

The transmission mechanism of new and traditional instruments of monetary and macroprudential policy

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Introduction

On 13 and 14 October 2016, the National Bank of Belgium (NBB) held its ninth academic conference on the theme “The transmission mechanism of new and traditional instruments of monetary and macroprudential policy”.

The financial crisis and the resulting economic recession created new challenges for monetary policy and proved the need for a macroprudential policy to guarantee financial stability. The current economic environment of low inflation and zero interest rates also illustrates the limitations of traditional monetary policy instruments. This situation implies that new instruments need to be implemented to achieve both monetary and macroprudential policy objectives.

From the monetary policy perspective, these new instruments are related to the composition and size of the central bank balance sheet – policies of credit and quantitative easing – and to forward guidance about future policy intentions. How do these measures encourage financial institutions to relax their credit supply policies and how do lower future borrowing costs convince firms and households to expand their investment plans? From the macroprudential perspective, the new countercyclical capital buffers, liquidity and leverage ratios, and specific target instruments – such as loan-to-value and debt-to-income restrictions – offer new ways to control the credit and financial cycle. Clearly, monetary policy and macroprudential policy interact directly: the monetary policy stance – which is a key determinant of nominal incomes – has an impact on the credit quality of borrowers. At the

same time, macroprudential policy has a first-order impact on banks’ balance sheets. Therefore, the instruments and decisions in these two policy domains affect and potentially complement each other, and this explains why the conference topic was so broadly defined.

Recent policy discussions have revealed a lot of unanswered questions about the transmission channels of these new instruments.

There is ample evidence that unconventional policy measures have helped to stabilise tensions in the financial markets, led to lower risk-free rates and supported the valuation of riskier asset classes. Yet many questions remain unanswered. What is the exact impact of monetary policy actions on real rates and inflation expectations? What does that imply for the reaction of the nominal long-term rate? In fact, could it not be that the preferred outcome of announcing QE or forward guidance would be a rise – rather than a decline – in long-term nominal rates, as such policies should provoke higher inflation expectations? Other key questions of pressing concern to central bankers these days are the role of risk premiums – including inflation risk premiums – in explaining the dynamics of bond yields, and whether more QE has any further impact on long rates and inflation.

While the financial market impact of monetary policy announcements is relatively easy to observe and evaluate, the impact on the rest of the economy is much harder to identify and quantify. Indeed, why inflation remains subdued despite all the measures taken by central banks is a frequently recurring question. The answer involves

a counterfactual economic impact assessment – in other words, it entails estimating how inflation would have looked if the central bank had not taken any action. To do that, we need models of the transmission mechanism.

An important element in such an assessment is why bank lending has grown by less than 2%, despite the ECB balance sheet growing from about € 2.2 trillion prior to the asset purchase programme (APP) to some € 3.4 trillion today. This is especially important in the euro area, where households and firms typically borrow through banks. Weak demand may be at the root of this moderate credit growth, though for some countries there are also credit supply factors. In fact, even though the Eurosystem's various credit support measures have alleviated funding constraints for banks, and the APP frees up space on their balance sheets and pushes up asset prices, the financial sector remains exposed to various challenges. Some institutions in the euro area are still struggling with the legacies of the financial and economic crisis, such as the large pools of non-performing loans or, in some cases, insufficient (re)capitalisation. Moreover, several new developments such as a persistently low – and even negative – interest rate environment could in the longer term weigh on the banks' profitability, and eventually on the financial sector's intermediation capacity. In this context, it is crucial that monetary policy should deliver on its mandate to support the health of banks: it is only when inflation is back on target in a durable way that nominal interest rates will revert to a sustainably higher level. However, policy-makers must also consider the policies' potential side effects on banks, for instance when the banks obtain most of their funding from retail deposits. Other examples are the efforts to reduce leverage in the banking system or, more generally, the more stringent regulatory requirements that banks must comply with. The crisis taught us the importance of a resilient banking system. But at the same time, policy should avoid any undue harm to the credit supply.

Monetary policy today must perform a difficult balancing act between its various objectives. The measures that central banks have taken over the past years have aimed at reviving the credit creation process. At the same time, we should be aware that 'too much' or the 'wrong type' of credit growth may also be harmful. Fortunately, the new macroprudential instruments developed since the crisis make that balancing act less difficult. In Belgium too, the National Bank of Belgium (NBB) has experience with these types of macroprudential measures. For mortgage lending, it has already introduced an add-on for the risk weights used by banks with internal risk models, and it was recently decided, subject to approval by the ECB and

the European Commission, to supplement this with an additional targeted capital add-on for riskier loans with a relatively high loan-to-value ratio. These measures should help to safeguard banks' resilience in the face of dynamic mortgage credit growth.

Empirical research on how prudential policy works – both at the bank level and at the macroeconomic level – is essential to inform policy-makers. At the same time, it is also essential to make progress in theoretical models that can inform macroprudential policy, including its interaction with monetary policy. These models can help us in assessing the potential impact and reach of the various macroprudential instruments such as countercyclical buffers on banks' resilience as well as the economy at large, and may help us in optimally assigning these instruments to the final objectives of the central bank as the macroprudential authority. Examining the effectiveness of macroprudential instruments seems especially relevant for the euro area, in which monetary policy is centralised while macroprudential responsibilities are shared between the national and supranational levels.

At the conference, these topics were discussed from a range of perspectives. In this article, we summarise some of the findings around three themes. The first of these is the increased importance of financial stability for monetary policy. To what extent may this cause potential conflicts between the various objectives and does the new macroprudential framework offer solutions to such conflicts? Section 2 focuses on the transmission and the efficiency of prudential and macroprudential instruments. Section 3 goes into the findings on the transmission of unconventional monetary policy instruments.

1. Financial stability and the interaction between monetary and macroprudential policies

Giovanni Dell'Ariccia, the conference's first keynote speaker, described how the financial crisis had thrust the issue of financial stability right back to centre stage, in both academic research and policy discussions.

Pre-crisis macroeconomic analyses devoted little time to the role of financial intermediation, with the financial sector pretty much seen as a neutral go-between in the transmission of monetary policies. Any changes in asset prices and net worth would either intensify or weaken the transmission of shocks, but financial institutions and active risk-taking in themselves were never considered as key sources of financial instability. The literature on the banking industry, by contrast, did touch on potentially excessive

risk-taking on the part of financial institutions operating with limited liability and on asymmetrical information – behaviour that may trigger bank runs and bankruptcies in imperfect markets. However, these insights were not tested against a broader macroeconomic framework and neither were monetary policy implications identified.

These theoretical insights were likewise reflected in actual monetary policy-making. The monetary policy focus was to combat inflation first and foremost and a stabilisation of inflation was typically assumed to imply that output would closely align with its potential levels, thus ensuring the efficient operation of the economic order. Financial developments were factored in as much as these could be expected to impact expected inflation or output, greatly downplaying the monetary policy importance of any imbalances in the financial markets. There was no need for central bank pronouncements on over-priced or under-priced financial markets, while *ex-post* policy accommodation was believed to curtail the costs of any financial crisis in the event of unexpectedly major corrections. Prudential policies providing supervision on individual institutions and arriving at correct estimates of individual risk positions were considered adequate guarantees of financial stability.

The financial crisis challenged this consensus. Corrections in the property markets and US sub-prime lending set off a systemic crisis in the international financial order. Standard monetary instruments soon proved inadequate and the crisis triggered a major downturn in output and employment, as well as significant budget deficits. Many countries faced a banking crisis, particularly where lending to the government or the private sector had taken off substantially in the run-up to the crisis and/or where residential property prices had boomed. A systematic relationship between the extent of the crisis and pre-crisis imbalances supported the view that relatively low interest rates in the previous period had contributed to excessive risk-taking.

At that point, the risk-taking mechanism and its role were pre-eminent in both theoretical thinking and empirical research. Interest rates that were too low were argued to encourage financial institutions to take on greater risks (Borio and Zhu, 2008). Rajan (2005) identified an increased 'search for yield' among portfolio managers in an environment of low interest rates and deregulated markets. Asymmetrical information and adverse selection problems may also prompt more relaxed lending standards and excessive lending in an environment of monetary stimulus (Dell'Ariccia and Marquez, 2006), while low leverage costs encourage banks to further expand their balance sheets (Adrian and Shin, 2008). Constraints on

risk-taking behaviour may weaken further because of expected bail-outs of institutions considered too big to fail and of the broader financial industry in the case of acute risk externalities.

Empirical information corroborates the importance of risk-taking in the monetary transmission mechanism. Ioannidou *et al.* (2015) showed how exogenous interest rate falls in Bolivia encouraged financial institutions to grant higher-risk loans to debtors with poorer credit records – a trend most marked for banks with bigger agency problems. Jimenez *et al.* (2014) found that, after a fall in overnight rates, Spanish banks with relatively low capital ratios lent more to *ex-ante* risky firms providing less in the way of security and running higher *ex-post* default risks. Similar outcomes were found for other countries, showing a clear negative correlation between financial institutions' risk-taking behaviour and short-term rates (see Maddaloni and Peydro (2011) for details about the United States and the euro area). Most studies find that this risk-taking channel comes into play most markedly at fragile banks that are most subject to moral hazard. However, Dell'Ariccia, Laeven and Suarez (2016) established that *ex-ante* risk-taking on short-term interest rate falls picks up particularly at banks that are sitting on relatively large amounts of capital. They argue that banks with high leverage ratios will prefer to focus on shifting risk due to moral hazard, and will in fact take fewer risks when interest rates are lower and profitability higher.

Despite strong evidence, then, that risk-taking is a key channel in the transmission of monetary policy, it remains unclear which banks are most prone to this mechanism. Yet that is important to know if we are to evaluate the implications of the risk-taking mechanism for the interaction between monetary and macroprudential policy. If it turns out to be mainly weaker banks that take greater risks when monetary policy is expansive, concerns about financial stability should emerge sooner and any conflicts between monetary and macroprudential objectives will be much clearer than if it is chiefly stronger banks that take on additional risks at times of monetary expansion.

In this new post-crisis environment, the question arises whether monetary policy should continue to focus solely on inflation targets and the concomitant balance in the real economy and the labour market. If the spillover effects of monetary policy are also having major repercussions for financial stability, broadening the objectives would appear to be advisable. It may be desirable for monetary policy to respond to a rapid expansion of financial variables by adopting a 'leaning against the wind' policy. That said, there should be less concern about spillover effects when central banks have in place strong macroprudential policies to ensure financial stability.

Both academics and policy-makers hold widely different views about the optimum coordination of the two policy domains. Dell’Ariccia suggested conducting a cost-benefit analysis to evaluate the policy response to financial variables, with the benefits inversely reflecting the real costs of a financial crisis multiplied by the chances of such a crisis if there is no timely monetary policy response to financial expansion. The costs would be real short-term output losses arising from early rate hikes. This analysis shows the benefits outstripping the costs only in exceptional cases, as there is usually only a slim chance that a financial crisis will be sparked by less-than-timely monetary policy action.

Dell’Ariccia identified alternative ways to boost efficiency in both policy domains. When assessing inflation and output expectations, for instance, monetary policy could devote more attention to financial data, while forward-looking information from financial variables can help improve real-time assessment of the potential output gap. It goes without saying that the development of a robust macroprudential framework should also help to secure financial stability, but with Western economies having built this new framework only since the financial crisis, there is simply not enough evidence yet to evaluate its outcomes. To date, such policies have primarily focused on bolstering acyclical instruments such as improved bank regulation and rules on bank governance. It remains to be seen to what extent these policies prove useful as cyclical risk controls. As such policies translate into more far-reaching measures that directly affect specific groups, a debate may well ensue about the independence of such decision-making powers relative to political bodies.

The subsequent panel debate delved deeper into the interaction between monetary and macroprudential policies. Landau noted a clear trade-off between recent experiences of both policy perspectives: monetary policy attempting to rekindle lending, while the goal of financial stability is predicated on deleveraging. It is a trade-off that is even more marked in a zero-interest environment in which short-term interest rates are kept at nil over a lengthy period – a policy that is supposed to work precisely by way of the risk-taking channel. What is more, Landau argued that unconventional measures may be showing diminishing returns, causing unwanted spillover effects on financial stability to take on a relatively greater role in the trade-off. A protracted period of low and even negative interest rates, combined with more rigorous rules and caution on the part of banks when it comes to changing their business models, has put pressure on banks’ profitability, preventing them from translating the benefits of monetary policy into their lending conditions. Having factored in all these considerations, he conceded that today’s conditions do not offer any solution other than to focus

monetary policy on inflation targets first and foremost. Uncertainty over policy efficacy should not be made even worse by questioning central banks’ willingness to pursue their primary goal of price stability. Keeping separate the implementation of both policy objectives is still the best solution, Landau felt. He also noted that ample and flexible liquidity policies are allowing monetary policy to support both objectives by combating one of the causes of today’s low rates, i.e. the shortage of risk-free assets. By actively managing the central bank balance sheet, monetary policy can offer a flexible response to the high demand for safe assets and gain a better handle on liquidity creation by the financial sector. Within such a framework, reserve requirements may prove a useful instrument to control liquidity creation and maturity transformation in the private sector. He reckoned this to be a more flexible instrument to control financial sector debt than countercyclical capital requirements or other instruments that directly or indirectly influence the financial cycle.

Tucker pointed out that the trade-off problem depends on how macroprudential policy objectives are defined. There is more of a trade-off if policy objectives include active supervision of bank lending and financial risk premiums during the business cycle. Macroprudential policies that primarily focus on ensuring the resilience of the financial system, especially at times of exuberant markets, are probably less likely to face these issues.

2. The transmission of prudential and macroprudential policies and their instruments

The first debate clearly showed the absence as yet of a consensus on the objectives of and the analytical framework for modelling and evaluating macroprudential policies. There is no doubt that traditional macroeconomic models must be expanded to include a financial sector whose lending and asset prices may deviate from their optimum equilibrium levels. Such financial sector imperfections are necessary to motivate a policy response that either focuses on stabilising the short-term fluctuations of these variables around the desired equilibrium or on limiting the costs of such fluctuations by making the financial system fundamentally more resilient.

Professor Javier Suarez’s keynote speech presented such a model-based approach aimed at setting the optimum level of required bank capital. It arrives at an optimum calibration of the required capital policy rule that is relevant in the current Basel framework. His analysis drew on work done on the so-called three layers of default (3D) model (Clerc *et al.*, 2015), which was developed

by the Eurosystem's Macro-prudential Research Network and which the ECB considers a key analytical instrument in thinking about optimum macroprudential policies and required capital ratios.

An original feature when compared with standard DSGE macro models is that this model explicitly captures the costs of excessive bank lending and financial fragility. These costs are determined by losses incurred in defaults and bankruptcies for the three types of agents in the model: households taking on mortgage loans to pay for their homes, businesses financing their company spending and banks allocating savings deposits across the various types of borrower. Such defaults do not only imply transfers between the various agents but also reflect real costs for the broader economy. And this is on top of the welfare costs of the general economic cycle and its related under- or over-utilisation of production capacity.

In the absence of any prudential policy, costs such as these are likely to be inadequately priced into the cost of lending, given banks' limited liability and deposit insurance when finance turns sour. This leads to excessive lending and consequently also higher default levels in all three sectors of the economy, and necessitates regulation of capital requirements for banks to adjust for distortion in lending costs. If capital requirements are low, any increase in the minimum ratio should benefit all sectors of the economy and the costs saved by curbing defaults should outstrip any other effects. A further increase in banks' capital ratio should protect savers from the costs of financial fragility, but debtors stand to pay the price in the shape of higher borrowing costs. A realistic calibration of the model puts the optimum capital ratio for mortgage loans at a minimum 4.5% – i.e. the optimum from a borrower's perspective – and a maximum 7.5-8% to optimise benefits to savers. These ratios move between a minimum 9% and a maximum 10-13% for business loans, depending on the default risk. Obviously, even these minimum levels are typically higher than those currently imposed by Basel II. The modelling exercise suggests that only limited welfare gains can be obtained from dynamically adjusting capital ratios across the cycle. The model puts the optimum adjustment for cyclical default risk below that prescribed by the point-in-time application of the IRB approach under Basel II and III.

At this point, the model does not contain a detailed nominal and monetary dimension and does not therefore allow for a precise assessment of the interaction between prudential and monetary policies. From a general perspective, the model suggests an important complementarity between the two sets of policies, as the imposition of higher capital requirements reduces the financial risks in

the various sectors. Default costs so saved are in addition to the benefits of greater cyclical stability. Meanwhile, scope for monetary support during recessions is enhanced as any spillover effects in risk-taking behaviour are less likely to lead to excesses, or to do so less quickly.

In addition to this keynote presentation, the session also included a discussion of two empirical studies attempting to estimate the impact of concrete prudential measures. These studies analyse the impact of prudential measures recently taken by NBB within the framework of its prudential responsibilities and reflect on how these (macro) prudential measures have influenced the lending behaviour of Belgium's financial institutions.

Ferrari, Pirovano and Rovira Kaltwasser investigated the impact of a 5 percentage point increase in the risk weights of Belgian mortgage loans for banks calculating their regulatory minimum capital requirements in accordance with an IRB model. The NBB introduced this measure in December 2013 as part of its macroprudential policy framework. It aims to enhance the capacity of lending institutions with the highest exposures to mortgage loans to accommodate potentially steeper-than-expected losses on Belgian mortgage loans. This add-on pushed average risk weights at these IRB banks from around 10% at the end of 2012 to nearly 15% by the end of 2013. The change involved a macroprudential measure intended to raise sector-specific capital requirements for mortgage loans for institutions using IRB models to calculate their risk weights. Professor Suarez argued that such a specific increase of risk weights is in perfect alignment with the recommendations arising from his model.

The paper by Ferrari, Pirovano and Rovira Kaltwasser concentrates on the measure's impact on the interest margin that credit institutions charge on new mortgage loans. Depending on the review period for which the interest margin is being estimated, the measure has pushed up the average spread by 4 to 11 basis points. This average effect on institutions' credit supply remains very subdued indeed, even more so if high spread volatility is factored in for the 2003-15 review period, with negative spreads between 2006 and 2007, and spreads exceeding 150 basis points in the 2012-13 period. More important than the measure's average impact, however, are the significant differences between the credit institutions surveyed. The interest margin showed a much more robust reaction for institutions with lower capital buffers and at those with larger mortgage loan exposures. Credit institutions whose balance sheets display only a limited proportion of mortgage loans and large capital buffers have hardly changed their credit conditions in response to the measure. Institutions with major mortgage loan portfolios and

relatively small capital buffers, by contrast, ratcheted up their interest rate spreads: depending on the period and specifications, the impact for the most affected among them ranged between 10 and 35 basis points.

On average, then, the measure has had but a minor effect on credit policies pursued by the institutions surveyed, but has sparked adjustments in the policies of those institutions that are most at risk and that have relatively limited buffers to cushion any unforeseen loan loss shocks.

A second study, by De Jonghe, Dewachter and Ongena, focuses on bank-specific pillar 2 capital requirements imposed by the NBB on individual credit institutions as part of its microprudential oversight. More precisely, their study reviews the effect of bank-specific capital requirements that the NBB imposed between April 2011 and November 2014 as part of its annual SREP test of financial institutions active in Belgium. The study investigates what impact, if any, changes to these capital requirements had on the total assets and the composition of the balance sheets of the institutions so reviewed. It also estimates the effect on their lending as reflected in the Central Corporate Credit Register, that is to say at the level of individual loans issued by their banking businesses. In addition to the impact of the changes in regulatory minimum capital requirements, the study also reviews the effect of the actual capital position on lending behaviour.

As for financial institutions' overall balance sheets, the study finds that an increase in actual and required capital ratios prompted a reduction in total assets and a shift in the composition of these assets: the institutions got rid of assets with relatively higher risk weights when calculating their minimum capital. Lending to individual firms allowed for more detailed analysis, as the Central Corporate Credit Register keeps monthly records of all loan operations between Belgian lenders and firms. More specifically, the study reviews the effect on authorised credits. Key information is that the analysis can control for loan demand by restricting the sample to firms with credit lines from multiple financial institutions or by using firm-time fixed effects. The study then reviewed the impact on different types of credit.

On average, any increase in regulatory capital requirements reduces credit supply in terms of both the intensive and extensive margins. When both required and actual capital ratios increase at the same time, this effect is stronger still. Raising both ratios by one standard deviation – i.e. 1.5 percentage point – reduces loan growth by 0.39 percentage point every quarter and causes a 1.11 percentage point fall in the chances of new bank-customer relationships. These effects are significant and long-lasting, but still relatively modest on average.

Much more interesting, once again, is that this impact varies greatly between financial institutions. Small institutions (the 5 % with the smallest total assets) will cut their lending three times as hard when facing steeper capital requirements than will larger institutions (the 95 % largest). The differences are greater still when we factor in the heterogeneity in loan loss provisions: institutions that have taken steep provisions in previous quarters will reduce their loan growth by 0.53 of a percentage point for each 1.5 percentage point of additional capital requirements, while those with relatively low loan loss provisions are unlikely to restrict such growth. Institutions that have increased their equity in the recent past or that have curbed their asset growth are liable to display a much more muted response to higher capital requirements. Controlled for individual characteristics, larger firms, volatile or high-risk firms and firms with low implicit loan rates are more affected.

To summarise, capital requirement measures chiefly affect loans offered by small banks, institutions with higher risk profiles, less profitable institutions and those with fewer capital reserves. These measures also have a greater impact on institutions facing high costs of new capital. Lending is mostly curbed in areas with the biggest influence on risk-weighted assets, i.e. where this contributes most to compliance with weighted capital requirements.

Microprudential measures have probably had a negligible macroeconomic impact on credit supply, and their effects have remained highly bank-specific. It is unclear whether these conclusions pertaining to the effects of individual capital requirements in the microprudential policy framework may be extrapolated to general or sector-specific capital requirements imposed as part of macroprudential policy. Whatever the case may be, the findings of both studies discussed in this session point to similar outcomes with a limited macroeconomic impact but targeted consequences for institutions running the greatest risks and facing the highest costs to meet their capital requirements.

3. Empirical evidence on the impact of unconventional monetary policies

Unconventional monetary policies percolate through to the real economy and the inflation process via a range of channels. The first group of instruments operates via the expected future short rates. Examples include the explicit forward guidance on policy intentions for future short-term rates, implicit signals on future rates via quantitative easing, and targeted longer-term financing operations in which central banks actually charge low policy rates for longer-term funding or investment. Other instruments

attempt to influence the risk premiums in the long-term yields and other lending rates. Examples are quantitative easing operations through the purchase of government paper or more or less risky private securities, relaxing lending criteria or cutting credit costs for longer-term refinancing operations, etc. These instruments mainly attempt to encourage risk-taking by investors and offer opportunities to take advantage of a variety of risk components: duration risk, credit risk, liquidity and funding risk. These risk premiums can be influenced on the one hand via the portfolio channel, which operates using substitution and arbitrage between a range of assets in the financial markets, and on the other hand via a bank lending channel that attempts to address all kinds of restrictions imposed by financial institutions to ease their interest rate margins and lending criteria and so expand the credit supply. In this context, the traditional bank lending channel focuses on the availability of sufficient liquid funding as a key credit supply obstacle. The risk-taking channel rather emphasises the ability or willingness of financial institutions to take on additional risk. The impact of the various policy instruments is typically down to one or more of these channels. Note that in the European context the bank credit channel typically takes centre stage because of the comparatively important role the region's credit institutions play in lending to firms and households.

Empirically, it remains difficult to estimate exactly the quantitative impact of the various channels in supporting lending and thus also economic activity and inflation – as became clear from the conference's various contributions on the subject.

In his keynote presentation on the transmission of quantitative easing, Professor Reis focused on the consequences of QE for the reserves that financial institutions keep with central banks. Whenever a central bank buys government securities and thus expands the asset side of its balance sheet, reserves will be the natural counterpart on the liability side. A greater supply of reserves will depress prices of such reserves. This price may be defined as the expected real return on alternative investments less the expected return on the reserves – a spread that will narrow as the supply of reserves increases. However, Reis identifies a saturation point at which spreads become negligible and financial institutions no longer make any distinction between the different ways in which they hold their cash. By this point, further easing will no longer have any effect via the reserve supply channel.

To support this view, Reis analysed the impact of the various QE programmes in the United States on inflation expectations, which can be considered a proxy for the ultimate monetary policy objective. The probability

distribution of inflation expectations may be derived from option prices for inflation contracts. The first QE programme had a clear impact on the distribution: five-year inflation expectations moved to the right as a much lower probability was put on very low future inflation. Later QE programmes failed to show similar effects – in Reis's view because the saturation point has been reached and further quantitative easing no longer had an effect via the reserve supply.

Reis's analysis primarily focused on the reserve supply effect, i.e. the expansion on the liabilities side of the central bank balance sheet. It barely mentioned the consequences for the asset side and, more particularly, the breakdown of the assets purchased in the easing operations. The stable distribution of inflation expectations he observed for later QE operations – in which a range of asset categories were purchased, including mortgage-backed securities, and which were accompanied with forward guidance messages – also implies that the breakdown on the assets side and the additional unconventional measures failed to have any major effects. The other transmission channels that operate via signs about future short-term rates, or via the portfolio balance channel and the bank credit channel appear to have been insufficiently robust to have had a meaningful impact on inflation expectations. This is not to say that these channels had no real effects on the economy: an absence of an effect on inflation expectations might also be explained by the inflation process's lack of sensitivity to real economic activity. After all, a flat Phillips curve is more probable at times of financial crisis and major slack in production capacity.

Reis saw no reason for concern over the easing operations and their concomitant increase in the size of central bank balance sheets. The present value of the seigniorage income is more than sufficient to guarantee the value of the reserves and there are no pressing signs that sizeable central bank balance sheets constitute a risk to financial stability. Central banks have other options at their disposal to achieve their inflation targets, Reis noted. The most obvious instrument is the reserve deposit with longer maturities and at fixed rates. Such measures guarantee low rates at longer durations and may actually be more effective than forward guidance on future short-term rates, which invariably create commitment problems. In fact, these measures are comparable with the ECB's longer-term refinancing operations, albeit that those directly affect bank funding and not the reserve holdings.

Impact via expectations and portfolio balance channel

De Graeve's paper presented a more positive take on the efficiency of quantitative easing in the United States and,

more specifically, on Operation Twist as part of QE2. De Graeve posits a structural macro model with an explicit portfolio balance channel, which assumes that investors prefer a specific portfolio breakdown. Whenever the supply of long-dated government paper available to private investors dips below this preferred portfolio demand, long-dated paper will command higher prices and returns will fall. To some extent, lower-term premiums will be passed on to firms' and households' costs of credit and thus boost investment in the economy. Operation Twist saw the US Federal Reserve buy long-dated paper and fund its purchases through the sale of short-term Treasury bills, specifically playing to preferred-habitat investors to help bring down long-term yields. On De Graeve's estimates, it succeeded: long-term yields fell. By encouraging more investment, this specific operation added 0.6% to GDP, while its effect on inflation was limited to 0.3%, as the estimated Phillips curve is fairly flat.

This reaction is more marked than Reis's findings suggested and significantly outpaces the original estimates for this portfolio model by Chen, Curdia and Ferrero (2012). Possible explanations include De Graeve's flexible modelling of the portfolio structure and more precise estimates of interest rate expectations. As optimum portfolio structures can vary over time in De Graeve's model, this allows for distinctions between short-term and long-term effects of changes in the supply of government paper. Any adjustment in the portfolio structure will require bigger yield differentials in the short run than in the long run. This makes it possible to estimate sizeable dynamic effects of Operation Twist on long yields while still remaining consistent with a stable yield curve over the long run. Identification of the portfolio balance effect on long-term yields also presupposes an appropriate modelling of interest rate expectations. Long-term yields being the outcome of the expected development of short-term rates and term premiums – including portfolio balance premiums – all these components need to be modelled correctly for their specific contribution to be determined. This necessitates a joint estimation of the effects of forward guidance and the portfolio balance effects of QE operations. Key to this identification is that any structural modelling also makes it possible to evaluate the announcement effects of these instruments. The study identified a key role for the coordination of monetary policy and fiscal policies, particularly in terms of the composition of government debt at times when short-term yields are constrained by the effective lower bound.

Other contributions to this session on unconventional monetary instruments discussed experiences in the euro area. Dewachter, Iania and Wijnandts analysed the transmission of the ECB's range of policy instruments using

a term structure model to decompose yields. This approach also attempts to identify the size of the various channels for unconventional policies, by breaking down long-term yields into their expected and term premium components. The analysis is done in two steps: the authors first posit a term structure model for risk-free yields based on OIS rates and then put forward a similar model for country spreads, more specifically for government paper in Italy, Spain, France and Belgium. Their risk-free rate model also includes a variant explicitly factoring in lower-bound constraints. These models allow for a breakdown of risk-free rates and country spreads into expected rates and term premiums for future interest rate risk. Next, the authors review how the observed yield curves and their estimated sub-components reacted to announcements of unconventional monetary policy measures. This event study makes it possible to break down the interest rate response by its underlying transmission channels: which part of the response reflects changes in expected future yields and which part relates to risk premiums for future interest rate risks or compensation for expected or unexpected country risks.

The ECB's first three unconventional measures – its SMP, (T)LTRO and OMT programmes – sparked significant falls in expected future yields according to the model for risk-free OIS interest rates, but these were largely offset by higher term premiums. More recent measures – in particular its forward guidance and asset purchase programmes as repeatedly announced from August 2014 – had only limited effect on the OIS rates. Controlling for the lower-bound constraint turned out to be an important model feature to avoid an overestimation of the expectations channel. Both the expectations effect and the portfolio balance effect for risk-free interest rates – and by extension the yield curves of the euro area's core countries – remained very limited in scale in this analysis.

By contrast, the effects on the country premiums were significantly greater, with the larger part of the fall in the country premiums – i.e. over two-thirds for all programmes – related to lower risk premiums for the uncertainty over future country spreads. This is not surprising, as the euro area was hit by a crisis of confidence over sovereign debt in the period, which closely tied in with the banking crisis. This is why the ECB's unconventional measures primarily focused on repairing the transmission mechanism of the low rates in the fragmented euro area. It may in part also explain why the impact on risk-free rates and yield curves in the core countries hardly budged: reviving confidence in the monetary union reversed the flight to safety that pushed down risk-free rates exceptionally as the financial crisis unfolded. A normalising risk-free term structure post-measures was the counterpart of the fall in the country premiums for the peripheral countries.

Impact via the bank credit channel

In their contributions, Boeckx *et al.* as well as Lamers *et al.* discussed in greater detail how the banking sector responded to monetary stimuli during and after the financial crisis.

Boeckx, de Sola Perea and Peersman focused on the bank credit channel in the transmission of monetary impulses driven by the ECB's balance sheet expansion. They build on from the 2014 research presented by Boeckx, Dossche and Peersman, which put forward a macroeconomic SVAR model to gauge the impact of such shocks in the euro area, and whose outcomes demonstrated that these shocks had a positive effect on bank lending and the financial markets, and were therefore also supportive of economic activity and inflation. Their new paper discusses in some greater detail the mechanisms by which lending was stimulated, and in particular which financial institutions the credit increase was concentrated with.

The authors proposed a panel regression model relating monetary easing-driven lending growth at individual banks to a series of bank characteristics. Their findings strongly support the bank credit channel, as the biggest effects in this channel occur at banks that find it hard to tap into external resources to fund their lending in normal circumstances. Monetary easing has provided access to much-needed funds for precisely these banks and, in keeping with the bank credit channel, the authors discovered the credit growth response to monetary easing to be most marked for smaller banks, banks with relatively fewer retail deposits, and for banks with lower liquidity levels and lower capital ratios. Put differently: the effects are greater for banks that rely more on external funding but have problems getting access to such resources because of asymmetric information or moral hazard. Loan volumes and rates responded more strongly to monetary shocks at these banks. Meanwhile, the non-linear role of capital requirements should also be factored in: banks that are close to their minimum capital requirements and that have no access to additional funding will continue to face obstacles to their lending. Empirical specifications must allow for the interaction with capital requirements or else the bank credit channel will be underestimated. Small banks that have little cash and are highly dependent on market funding will benefit most from central-bank-provided liquidity but only if their capital position effectively allows them to take on extra risk.

Panel data analysis revealed that, on average, lending rose six basis points while credit rates fell by four basis points in the event of a monetary shock in accordance with an ECB total asset expansion of 1.5%. This average response

is relatively minor and coincides with past outcomes in the macroeconomic arena. That said, there are major differences between financial institutions and credit growth in particular may well be a multiple of that figure at precisely those institutions most severely restricted in their funding.

These outcomes match the conclusions of similar papers drawing on the same dataset of banks' balance sheet data and interest rates. Altavilla, Canova and Ciccarelli (2016), for their part, focused rather more on shocks in short rates and how they are transmitted to lending rates. They find that the sharp widening of lending rates between banks at the time of the euro area sovereign debt crisis in 2012 and 2013 was mainly caused by low market rates being insufficiently passed on by banks with little capital and high exposures to government paper. It would appear that the bank credit channel for the transmission of traditional interest rate shocks is also obstructed in times of crisis, when multiple institutions face binding restrictions in terms of capital requirements, for instance, or other economic or regulatory constraints. The authors also demonstrated that the unconventional measures taken since 2014 – and particularly the TLTRO and APP programmes – have done much to repair lending capacity for these banks: banks weighed down by many non-performing loans and little capital benefited most from fresh monetary support. At the same time, they note that these effects came at the expense of interest rate margins, which may cause problems in the rather longer term as this might erode the profitability of the relevant institutions.

In their contribution, Lamers, Mergaerts, Meuleman and Vander Vennet explicitly investigated the extent to which monetary policy shocks have influenced financial stability since the start of the financial crisis. More specifically, their study reviews the effect of monetary stimulus on the share prices of financial institutions as well as share price sensitivity to systemic risks. Monetary innovations are identified by an original technique exploiting the heteroscedasticity in a set of financial variables among days with and without monetary policy announcements. The impact of systemic risk on the financial sector is measured by the long-term marginal expected shortfall (MES), a measure of potential price adjustment in a banking share over six months should the financial sector market index come down by 40% over that same period.

The paper is underpinned by an analysis of a database of listed banks in the United States (438 institutions) and the euro area (63 institutions) containing information on their market values and a set of other bank characteristics. In the United States, both market prices and systemic risks of these financial institutions responded

positively to expansionary monetary shocks on average. Such shocks proved particularly supportive for the market values of financial institutions with relatively more risk-weighted assets, less deposit funding and a larger proportion of their income from interest margins. Systemic risks, by contrast, mostly increased for institutions with fewer risk-weighted assets, more deposit funding and more equity. In other words, market prices moved up at riskier institutions, while higher systemic risks were concentrated at robust institutions.

Similarly, monetary support boosted the market prices of riskier and more interest-rate-margin-dependent banks in the euro area, while this was also the case for banks with low equity in the periphery. Unlike the United States, the euro area recorded a fall in systemic risk, particularly at the riskier peripheral banks.

These findings show that post-financial crisis monetary stimulus has benefited both the financial sector and financial stability. That said, there are indications that these measures have allowed some institutions to postpone a much-needed review of their balance sheet structures. At the same time, the situation might get worse if long-term low interest rates continue to undermine financial institutions' interest income and thus encourage them to take on riskier activities. This would be a major problem if such risk-taking was primarily concentrated at weaker banks. As already noted, however, the empirical evidence for this type of reaction is not clear-cut and this trend may well depend on the response to banking supervision as well. Monetary easing having mostly benefited riskier institutions that rely heavily on market funding and have relatively little equity, the question arises as to whether stricter monetary policies in the future might cause trouble for this group of more risk-sensitive institutions.

Conclusions

Several contributors to the conference attempted to quantify the transmission channels for monetary and prudential instruments. Changes in prudential capital requirements are found to have steeply diverging effects, depending on the characteristics of individual banks. The institutions at greatest risk are effectively also the most restrained by these measures, while any undesirable costs arising from lending restrictions were found to be limited. This shows that such measures can be efficiently used to enhance the financial stability and resilience of financial institutions, without sparking major macroeconomic spill-over effects. These same observations also apply to the effects of unconventional monetary policy incentives. Here too, the relevant instruments manage to reach the

financial institutions that most need the additional funding. There are few signs that such capital injections are encouraging excessive risk behaviour, even at less robust institutions. A more rigorous regulatory framework may have helped to ensure this stability.

Many contributions at the conference took a critical view of any active cyclical fine-tuning of macroprudential policy. The focus was rather on a stable and rigorous prudential framework with steep capital requirements for the financial sector, based on correct assessments of credit risks. This way, policy could contribute most efficiently to keeping in check any excess risk-taking behaviour by the most vulnerable institutions. After a period of crisis and financial stress, it is essential that financial institutions quickly review their balance sheet structure and bolster their capital positions. Only by doing this will they be able to allocate new lending to healthy and productive investment. The current environment of low returns also demands that financial institutions adjust their business models flexibly and so safeguard their long-term profitability. It is up to the (macro)prudential framework to monitor this.

In the tough conditions over the past few years, monetary policy has succeeded in getting the transmission mechanism back on track and scaling back the main credit constraints on the supply side. Unconventional instruments have restored calm to the financial markets and have created scope for financial institutions to live up to their roles as financial intermediaries. Active and ample liquidity provision by central banks may remain in place for a good while yet, but it is still unclear whether these policies have had much impact on their ultimate target: the inflation process. It is not evident to stabilise inflation permanently during a protracted period of subdued growth and low nominal interest rates; it is therefore imperative that no doubts emerge about the preparedness of the monetary authorities to persist in their monetary policies by all possible means until they achieve their ultimate goal.

The contributions at the conference clearly demonstrated the usefulness of microeconomic research into the transmission mechanism of the various instruments at the financial institutions. Moreover, it is important to use data for individual credit institutions that can be related to information on individual borrowers, and to follow these relationships over time – this is the only way to clearly identify the role of credit supply, a necessary prerequisite for any evaluation of the transmission mechanism. This type of analysis is crucial if we are to fully understand the interaction between monetary and (macro)prudential policies. Such studies should also devote more attention to the effective use of additional financial resources and

to how such resources eventually influence output and price-setting. Macroeconomic models offer an advantage in that they can explicitly control for expectations in the analysis and so facilitate interpretation of leading financial variables. Such models need further work to enable the integration of monetary and macroprudential instruments into a consistent framework, and further research is also needed into the optimum coordination of these policy domains. Contributions at the conference by Dennis and Ilbas and by Lewis and Villa proved that these interactions

are complex and that further investigation is imperative. Any macro model should also take account of the heterogeneous nature of the financial sector, as the transmission mechanism has very diverse effects depending on the specific characteristics of the financial institutions. The interaction between the financial institutions is also relevant, as Gnabo and Scholtes demonstrated in their contribution about the role of the network structure in the transmission mechanism.

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