the sudden freeze of the short-term funding market – what the author refers to as a "modern bank run". Perri and Quadrini (2014) recently proposed a model that combines collateral constraints and self-fulfilling expectations, where large recessions may also follow credit booms even in the absence of fundamental shocks. Gertler and Kiyotaki (2013) develop a model in which bank retail depositor runs induce changes in the economic regime.

The severity of the recession is determined by the nature of the business cycle – whether or not a credit boom is under way – and not by the size of the shock.

The credit boom preceding such a banking crisis and, particularly, the "savings glut" that drives it at an advanced stage are key to the run of events portrayed in the model. A sequence of favourable, non-permanent, supply shocks hits the economy. The resulting increase in productivity leads to rising demand for credit on the part of firms. The efficient banks expand their corporate lending, funding it, inter alia, by borrowing from the inefficient banks in the interbank market. The size of the banking sector increases, firms invest more and the economy booms (consumption also rises because households earn greater returns on their savings). But, as supply shocks run their course, the probability that productivity will revert towards average levels also increases. At some point, this starts to dampen corporate demand for loans while, at the same time, inducing households to accumulate more savings in order to smooth consumption. As this savings glut develops, interest rates decline, consequently, the inefficient banks become able to finance their unproductive activities through borrowing in the interbank market. Given that the identity of these banks is unknown to lenders, general counterparty risk in the interbank market increases, which leads to an overall reduction in interbank lending. Boissay et al. (2013) show that there is a threshold value of interest rates below which the interbank market freezes, corporate credit collapses, and investment and consumption adjust in a drastic discontinuous downturn.

Chart 2

Dynamics of the real economy and the financial sector around recessions



Source: Authors, based on Boissay et al. (2013).
Notes: The horizontal axis is scaled in terms of the number of years before and after the trough of a recession (the trough is 0, which also corresponds to the first year of crisis in a financial recession). The vertical axis is scaled in terms of the quantity of the consumption good, which is the numeraire. The size of the banking sector is measured as its total assets (i.e. the sum of corporate and interbank loans in the economy).

Chart 2 illustrates the dynamics of output (left panel) and the size of the banking sector (right panel) around financial and non-financial recessions. It shows the results of a version of the model that is calibrated to match the historical frequency of crises in developed countries, as well as the average risk-free interest rate and the spread between the corporate lending rate and the risk-free interest rate in the United States. Long before a financial recession occurs, bank assets and output grow far above their trend levels. But at some point the boom slows down and ultimately finishes with a collapse of the banking sector. This sharply contrasts with non-

financial recessions, around which bank assets and output stay relatively close to their trend levels. Financial and non-financial recessions have one feature in common, however: both are triggered by a rather mild, almost identical, negative productivity shock. In other words, what determines the severity of the recession is the nature of the business cycle – in particular, whether or not a credit boom is under way – not the size of the shock. Chart 2 shows that the fall in output and bank assets (but also in other variables, such as consumption and investment, which are not displayed in the chart) is much sharper in financial recessions than in non-financial recessions. Notably, the large discontinuity that ends a credit boom illustrates the powerful non-linearities at work in the model.

Bank defaults and the benefits and costs of capital requirements: the 3D model

Although the works by Dewachter and Wouters (2014) and Boissay et al. (2013) are important advances towards including non-linearities and endogenous credit imbalances in macroeconomic models, they do not, in their current versions, take the extra steps needed to assess the merits of financial regulatory policies designed to prevent or reduce the costs of financial crises. To assess such macroprudential policies, MaRs conducted a joint cross-country project, aimed at developing a model specifically designed for this (see Clerc et al., 2015). It adds a number of financial instability channels – most importantly, an explicit treatment of bank default – to an otherwise standard macroeconomic model. To allow for a welfare analysis of policy interventions, the model captures both the benefits and costs of macroprudential regulatory measures.[6]

Capital regulation can be used as a welfare-improving response to excessive risk-taking by banks and the economic fragility that it creates.

It is termed a "3D model" on account of the unique fact that all three sectors considered (banks, households and firms) exhibit positive equilibrium default rates.[7] The model is centred around heterogeneous banks that use equity capital and deposits to finance mortgage loans to households and corporate loans to firms. Excessive bank risk-taking arises as an unintended side effect of public safety nets. While such safeguards may be needed for consumer protection and to ward against runs on short-term liabilities, they also partially insulate banks' funding costs from their risk-taking. This leads to increased bank risk-taking and a build-up of credit imbalances (in the form of excessive credit). As a result, in the absence of regulation, borrower and bank defaults are relatively high, especially following large negative shocks, which is costly for the economy.

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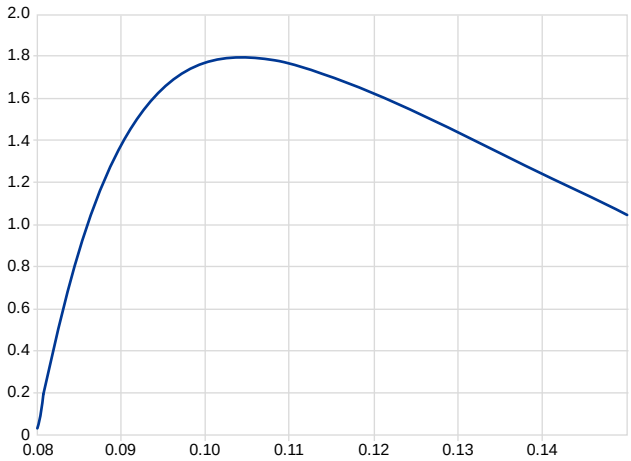
6 Martinez-Miera and Suarez (2014) and Nguyen (2013) similarly examine the benefits and costs of financial regulation in a macroeconomic model with bank defaults (in equilibrium).
Putting these developments into perspective, it should be borne in mind that the "state of the art" of macroeconomic models at the time when the two main studies of the Basel III regulatory reforms were conducted (i.e. Basel Committee (2010) and Macroeconomic Assessment Group (2010)) did not include any approach that could compare the costs and benefits of macroprudential regulatory measures within a single coherent model. Therefore, the costs and benefits had to be added up separately and then compared using a multiplicity of different approaches.

7 For early work highlighting the importance of default in general equilibrium for understanding financial instability phenomena, see Geanakoplos (2003).

Chart 3

Social welfare effects from different capital ratios

(y-axis: percent; x-axis: bank capital ratio)



Source: Clerc et al. (2015).
Notes: The horizontal axis shows the publicly imposed ratio of risk-weighted bank assets (mortgage loans to households and corporate loans to firms) to bank equity. The vertical axis shows the change in equivalents of aggregate consumption for different capital ratios relative to the level of consumption implied by the Basel II capital ratio of 8%.

The 3D model suggests that capital regulation can be used as a welfare-improving response to excessive risk-taking by banks and the economic fragility that it creates. When capital ratios are low, increasing them helps to correct banks' tendency to take on too much risk. This has the benefit of reducing bank and borrower defaults and therefore increases welfare. The costs of capital requirements derive from the fact that banks' equity funding in the model is limited by the wealth endogenously accumulated by the bankers who own and manage the banks. Thus, capital requirements force banks to make greater use of bankers' limited wealth, which has a contractionary impact on credit provision and economic activity. There is therefore an optimal level of capital requirements, which reflects the trade-off between the benefits and costs of regulation. This is illustrated in Chart 3, which shows the implications of different capital ratios for aggregate consumption in the model calibrated to the euro area. The calibration is also done in a way that the Basel II capital ratio of 8% coincides with the origin. Welfare effects of changing capital requirements can therefore be assessed relative to that level. Notice that the shape of this welfare representation resembles very much the shape of representations purely based on empirical measures of the benefits and costs of capital requirements (see, for example, Miles et al. (2013), Figures 6 and 7).

Bank defaults, shadow banking and multiple financial regulations

In its current version, the 3D model includes only bank capital regulation as a macroprudential policy instrument. In practice, however, there are many more regulatory instruments that could be used for macroprudential purposes and the effects of which on the macroeconomy have yet to be understood. In another MaRs paper, Goodhart et al. (2013) propose an integrated macroeconomic framework to analyse the effects of multiple policy instruments. To this end, and unlike any other paper on this subject to date, they introduce multiple financial frictions typically associated with financial instability in a static but otherwise very rich general equilibrium model. The model includes, inter alia, shadow banks (in addition to traditional banks), defaults (in equilibrium) for both types of financial intermediary and liquidity risk, but a less elaborate representation of the macroeconomy than the other three papers covered in this article. Using this framework it is possible to identify the effectiveness of individual policy instruments, as well as their joint effects and interactions.[8]

[8] Four regulatory instruments are considered for commercial banks (namely capital requirements, limits on loan-to-value ratios, liquidity coverage ratios and dynamic loan provisioning) and one instrument for shadow banks (margin requirements on repurchase agreements).

In the model, commercial banks repackage mortgage loans into mortgage-backed securities (MBS) and sell the MBS to shadow banks. The shadow banks finance their MBS purchases by issuing equity and by borrowing from commercial banks through the market for repurchase agreements (repos). Goodhart et al. (2013) assume that (i) shadow banks have a greater appetite for risk than commercial banks, and therefore are the natural buyers of MBS, and (ii) shadow banks cannot issue equity easily (they are capital constrained). When commercial banks need to deleverage (for example, in periods of stress), they tend to sell off mortgages in order to pay back their debt and hence to supply more MBS. At the same time, they tend to reduce repo lending to shadow banks, which induces a fall in the demand for MBS on the part of shadow banks. The concomitant fall in the demand for and increase in the bank supply of MBS triggers a fire sale and a sharp decline in MBS prices, which depletes shadow banks' equity, leading to repo defaults and capital losses for commercial banks. The banks do not internalise these fire sale externalities, which are key for economic performance in this model, thus there is a case for financial regulation. For example, building up counter-cyclical buffers in good times, such as via time-varying liquidity or capital requirements, would limit deleveraging in periods of stress, and therefore the size of fire sales. At the same time, however, a tightening of regulation that only affects commercial banks may lead to regulatory arbitrage in the model, since business would migrate to shadow banks.

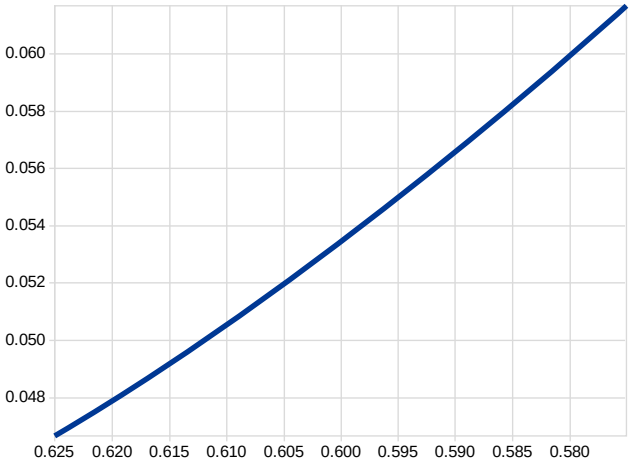
For macroprudential policy tools to be effective, they must not be used in isolation. Their interactions must also be taken into account, as well as the distortions they are ultimately intended to address (rather than the sector they apply to).

An important part of the contribution of Goodhart et al. (2013) is the analysis of how different regulatory instruments interact with each other. For example, a reduction in the loan-to-value ratio (LTV) on mortgages reduces the demand for mortgage loans and weighs on the demand for housing and on house prices. The fall in house prices, however, induces higher margin charges on repo loans that use MBS as collateral, further reducing the volume of mortgages. Chart 4 illustrates this relationship between LTV ratios and repo margins. This complementary nature has two implications. First, different macroprudential policy measures applied to very different sectors (in this case households and shadow banks) may have similar effects on the economy. Second, if the regulator wanted to act on repo margins, a smaller intervention would be needed if policy actions were also taken on LTV ratios.

Chart 4

Effects of loan-to-value ratios on repo margins

(y-axis: endogenous margins in repo loan; x-axis: tightening loan to value requirements)



Source: A. Vardoulakis, based on Goodhart et al. (2013).
Notes: The horizontal axis shows the publicly imposed loan-to-value (LTV) ratio as a fraction of the house value. A decrease in the LTV ratio corresponds to a tightening of policy, therefore, the scale is reversed and the LTV ratio declines going from left to right. The vertical axis shows the margin required on the repo market (or, equivalently, the haircut on the mortgage-backed securities pledged as collateral on the repo market) as a fraction of the nominal repo value. The upward-sloping line describes how the margin on the repo market endogenously increases as the LTV ratio is reduced.

By contrast, the effects of bank liquidity requirements and repo margins may offset each other. On the one hand, an increase in liquidity requirements induces commercial banks to repackage illiquid mortgage loans into liquid MBS. On the other hand, an increase in repo margins reduces shadow banks' ability to purchase MBS, making it more costly for commercial banks to issue them. All in all, for macroprudential policy tools to be effective, they must not be used in isolation. Their interactions must also be taken into account, as well as the distortions that they are ultimately intended to

address (rather than the sector they apply to). Indiscriminate combinations of instruments could easily make matters worse.

Concluding remarks

The MaRs research agenda and this article have focused strongly on financial instability, crises and macroprudential policy. But the severe financial instabilities observed after the summer of 2007 also contributed to major monetary policy actions, in particular unconventional monetary policy measures. Therefore, it is important for future research to incorporate similar representations of widespread financial instability into macroeconomic models for monetary policy analysis. This will not only allow more light to be shed on the analytical foundations of unconventional monetary policies, but will also enable the interactions between macroprudential and monetary policies to be studied.

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The financial and macroeconomic effects of OMT announcements

by Michele Lenza[9]

In the third quarter of 2012 the ECB announced that it could conduct Outright Monetary Transactions in secondary sovereign bond markets. This article adopts an event study approach to estimate the effects of the announcements on government bond yields in France, Germany, Italy and Spain. The results of the event study are used to evaluate the related macroeconomic effects in the context of a multi-country model of the macro-financial linkages in France, Germany, Italy and Spain.

The euro area sovereign debt crisis led to a repricing of sovereign credit risk, notably for euro area countries with deteriorating public finances. During the most severe phase of the crisis, contagion effects and unfounded fears of currency redenomination added significant upward pressure to sovereign spreads, impairing the transmission of monetary policy in some euro area countries. Against this background, between July and September 2012 the Governing Council of the ECB announced the possibility of conducting Outright Monetary Transactions (OMTs) in secondary sovereign bond markets.

Although no euro area country asked for the activation of OMTs, asset prices such as bond prices generally incorporate the publicly available information on policy announcements. Indeed, casual observation suggests that the OMT-related announcements had an impact on the financial sector. Chart 1 shows the two-year government bond yields in Italy (IT) Spain (ES), Germany (DE) and France (FR), over the period January 2007 to February 2013. Vertical gridlines indicate the dates of the three main OMT announcements.[10]

The three announcements are associated with a relevant and persistent decrease in the bond yields in Italy and Spain, and with a more muted effect in France and Germany. This article gauges the extent to which the OMT announcements affected the yield curve in the four largest countries of the euro area and how the changes in the yield curve may transmit to the other sectors of the economy.[11]

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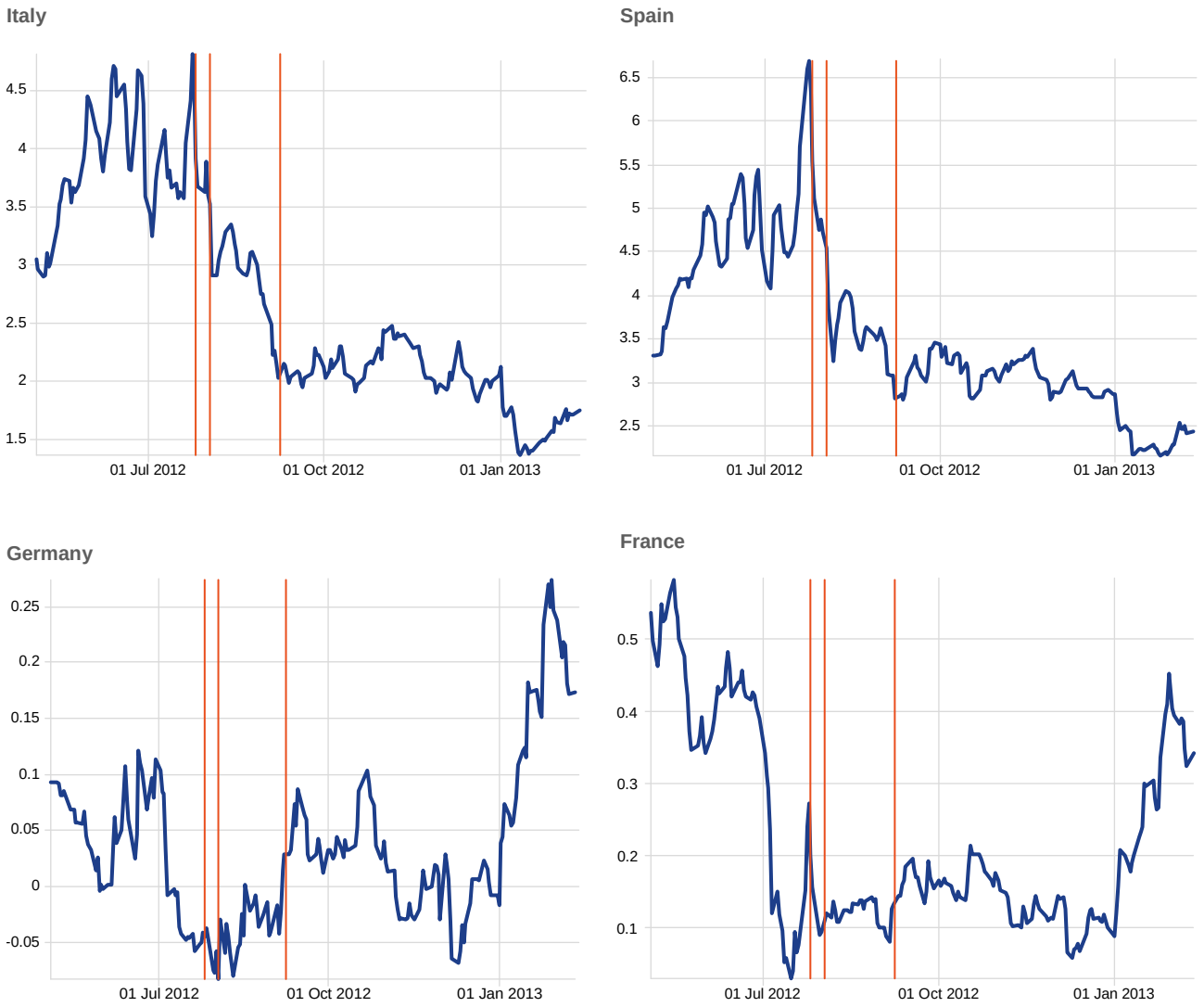
9 Based on an ECB working paper co-authored with C. Altavilla and D. Giannone. See Altavilla et al. (2014).

10 On July 26 2012, during a conference in London, President Draghi said that "within our mandate the ECB is ready to do whatever it takes to preserve the euro". On August 2 2012, during the press conference after the Governing Council meeting, President Draghi announced that the ECB's Governing Council "may undertake outright open market operations". On September 6 2012 Governing Council announced a number of technical features of OMTs.

11 The unconventional measures carried out by the major central banks sparked a large and growing body of literature trying to estimate their effects and transmission channels. For the euro area, see Eser and Schwaab (2013), Falagiarda and Reitz (2013), Giannone et al. (2012), Lenza et al. (2010), Ghysels et al. (2014), Rivolta (2012), Szczerbowicz (2012). See also the extensive survey in ECB (2014).

Chart 1

Two-year bond rates – daily frequency



Note: Sample: January 2012 to February 2013. Vertical gridlines indicate the dates of the OMT announcements, i.e. 26 July, 2 August, and 6 September 2012.

The effect of the OMT announcements on the yield curve of euro area countries

Two-year bond yields in Italy and Spain are estimated to have fallen by around two percentage points because of the OMT announcements

In order to estimate the extent to which the OMT announcements were the trigger of the observed decrease in Italian and Spanish yields, an event study looking at daily data was conducted.[12] The main purpose of the event study is to assess the effects of the policy announcements through the regression of sovereign bond yields on event dummies which take the value one on the date of the event (the OMT announcements) and zero otherwise. Although high-frequency data help to isolate

[12] For a detailed description of the event study methodology used in the paper, see Altavilla and Giannone (2014).

the effects of the OMT announcements, other important economic "news"[13] may have contemporaneously affected the yield curves in the euro area countries. For this reason, all the other relevant economic news made publicly available in the period under analysis is also included in the event study regressions. Table 1 shows the results of the event study across countries for a measure of the "target" bond yields (two-year government bond yields) and ten-year government bond yields.

The event study reveals that the OMT announcements had a significant impact on the bond yields of Italy and Spain, whose two-year bond yields declined by about two percentage points. At the same time, there was no significant impact on German and French yields.

Table 1

Effect of the OMT announcements on sovereign bond markets

Variable	OMT impact (percentage points)
DE 2-year bond yields	0.10
FR 2-year bond yields	-0.01
IT 2-year bond yields	-1.75***
ES 2-year bond yields	-2.09***
DE 10-year bond yields	0.29*
FR 10-year bond yields	0.04
IT 10-year bond yields	-0.63***
ES 10-year bond yields	-0.96***

Note: The effects of the three OMT announcements are reported as percentage points and computed as the sum of the changes on the days of the announcements and over the subsequent day. *, **, and *** denote the significance of the F-test for abnormal returns at 10%, 5% and 1% respectively.

Table 2

Macroeconomic effects of the OMT announcements

	Variable	Effect (percentage points)
Germany	GDP	0.34
	Price	0.28
	Loans	1.08
France	GDP	0.46
	Price	0.28
	Loans	1.38
Italy	GDP	1.50
	Price	1.21
	Loans	3.58
Spain	GDP	2.01
	Price	0.74
	Loans	2.31

Note: The table shows the effects of the OMT announcements as percentage deviations of the outcomes in the OMT scenario relative to the outcomes of the no-OMT scenario.

The macroeconomic effects of the OMT announcements

The drop in bond yields as a result of the OMT announcements is likely to have non-trivial effects on the Italian and Spanish economies and milder spillovers to France and Germany.

Changes in financial prices may alter the behaviour of private agents, potentially affecting the rest of the economy. In order to gauge the macroeconomic effects associated with the estimated changes in financial prices, a large multi-country model was employed which captures the associated macro-financial linkages. The model includes six variables for each of the four countries considered (real GDP, consumer prices, M3, retail credit, two-year and ten-year government bond rates), measures of the ECB policy rate and expected euro area aggregate bond market volatility. The model allows for country heterogeneity, cross-country spillovers and rich dynamics

[13] The economic "news" is defined as the surprise component of macroeconomic and other relevant releases, i.e. the difference between the data release and the corresponding expectation of market participants. The news is evaluated by looking at 151 categories of releases, made available by Bloomberg, and their expectations for France, Germany, Italy and Spain the euro area as a whole.

by adopting a flexible vector autoregressive (VAR) specification.[14] The assessment of the likely macroeconomic effects of the OMT announcements is conducted over a horizon of three years following the announcements by comparing two scenarios, referred to as the "OMT" and "no-OMT" scenarios. In the OMT scenario, the two-year bond yields in Italy and Spain are assumed to remain around two percentage points lower than in the no-OMT scenario for the whole horizon of three years, while they do not vary across scenarios in France and Germany. In order to isolate the effects of the announcements as much as possible, standard monetary policy, as captured by the ECB policy rate, is assumed to be the same in the two scenarios. Table 2 shows the effects of the OMT scenario relative to the no-OMT scenario at the end of the evaluation horizon (i.e. three years after the announcements).[15]

All in all, the scenario evaluation suggests that the OMT announcements were associated with increases in real economic activity, consumer prices and bank loans in Italy and Spain. France and Germany were moderately, but still positively affected. These results, in turn, suggest that non-standard policy measures acting through changes in asset prices, for example as large scale asset purchases, may have non-trivial effects on the main macroeconomic variables in the euro area.

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[14] For the estimation of the VAR, we address the high dimensional data problem (26 variables, five lags and quarterly sample ranging from the first quarter of 1999 to the third quarter of 2012) by means of the Bayesian techniques suggested in Bańbura et al. (2010) and Giannone et al. (2012).

[15] See Bańbura et al. (2014) for a description of the methodology used to compute the scenario outcomes.

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The impact of financial transaction taxes: new evidence

by Jean-Edouard Colliard and Peter Hoffmann

The recent financial crisis has reignited interest in the long-standing idea of a financial transaction tax (FTT). While such a policy has become politically viable, the underlying economic rationales remain all but clear-cut. This article provides a brief review of the debate on FTTs and presents empirical evidence from a recent policy experiment in France.

The financial crisis has sparked new interest in the concept of an FTT, which is most frequently attributed to Keynes (1936) and Tobin (1978). Public support for such a levy has grown since the financial crisis, which generated widespread discontent with the financial sector, and there have been calls for redistributive policies (the "Robin Hood tax"). As a consequence, 11 EU countries have formally agreed to implement a common FTT on all transactions in a wide range of financial instruments (e.g. equities, bonds, derivatives, etc.). However, opponents insist that such a tax would hurt market liquidity, investment and growth in economies that are struggling to recover from the deepest recession since the Second World War. Consequently, negotiations on the exact details of the pan-European FTT have repeatedly stalled.

Proponents of FTTs expect them to curb volatility in financial markets by reducing various forms of "excessive trading" such as short-term speculation and noise trading, while at the same time generating significant tax revenues. While the general idea is appealing, economic theory has long shown that the effect of an FTT is not straightforward: a tax not only discourages destabilising noise trading, it also hurts fundamental traders and liquidity providers (see, for example, Song and Zhang, 2005). As a result, markets may become even more volatile after the introduction of such a tax. Moreover, a decrease in liquidity provision can have a large impact on trading volumes, thus substantially reducing the revenues generated by the tax. The total impact of such a policy depends on how different types of traders are affected, which is ultimately an empirical question.

Unfortunately, the available empirical evidence on FTTs relies exclusively on aggregate data and frequently offers contradicting conclusions. For instance, Jones and Seguin (1997) find that transaction taxes increase market volatility, while Liu and Zhu (2009) find the opposite. While these discrepancies are likely to reflect differences in the trader populations of the underlying markets,[16] more detailed data pertaining to individual market participants have only become available in recent years. Moreover, markets have evolved dramatically (e.g. through automation and fragmentation) since these early experiments, which somewhat limits how informative they are for current policy design. Idiosyncratic tax designs further limit the

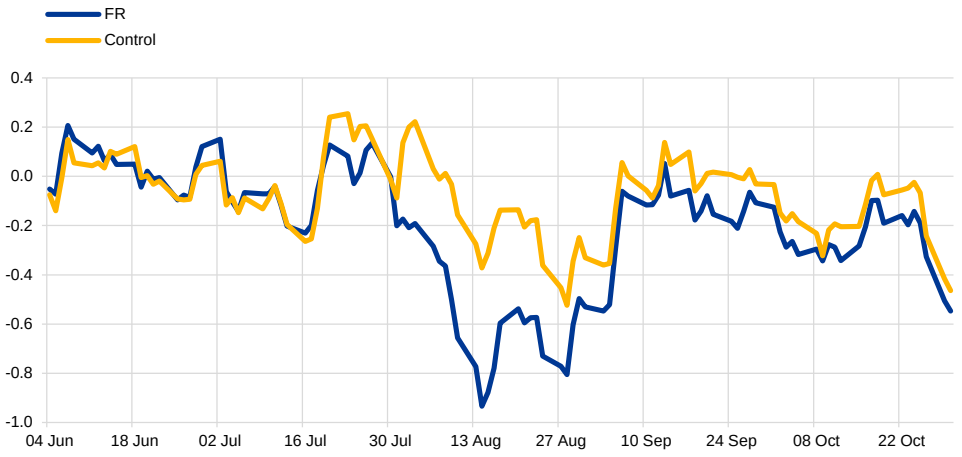
[16] Jones and Seguin study US equities in 1975, while Liu and Zhu study Japanese equities in 1999.

usefulness of past experiences. One prominent example is the Swedish FTT of 1983, which resulted in a migration of 60% of the trading activity in Swedish stocks to London, mainly due to it being levered on Swedish brokerage services (see Campbell and Froot, 1994).

It is therefore useful to examine more recent implementations of FTTs. The recently implemented FTT in France (August 2012) is a particularly interesting pilot experiment. This policy, which closely resembles the UK stamp duty, imposes a levy of 20 bps on the acquisition of French stocks with a market capitalisation of more than EUR 1 billion. Some activities, such as market making and primary market issuance, are exempt. In addition, the tax only applies to ownership transfers and thus implicitly exempts round-trip intraday transactions. Colliard and Hoffmann (2013) study the French experiment in detail by comparing the trading activity in French stocks (subject to the tax) with a sample of mostly Dutch securities (not subject to the tax) traded on the same market, Euronext. On average, the French FTT caused a decline in trading volume of around 10% in the long run (see Chart 1), which was accompanied by a deterioration of some dimensions of market liquidity (depth, resiliency and price efficiency). However, bid-ask spreads and intraday price volatility were unchanged, so that the overall effect on market quality was rather muted.

Chart 1

Development of (log) trading volume in French and Dutch stocks surrounding the introduction of the French FTT

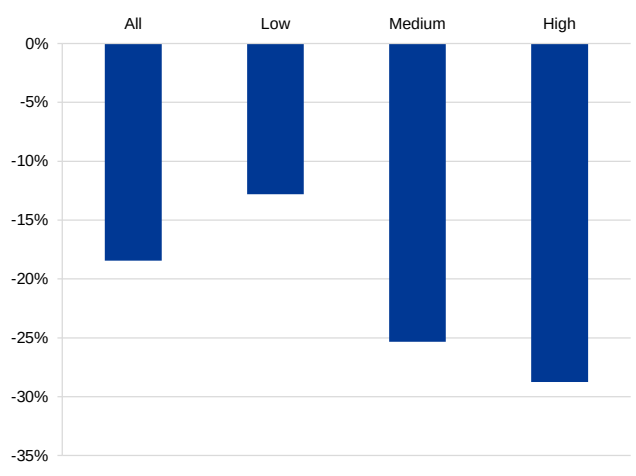


Note: The variables are normalised by their respective averages over the period June-July 2012. The difference between the lines provides an estimate for the causal effect of the policy change.

An important feature of the French experiment is the fact that market making and intraday trading activity are exempt from the tax. In order to investigate the importance of this provision, Colliard and Hoffmann (2013) estimate the impact separately for two groups of stocks, one with regular trading activity by high-frequency market makers and one without. The results are consistent with a significant role for liquidity provision, as stocks without regular high-frequency market making display a larger decrease in trading volume (approximately -20%), an increase in volatility and an increase in adverse selection costs. These effects are absent for the stocks with regular high-frequency market making.

Chart 2

Impact of the French FTT on institutional trading for investors with different portfolio turnover



Note: Estimates are based on changes in security holdings during the second and fourth quarters of 2012.

One important issue is that overall market activity is largely dominated by short-term trading (e.g. high-frequency trading), which clouds the FTT's impact on the actual end investors subject to the tax. In order to address this issue, Colliard and Hoffmann (2013) examine changes in institutional portfolio holdings before and after the implementation of the FTT in order to directly estimate the effect on long-term investors. They find that institutional investors reduced their trading in French stocks (relative to the control group) by approximately 20%. In addition, their data also allow them to study variation across different types of institutional investors. They show that market participants that trade more frequently were significantly more affected than those who hold a more stable portfolio (see Chart 2), which is in line with standard arguments on transaction costs (see Amihud and Mendelson, 1986). Similarly, investors with a broader investment universe reduced their trading in French stocks significantly, presumably due to their ability to invest in substitute assets.

Overall, Colliard and Hoffmann (2013) do not find any support for a "corrective" impact of the French FTT, which did not decrease volatility or improve market liquidity. The only rationale for this tax is thus to generate revenue. Interestingly, the design of the tax seems to have efficiently protected liquidity for the largest stocks, which did not suffer a significant decrease in market quality while probably generating most of the tax revenues. However, protecting liquidity provision for smaller stocks seems more challenging.

It is important to note that the current proposal for the pan-European FTT deviates considerably from the French implementation of 2012, as it aims to tax a wide range of instruments (e.g. equities, bonds, derivatives, etc.) and does not foresee any exemption for intraday trading or market making.[17] Focusing on the equity market, it seems guaranteed that such an implementation, less cautious in protecting liquidity provision, would have a more significant impact on market liquidity. However, it is less clear whether protecting liquidity provision would have a large effect on tax revenues. While the pan-European FTT is estimated to generate around EUR 4.8-6.5 billion from trading in EU-27 equities, Colliard and Hoffmann (2013) estimate that an extension of the French FTT to the remaining EU countries would generate approximately EUR 3.4 billion. The relatively small difference suggests that it may not be too costly in terms of foregone tax revenue to protect market liquidity.

[17] The EC proposal is available at: http://ec.europa.eu/taxation_customs/taxation/other_taxes/financial_sector/index_en.htm

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Box 1

ECB Workshop on non-standard monetary policy measures

On 6-7 October 2014 the European Central Bank (ECB) hosted a workshop on “Non-standard monetary policy measures” jointly organised by the Directorates General Economics, Market Operations and Research. The workshop brought together academics and central bank researchers to discuss the effectiveness and desirability of various non-standard monetary policy measures, including central bank liquidity provision and asset purchase programmes, in light of new theoretical and empirical research.

Evidence presented at the conference identified the impact and challenges of past non-standard measures. Simone Manganelli (ECB) and Bernd Schwaab (ECB) analysed the impact of the Securities Markets Programme on the financial market. Stefano Corradin (ECB) quantified the impact of ECB collateral policies on the prices of euro area assets. Sandra Eickmeier (Deutsche Bundesbank) found that monetary policy shocks became less effective during the sovereign debt crisis, although this difference can be largely attributed to their reduced persistence. Gert Peersman (Ghent University) found that the ECB’s balance sheet policies were successful in stimulating demand, but were less effective in countries with deleveraging banks. Jean-Stéphane Mésonnier (Banque de France) showed that the three-year longer-term refinancing operations of the

Eurosystem increased the credit supply of banks in France, especially those with healthier balance sheets. Björn Imbierowicz (Goethe University Frankfurt) argued that fixed rate tender procedures with full allotment have significantly reduced deposit costs for banks and contributed to lower lending rates of less risky banks.

The Japanese experience also provided useful lessons. Fang Cai (Federal Reserve Board) analysed the effectiveness of the Bank of Japan's quantitative easing policy between 2001 and 2006. Using bank-level data she found that the liquidity provision did increase bank lending, although the effect was relatively muted. Andrea De Michelis (Federal Reserve Board) argued that the current Japanese experience underlines the difficulty in reflating the economy after expectations have stabilised at a low level.

In his remarks addressed to the workshop participants, Vítor Constâncio (Vice-President, ECB) stressed that recent measures adopted by the ECB mark a new phase in its non-standard policies, with the Governing Council being ready to actively steer the size of the ECB's balance sheet with the interest rate constrained by its lower bound. He argued that the recent non-standard measures were successful in signalling the Governing Council's commitment to meet its inflation objective and were instrumental in supporting the flow of credit to the real economy. Peter Praet (Member of the Executive Board, ECB) explained that the non-standard measures implemented by the ECB in 2014 were tailored to those specific financial market segments that were assessed to be at the source of impaired monetary policy transmission. In her keynote speech Annette Vissing-Jørgensen (Haas School of Business) cited US evidence which suggests that a calm financial environment characterised by low interest rate spreads does not necessarily eliminate the effectiveness of non-standard measures: large-scale asset purchases can create scarcity, which reduces yields and provides incentives to issuers to increase their credit supply.

Reflecting on potential long-term developments, Gauti B.Eggertsson (Brown University) presented a theoretical framework in his keynote speech in which adverse demographics or financial shocks can generate secular stagnation characterised by persistently low growth, low inflation and interest rates constrained by the zero lower bound. Forward guidance can prove ineffective in this scenario and instead he emphasised the potential of fiscal policies for mitigating the demand shortfall. Charles Goodhart (London School of Economics) agreed in his keynote speech that global demographic trends will shape the environment of central banks in the future. He suggested that reductions in the savings rate of ageing societies (such as Germany and China) would eliminate the current global savings glut and lead to higher long-term real interest rates in future decades.

The contributions to this conference can be downloaded from the ECB's website at: https://www.ecb.europa.eu/pub/conferences/html/ws_non-stmopomeas.en.html.

Box 2

Conference on the optimal size of the financial sector

On 2 September 2014 the European Central Bank hosted a conference on "The optimal size of the financial sector". The conference brought together academics and policy-makers from Europe and the United States to discuss the contribution of the financial sector to economic growth, against the backdrop of recent reforms to the global regulatory architecture.

In his opening address**,** Benoît Cœuré (Member of the Executive Board, ECB) addressed the issue of non-linearities in the finance and growth nexus and the reasons why they arise. He then discussed how the banking union will address these problems in the future, and talked about the need to develop a genuine single market for capital.

The first session of the conference focused on "Rents and misallocation of talent". Tano Santos (Columbia University) presented a paper entitled "Cream skimming in financial markets" on the implications of information rents in financial markets. The model shows that the level of both information acquisition and information rents in the financial sector are excessive relative to the social optimum. Ariell Reshef (University of Virginia) presented evidence on the development of wages and human capital in the financial industry in 22 industrialised and transition economies over the period 1970-2005. The paper also looks at the role of technology, financial globalisation and financial deregulation in the observed differences across countries in skill intensity and excess wages in the financial industry.

The second session addressed the issue of "Efficiency and contribution to the real economy". The first paper was presented by Marco Pagano (University of Naples Federico II). The paper points to the fact that relative to other markets such as the United States, Europe appears to be "overbanked" and European banks appear to be both larger relative to the real economy and more leveraged. It also discusses possible explanations for these developments, such as the leniency of supervisors and the lack of comprehensive resolution regimes in the past. Indraneel Chakraborty (Southern Methodist University) presented empirical evidence on the crowding-out effect of mortgage lending on investment. In particular, the authors find that during the US housing price boom of the early-to-mid 2000s business lending by banks which became active in the mortgage market declined.

The topic of the third session was "Complexity, vulnerability, and systemic risk". David Thesmar (HEC Paris) presented a model in which fire sales propagate shocks across bank balance sheets. The model allows for the computation of spillover effects, given banks' exposures, in response to fire sales induced by shocks to asset prices. Luc Laeven (IMF) presented a paper which uses a large panel of internationally active banks to evaluate the contribution of bank-specific factors to systemic risk. The authors find that size and leverage are the main determinants of systemicity in banking.

The conference concluded with a policy panel. The panel was chaired by Vítor Constâncio (Vice-President, ECB), who stressed the role of market forces in determining the equilibrium financial structure in Europe. Martin Hellwig (Max Planck Institute) talked about sources of inefficiency in the European banking industry, such as failures of corporate governance and barriers to exit. Thorsten Beck (Cass School of Business) discussed some of the reasons for the declining effect of finance on growth before the crisis, such as the overextension of household credit and the reduction in traditional intermediation. Adair Turner (Institute for New Economic Thinking) discussed the role of housing finance in industrialised economies. Axel Weber (UBS) argued that the overall size of the financial sector is less important for financial stability than the extent of the diversification of banks' business.

The contributions to this conference can be downloaded from the ECB's website at: https://www.ecb.europa.eu/pub/conferences/html/140902_opt_size.en.html.

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