Interactions between monetary and macroprudential policies

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This article reviews the potential tensions between monetary and macroprudential policies and tries to quantitatively evaluate their importance. Both types of policies have overlapping transmission mechanisms, since they primarily work through the financial system. One policy shapes the playing field of the other. Thus, the effects of one policy need to be considered in the conception and implementation of the other, very much the same way as policy makers already take into account other structural economic features that affect the level and composition of output.

In order to evaluate how quantitatively important these interactions are we simulate a dynamic stochastic general equilibrium model that we calibrate to euro area data. The model encompasses, among others, financial frictions that manifest themselves as a collateral constraint. Macroprudential policy is modeled as a countercyclical variation in the intensity of the latter. We embed three macroeconomic shocks that illustrate the key propagation and amplification mechanisms of the Great Recession. Finally, we explicitly consider the zero lower bound (ZLB) on nominal interest rates. Given this set-up, our main findings are:

- macroprudential policies act as a useful complement to monetary policy during crises, by attenuating the decrease in investment and, hence, output;

- forward guidance is very effective at the ZLB, by providing a substantial boost to demand and reducing the costs of private deleveraging at the same time;

- overall, countercyclical macroprudential policies do not undo the benefits of forward guidance, but rather sustain them.
Prior to 2007, there was a broad consensus on policy objectives, the tools necessary to attain them, and their implications for stabilising the economy. The recent financial turmoil has completely undermined this consensus showing that price stability does not guarantee financial or, for that matter, macroeconomic stability. Economists and policy makers now largely agree that policies explicitly targeted at reducing the frequency and gravity of financial crises are necessary to ensure macroeconomic stability. Yet, experience and knowledge of these policies and their interactions with other public policies, and notably monetary policy, are still limited.

This article, therefore, offers a review of the literature in an attempt to examine the potential tensions between these two types of policy. It then presents a series of quantitative simulations to study these tensions under a crisis scenario. More specifically, we simulate a dynamic stochastic general equilibrium model subject to shocks that trigger a recession similar in amplitude to the Great Recession. We use these simulations to assess whether a countercyclical macroprudential policy might jeopardise monetary policy and show that, contrary to what might have been expected, both policies seem to be largely complementary. This turns out to be particularly true for the scenarios in which the central bank can engage in forward guidance.

1| HOW DO INTERACTIONS BETWEEN MONETARY AND MACROPRUDENTIAL POLICIES ARISE?

1|1 The role of different distortions

The ultimate goal of policy is to ensure the highest attainable level of welfare, which implies an efficient level and composition of output. In the presence of distortions, economic policy will target intermediate goals – such as price or financial stability – that entail mitigating these welfare-reducing distortions. When price rigidities are the only distortion to which the economy is subject, monetary policy aims to stabilise inflation in order to eliminate the fluctuations of output generated by price rigidities (Woodford, 2003). Thus, by keeping monetary policy focused on price stability, output stability is guaranteed and the best feasible outcome for welfare is obtained.1

Financial market imperfections give rise to distortions that manifest in the form of excessive risk-taking ex ante and negative asset-price or exchange-rate externalities ex post. When these distortions vary over time, respond to economic conditions, or affect one sector of the economy more than others, the composition of output is affected (Curdia and Woodford, 2009; Carlstrom and Fuerst, 2010). Welfare maximisation then requires adding financial stability as an intermediate goal for policy, as this mitigates the distortions in the level and/or composition of output caused by financial market imperfections.2

1|2 Side effects of monetary and macroprudential policies

In a perfect world where monetary and macroprudential policies completely meet their targets, side effects of one tool on the target of the other might be negligible. A more realistic framework is, however, one in which distortions respond to economic conditions and in particular to policy: changes in the policy rate, for instance, affect incentives to take excessive leverage, while leverage is an intermediate target for macroprudential policies. Side effects from monetary policy on macroprudential targets, and from macroprudential policies on output and inflation, therefore, need to be considered (for an overview, see IMF, 2013).

1|3 What monetary policy can entail for financial stability

Monetary policy can have an effect on financial stability through a host of channels:

• changes in the monetary stance affect the tightness of borrowing constraints and the probability of

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1 For the importance of real wage rigidities and the resulting trade-off between stabilising output and inflation, see Blanchard and Gali (2007).
2 Note that some types of financial distortions or their conjunction give rise to systemic risk, which cannot effectively be addressed by macroprudential regulation. See Bianchi (2011), Caballero and Krishnamurthy (2003, 2004), Lorenzoni (2008), Mendoza (2010), Korinek (2010) and De Nicolò et al. (2012) for a review of them.
default. While monetary easing relaxes collateral constraints, tightening can adversely affect the quality of borrowers, leading to higher default rates (Allen and Gale, 2000; Goodhart et al., 2009);

- monetary policy can influence the risk-seeking behaviour of financial intermediaries. Low interest rates can create incentives to expand balance sheets, reduce screening efforts (Borio and Zhu, 2008), and seek more risk in order to achieve higher returns (Rajan, 2006; Challe et al., 2013). In addition, if monetary policy is expected to be accommodative in case of financial turmoil, this creates additional incentives to correlate risks (Farhi and Tirole, 2012);

- by affecting aggregate financial prices, monetary policy can potentially exacerbate externalities. Low interest rates can lead to increases in asset prices, which can trigger further increases in leverage and lead to asset price booms, amplifying the financial cycle (Bernanke and Gertler, 1989). Conversely, a tightening of the monetary stance can cause collateral constraints to bind and fire sales to follow (Shin, 2005). In open economies, interest rate hikes can attract capital flows, lead to excessive borrowing in foreign currency, and lay the ground for exchange rate externalities (Bruno and Shin, 2012; Hahm et al., 2012).

The intensity of these effects depends on the point in the financial cycle and the financial structure and capital account openness of an economy. As financial imbalances build up, low policy rates can induce risk-taking and increase leverage. Interest rate hikes close to the peak of the financial cycle, can cause borrower defaults. More generally, in open and financially-integrated economies, domestic monetary policy has a weaker influence over domestic long-term rates and asset prices, but exchange rate externalities may become more important.

1|4 How macroprudential may influence the conduct of monetary policy

Well-targeted macroprudential policies can contain the undesirable effects of monetary policy, thereby reducing policy dilemmas and creating additional room for manoeuvre for monetary policy. For instance, limits on debt-to-income (DTI) ratios can attenuate the impact on defaults from a tightening of monetary policy (Igan and Kang, 2011); capital requirements or leverage ratios can help contain increases in bank leverage in response to low policy rates and reduce risk-taking incentives (Farhi and Tirole, 2012); limits on loan-to-value (LTV) ratios can lessen asset price booms, when accommodative monetary policy drives up asset prices (IMF, 2011); limits on foreign exchange lending can reduce the systemic risk associated with capital flows (Hahm et al., 2012).

In addition, macroprudential policies can affect the composition and level of output and inflation, since they have an effect on credit flows.

- Dynamic capital buffers can increase the resilience of the banking system and contribute to the proper transmission of monetary policy. This reduces the need for monetary policy makers to offset the effects of tighter credit conditions on output, as the buffers can help sustain the provision of credit to the economy and reduce the depth of the downturn. Conversely, in the absence of sufficient buffers, an erosion of capital may lead banks to reduce the supply of credit. This may even be the case when policy rates are lowered substantially.

- Limits on LTV and DTI ratios contain house price accelerations and changes in household debt more broadly. In this sense they also dampen the associated changes in aggregate demand to which monetary policy may have to respond.

- These tools also allow the appropriate transmission of monetary policy when house prices are falling. As a low LTV can mitigate the probability that the principal exceeds the value of the property, borrowers may refinance their loans by taking advantage of lower mortgage rates that an easing of monetary policy might bring about (Geanakoplos, 2010).

- Limits on LTV and DTI smooth the credit cycle and reduce, therefore, the depth and duration of the downturn. These tools can, thus, alleviate the risk that monetary policy will hit its lower bound.

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3 When high credit growth triggers an increase in the dynamic capital buffer in good times, the buffer can cushion the effect of losses on bank balance sheets and thus help maintain the flow of credit when losses materialise.
Reserve requirements (RR) restrain excessive credit growth without attracting capital inflows that may lead to an appreciation of the exchange rate. When used as a macroprudential tool, they might, hence, be a useful complement to monetary policy, especially in open economies (Tovar et al., 2012).

## 2 The Crux of the Matter: Operational and Institutional Consequences

Given the policy relevance of macroprudential policies and their interactions with monetary policy, it is important to emphasise the operational and institutional consequences that arise when macroprudential tools are not perfectly targeted or implemented, do not fully offset the financial shock or distortion targeted, and are subject to time inconsistency issues arising in part for reasons of political economy.

### 2|1 Technical issue of setting target values for financial stability

Financial stability concerns are hard to capture, let alone quantify in practice. It is difficult to differentiate efficient market responses from those implied by market failures or externalities. In this respect, it remains a challenge to measure changes in financial stability, as reflected in the long-standing debate on whether policy makers can identify or prevent asset price bubbles.

Moreover, some of the suggested macroprudential tools have never been tried in practice. Limited knowledge on the quantitative impact of macroprudential policies, therefore, makes their calibration difficult. In addition, experience still needs to be gained on how to adjust macroprudential policy tools in the face of changing economic conditions, and quantitative research faces a range of obstacles. Finally, practical experience with the use of both monetary and macroprudential policies for price and financial stability is still limited. While some countries have used both policies in conjunction, few countries have done so with clearly articulated and communicated objectives (IMF, 2012; 2013).

### 2|2 Where one type of policy is constrained, the demands on the other will be exacerbated

Weaknesses in the application of macroprudential policies make it more likely that monetary policy may need to respond to financial conditions. In models where macroprudential policy is absent or time invariant, it may be optimal for monetary policy to respond to financial conditions. By extension, to reduce the effects of imperfectly targeted or less effective macroprudential policy, it could be desirable for monetary policy to respond to financial conditions (IMF, 2013).

Conversely, where monetary policy is constrained, the demands on macroprudential policy may be greater. Financial distortions can manifest themselves in the form of an inefficient composition of output, including across member countries of a currency union. In such cases, macroprudential policies need to address the adverse side-effects of monetary policy on financial stability. In addition, macroprudential policies would preferably be coordinated inside the currency union, as acknowledged by the founders of the European Systemic Risk Board. Finally, macroprudential policies will need to be supplemented by fiscal and structural policies.

### 2|3 From the Tinbergen to the separation principle

Given the potentially high degree of interconnectedness between the two types of policies, it is essential that macroprudential policies be assigned clear targets and given adequate and distinct instruments to attain them. A straightforward application of Tinbergen's principle, thus, stipulates that the objective of financial stability has to be paired with the necessary toolkit. This contributes to avoiding trade-offs between the goals of financial and price stability.

Furthermore, it should be emphasised that macroprudential and monetary policies are not only technically but also conceptually separate. Their goals and instruments differ, which means that both types of measures have to be assessed and decided upon independently. When policy rates move in response to
the inflationary outlook, this does not necessarily mean that there will be consequences for macroprudential decisions. Reciprocally, depending on systemic risk developments, macroprudential measures can be implemented or phased-out without implied consequences for interest rate decisions.

This is an application of the separation principle – initially developed to distinguish conventional from non-conventional monetary policies – to macroprudential policies (Trichet, 2013). The separation principle is especially pertinent when, in the presence of certain types of shocks, one type of policy has to be tightened while the other has to be loosened (De Paoli and Paustian, 2013; Quint and Rabanal, 2013). It also becomes applicable when one type of policy is constrained, for instance, when nominal interest rates hit the zero lower bound (ZLB), as the remaining policy options are, by definition, assessed independently (Goodhart, 2010).

The above reflects the tensions that are inherent in the simultaneous implementation of monetary and macroprudential policies. Although their intermediate targets and tools differ, both types of policies have overlapping transmission mechanisms, since they primarily work through the financial system. One policy shapes the playing field of the other. Thus, the effects of one policy need to be considered in the conception and implementation of the other, very much in the same way as policy makers already take into account other structural economic features that affect the level and composition of output. At the same time, distinct policy goals call for separate tools to achieve them, and the various possible economic conditions require that both types of measures be decided upon independently.

2|4 Why central banks make good macroprudential supervisors

Historically, several central banks have been in charge of financial stability (Bordo, 2007; Goodhart, 2010). Moreover, even when central banks were assigned a relatively narrow mandate, such as that of inflation targeting in recent years, they often played a decisive role when financial instability struck. In particular, their ability to act as lender of last resort in the financial system and to manage liquidity in the interbank market typically made them a key player in crisis management.

As liquidity and crisis management, on the one hand, and systemic risk and financial stability, on the other, are intrinsically linked, central banks are also well suited to take a leading role in macroprudential oversight and regulation. What is more, there are a number of benefits from assigning banking supervision and broader macroprudential policy-making to a central bank:

- data collected and analyses conducted as part of banking supervision – micro- or macroprudential in nature – provide valuable additional information about the financial sector and the state of the economy (Peek et al., 1999). The value added of this information becomes even more critical in a crisis, given its importance for the transmission of monetary policy;

- supervisory data broaden the basis for assessing monetary policy options. This is especially the case in the euro area, where bank lending accounts for almost two-thirds of the total financing of non-financial corporations. Hence, monetary transmission channels through the banking sector are particularly important in understanding the effects of monetary policy;

- a single institution can avoid conflicts and coordination problems between separate policy authorities, while taking into account the interactions between monetary, supervisory and regulatory policies. This might be particularly important in a crisis and in a multi-country setting;

- a central bank has strong incentives to supervise rigorously, as this reduces the likelihood of crises and, therefore, of lender-of-last-resort interventions. In addition, rigorous supervision counters the credit and interbank market related risks implied by weak financial institutions. Finally, close banking supervision ensures the soundness of counterparties in monetary policy operations, which protects the central bank’s balance sheet, safeguarding its independence and credibility.

4 Reciprocally, the analyses of money and credit are essential to preserving financial stability (Issing, 2003).

5 White (2011) points out how the fragmented supervisory system in the United States led to “competition in laxity” among regulators and “regulatory arbitrage” by banks.
The financial and fiscal dangers for monetary policy

Despite the advantages of macroprudential and monetary policies being conducted by the same institution, having both under the same roof comes with its own risks. These stem mainly from the fact that a financial stability objective may have distributional and fiscal consequences.

- An effective macroprudential supervisor might have to impose sanctions or levy taxes. These actions, however, hinge on and are embedded into national democratic legislations. In practice, the systemic supervisor will, thus, have to closely engage with government(s) in order for sanctions and/or taxes to be implemented (Goodhart, 2010).

- Governments insure the systemically important parts of their financial systems. As the ultimate provider of such insurance, governments should be expected to maintain a close involvement with the conduct of systemic stability (Goodhart, 2010).

- Conflicts of interest could arise regarding the resolution of insolvent banks. In particular, central banks could be inclined to continue lending to weak banks for fear that winding them up would trigger losses, and political interference could seek to avoid costly bank restructurings (Brunnermeier and Gersbach, 2012; Gerlach, 2013).

In order to avoid financial or fiscal dominance over monetary policy, it is, therefore, essential that governance structures for the monetary and supervisory functions be strictly separated. This should entail a separation of the decision-making bodies. As already pointed out, it should also involve distinct policy goals and instruments. These safety devises should go a long way to solve potential conflicts of interest (Cœuré, 2013).

In addition, beyond a clear functional separation inside the central bank, supervisory and macroprudential policies also need to be distinctly separated from resolution authorities. A well-functioning bank resolution mechanism endowed with an appropriate set of tools and an adequate financial backstop limits risks to governments’ balance sheets. Hence, such an outside mechanism alleviates the risk of fiscal dominance, contributing to the central bank’s credibility and independence.

Quantitative evidence on the interactions between monetary policy and macroprudential policy in crisis times

The previous section discussed tensions that are inherent in the simultaneous implementation of monetary and macroprudential policies. As we saw, these tensions stem mainly from the fact that both types of policies have overlapping transmission mechanisms working through the financial system.

Tensions between both types of policies might turn particularly acute in crisis times, when monetary policy runs out of standard ammunition. Once the ZLB on the nominal interest rate has been reached, monetary policy is left with non-standard tools. Be it credit easing, quantitative easing, or forward guidance, these tools aim at stimulating credit by affecting the yield curve (either through a compression of credit and term premia or by directly trying to flatten the yield curve).6

Thus, by their very nature they may run into conflicting objectives with macroprudential policy at some point. The intuition behind this is straightforward: non-standard monetary policy tries to boost credit in the recovery phase, while countercyclical macroprudential policies mechanically undo part of the credit boom. Although this tension seems well established from a theoretical point of view, it remains to be seen whether it is quantitatively relevant.

In the remainder of the paper we address this issue by quantifying the interactions between monetary and macroprudential policies in times of crisis. Addressing this question requires a model that we can use as a “laboratory” to compare alternative policies. To this end, we develop a dynamic

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6 In the euro area, the bulk of non-standard interventions took the form of longer term refinancing operations (LTROs). While these policies operate through the same transmission channels as those of credit easing, they also have specific features. See Calm et al. (2014) for a quantification of the macroeconomic effects of LTROs.
stochastic general equilibrium (DSGE) model, which we calibrate to euro area data.

3|1 The quantitative framework

The model considered here is an extension of the one developed by Liu, Wang and Zha (2013), which itself is a variation of Iacoviello (2005). As in the other setups, there are two distinct types of agent: households and entrepreneurs.7

3|2 The protagonists

Households supply labour, consume, invest in housing, and lend funds to financial intermediaries (not modelled explicitly). Financial intermediaries, in turn, lend funds to entrepreneurs. This process is subject to financial frictions. The latter manifest themselves as a collateral constraint that financial intermediaries impose on entrepreneurs (and which might be thought of as resulting from similar constraints imposed by households on financial intermediaries).

Entrepreneurs consume, produce and borrow to finance purchases of new housing units and capital units used for production. Production is undertaken by combining labour, capital, and residential investment. While highly stylised, this framework has been shown to capture, in a quantitatively convincing way, essential characteristics of the business cycle (Iacoviello, 2005; Lui et al., 2013).

3|3 More frictions accounted for in our framework

Our model is then augmented by introducing sticky prices and wages. These nominal rigidities create distortions in the competitive equilibrium that justify the intervention of a central bank. In our framework, as in the discussion of the previous section, the central bank has the specific objective of price stability. Yet, as nominal rigidities affect both prices and wages, it is not possible to perfectly stabilise the business cycle by just stabilising prices. We capture how the central bank dynamically responds to economic circumstances through a simple Taylor rule.

In addition, our model features a large number of additional frictions. In particular, we allow for partial indexation of inflation and wage inflation to past inflation. Both entrepreneurs and households have preferences characterised by habit formation,8 a feature often discussed in the literature as necessary to capture aggregate persistence. There are also dynamic adjustment costs to investment, which allow us to reproduce the hump-shaped response of investment to a number of shocks.

3|4 Modelling macroprudential policy

Macroprudential policy is modelled as a countercyclical variation in the intensity of the collateral constraint. We view this as a useful modelling device since it allows us to capture the main characteristic of macroprudential policies, without having to specify a complete setup rationalising the advent and design of such policies.

In particular, in boom periods, i.e. when asset and house prices increase, it becomes easier to borrow large amounts against collateral. Macroprudential policy then leans against the wind by tightening the collateral constraint, thus, mitigating the effects of raising asset prices. Conversely, in periods of depressed activity, i.e. when asset prices are decreasing, countercyclical macroprudential policy softens the collateral constraint, hence, stimulating investment in housing and capital.

Finally, for parameter values of the above we rely on Beau et al. (2011), as the authors estimate a simplified version of our model on euro area data. The Box below offers a complete description of the model. For further details, a technical appendix is available from the authors upon request.

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7 Beau et al. (2011) consider a similar model. Here, however, the collateral constraint features both housing and capital, as in Liu et al. (2013). This apparently innocuous elaboration turns out to be essential to generate the crisis episode that we discuss in this paper.

8 Under habit persistence, an increase in current consumption lowers the marginal utility of consumption in the current period and increases it in the next period. Intuitively, the more the consumer eats today, the hungrier she wakes up tomorrow.
Box

Details on the DSGE Model

This box briefly presents the model used for the simulations outlined above. A more complete description is available upon request.

The economy is populated with a representative household and a representative entrepreneur.

The representative household has a utility function of the form:

$$\mathbb{E}_t \left( \sum_{t=0}^{\infty} \beta_t^{\phi_c} \ln(c_{S,t} - \eta c_{S,t-1}) + e^{\phi_h} a_t \ln(h_{S,t}) - \frac{a_t}{1 + \chi} \frac{1}{\beta_t^*} \int l_t(\nu) d\nu \right)$$

where $c_{S,t}$ is consumption, $\eta c_{S,t-1}$ is the external stock of consumption habits (a bar stands for the aggregate counterpart of the associated variable), $h_{S,t}$ denotes housing services, and $l_t(\nu)$ is the labour supply by member $\nu$ (there is a unit-mass continuum of such members). $\beta^*_t$ represents the household’s subjective discount factor. Finally, $\phi_{c,t}$ and $\phi_{h,t}$ are shocks to the discount factor and housing-demand respectively.

The representative household maximises utility subject to the sequence of nominal budget constraints (one for each period of time):

$$P_t c_{S,t} + P_{H,t} (h_{S,t} - h_{S,t-1}) + R_{t-1} B_{S,t-1} = B_{S,t} + F_t + \int W_t(\nu) l_t(\nu) d\nu$$

where $P_t$ is the aggregate price level, $P_{H,t}$ denotes housing price, $R_t$ is the nominal interest rate on one period bonds $B_{S,t}$ issued at $t$ and maturing at $t+1$, $F_t$ denotes the dividends received from monopolistic firms, and $W_t(\nu)$ is the nominal wage paid on labour of type $\nu$. Each household member is the monopolistic supplier of its labour type. As such, they can set wages. We assume, however, that wage re-optimisation happens infrequently, with probability $\alpha_w$. This process is the source of nominal wage stickiness.

The representative entrepreneur has utility of the form:

$$\mathbb{E}_t \left( \sum_{t=0}^{\infty} \beta_t^{\phi_c} \ln(c_{E,t} - \eta c_{E,t-1}) \right)$$

where $c_{E,t}$ is consumption, $\eta c_{E,t-1}$ is the external stock of consumption habits. $\beta^*_E$ is the representative entrepreneur’s subjective discount factor, which we assume is smaller than $\beta^*_S$. As a consequence, in equilibrium, households are net lenders and entrepreneurs are net borrowers.

The representative entrepreneur maximises utility subject to the sequence of budget constraints:

$$P_t (c_{E,t} + i_t) + P_{H,t} (h_{E,t} - h_{E,t-1}) + R_{t-1} B_{E,t-1} + W_t l_t = B_{E,t} + P_t y_t$$

$$y_t = (e^{\phi_k} k_{t-1})^{1-\theta} h_{E,t-1}^\theta$$

$$k_t = (1 - \delta) e^{\phi_k} k_{t-1} + i_t \left( 1 - S \frac{1}{\phi_h} \right)$$

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\[ R_t B_{E,t} \leq \xi_t \mathbb{E}_t \left( P_{K,t+1} h_{E,t} + P_{K,t+1} e^{\phi_{k,t+1}} k_t \right) \]

where \( i_t \) denotes non-residential investment, \( B_{E,t} \) is the amount of funds borrowed by the entrepreneur at the end of date \( t \); \( W_t \) is the aggregate nominal wage; \( i_t \) is the input of aggregate labour (a combination of all labour types, with imperfect substitutability); \( P_t \) is the nominal price of the good produced by entrepreneurs in quantity \( y_t \); \( k_t \) is the quantity of capital purchased at the end of \( t \) and usable next period; \( h_{E,t} \) is the quantity of housing services purchased at \( t \) and usable next period; \( P_{K,t} \) is the shadow price of capital (Tobin's Q), and \( \phi_{k,t} \) is a capital quality shock.

The first equation is the representative entrepreneur’s budget constraint; the second describes the production function; and the third equation stipulates the law of motion for capital, where \( S \) is an adjustment cost function on investment. Finally, the last inequality represents the collateral or borrowing constraint. The latter states that borrowed funds (inclusive of interest payments) cannot exceed a fraction \( \xi_t \) of the expectation at \( t \) of the entrepreneur’s assets in the next period.

Entrepreneurs sell their good to intermediate goods producers. Each of the latter produces a good that is imperfectly substitutable. As such, they have monopoly power and can set prices. However, price re-optimisation happens infrequently, with probability \( \alpha_p \). This process is the source of nominal price stickiness.

Monetary policy is set according to the Taylor rule:

\[ R_t = \rho R_{t-1} + (1 - \rho) \left( a_p \pi_t + a_y g_t \right) \]

where \( \rho \) is the degree of interest rate smoothing, \( a_p \) is the reaction to year-on-year inflation \( \pi_t \), and \( a_y \) is the reaction to year-on-year output growth \( g_t \). We set \( \rho = 0.7 \), \( a_p = 1.5 \), and \( a_y = 0.5/4 \), consistent with the traditional values assigned to these parameters.

Macropurudential policy takes the form:

\[ \xi_t = \xi_0 \left( \frac{B_{E,t}}{B_{E,t}} \right)^{-\tau} \]

where \( \xi_t \) is the steady-state intensity of the borrowing constraint, \( \tau \) is the reaction to deviations of borrowing from a target path \( B_{E,t} \) corresponding to the steady-state evolution of nominal borrowing. Thus, whenever borrowing is above its “normal” path, macropuralential policy tightens the collateral constraint in an attempt to lean against the wind. In the benchmark simulation, we set \( \tau = 0.5 \).

3|5 Simulating a great recession: the role of different shocks

Instead of adding a full stochastic structure to the model, we focus on three distinct, macroeconomic shocks that can be thought of as capturing crudely the essential features of the Great Recession. As we discuss later, the effects of these shocks also offer a neat illustration of the key propagation and amplification mechanisms of the model. In particular, the shocks we consider are:

- a capital quality shock implies an exogenous change in the productivity of capital as in Gertler and Karadi (2011). A crisis is then an event in which capital suddenly proves much less productive than initially planned. As a result, Tobin’s Q declines sharply, resulting in a severe tightening of the collateral constraint. In turn, this tightening depresses asset prices even further by deterring investment. This amplification loop resembles the phenomenon of fire sales often encountered in crisis times;

- the second shock we consider affects the demand for housing. A crisis is then an event in which housing demand declines exogenously. This broadly captures a macroeconomic situation characterised by large-scale individual bankruptcies and associated foreclosures. The sudden decrease in
housing demand triggers a sharp fall in residential prices, resulting in a tightening of the collateral constraint. By the same logic as before, this generates an amplification loop conducive to a simultaneous decrease in Tobin’s Q, a further tightening of the collateral constraint, and an even sharper decline in the demand for housing and in investment;

- finally, we consider an exogenous shock to the discount factor of households, which generates a fall in consumption. This type of shock is widely used in the DSGE literature to generate a demand-driven crisis, characterised by a simultaneous decline in production and the aggregate price level. In particular, it is often used as a modelling devise that can generate a large recession resulting in the occurrence of a liquidity trap, due to the ZLB on the nominal interest rate (Eggertson and Woodford, 2003).

### 3|6 Crisis scenarios and the ZLB

A central ingredient of the model considered here is that we take the ZLB explicitly into account. In particular, we consider a combination of the three shocks discussed above that result in a sufficiently sharp decline in production and inflation that the Taylor rule prescribes a negative nominal interest rate. Yet, due to the ZLB the nominal interest rate cannot reach such levels. Monetary policy can, therefore, not completely accommodate the crisis, which ultimately renders the latter even more severe.9

To make sure that we reach the ZLB, we set the steady-state value of the nominal interest rate to 2% and assume that inflation is zero in steady state.10 This implies that for a deviation of the nominal interest rate equal to -2%, the ZLB has been met. Note also that the amount of time at the ZLB is endogenously determined. Thus, policy actions are susceptible to shorten the duration of the liquidity trap.

In the following, the simulation is undertaken in a way that the recession triggered by the shock is much larger than the Great Recession. This is done in order to rapidly reach the ZLB. Charts 1 opposit report the benchmark path of key aggregate variables for versions of the model in which macroprudential policy is switched off – label “no MP” – and activated – label “with MP” – respectively. In period 1, all the variables are at their steady-state value. In period 2, the shocks to capital quality, households’ discount factor and housing demand hit the economy. The dynamics are reported in percent deviations from steady-state values.

The top panel reports the dynamics of output and investment; the middle panel displays the responses for year-on-year inflation and for the annualised nominal interest rate. The bottom panel reports the dynamics of the real prices of capital and housing. The simulation shows clearly that macroprudential policy acts as a useful complement to monetary policy during the crisis. In particular, in the absence of macroprudential policy, output declines by close to 7% and investment decreases by about 15%. The ZLB is reached in three periods and lasts for four quarters. As outlined before, the severity of the crisis stems in part from the very large decline in asset prices, depicted in the bottom panel.

By contrast, when macroprudential policy is activated (see Box for parameter values), the recession is less pronounced, even though macroprudential policy does not suffice in itself to undo the crisis. Output now declines by about 5.5%. More importantly, investment decreases by only half as much, 8%. Under this alternative scenario, the ZLB is also less protracted: it is reached after four periods and binds only for two periods.

This more benign scenario is the consequence of a less stringent collateral constraint, softened due to the countercyclical nature of macroprudential policy. This also generates a second-round effect through which asset prices decline by less, in turn rendering the borrowing constraint less severe. In addition, by attenuating the recession and, thus, by reducing the lapse of time spent at the ZLB, macroprudential policy generates a third effect that consists in freeing standard monetary policy from its constraint.

The exercise undertaken suggests that macroprudential policies have a quantitatively significant effect in

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9 As a practical matter, the model is log-linearised. We solve it by resorting to the Fair-Taylor approach in order to deal with the ZLB.
10 This value is probably too low compared with the historical record. However, having a higher steady-state nominal interest rate would require much more dramatic shocks to hit the ZLB.
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mitigating the impact of shocks that would otherwise have triggered a recession about as severe as the Great Recession. Thus, far from being in conflict, monetary and macroprudential policies are complementary in attenuating the recession under this benchmark simulation.

Simulating a great recession with unconventional monetary policy

We now modify the previous simulation by allowing monetary policy to engage in forward guidance at the onset of the crisis (the crisis is triggered by the exact same shocks as before). Hence, at the first period of the simulation, monetary authorities drive the nominal interest to zero and announce (credibly) that it will stay there for seven quarters.

Simultaneously, we consider two alternative settings for macroprudential policy. In the first one, we use the same degree of countercyclicality as in the previous benchmark simulation, labelled “benchmark MP” (see Box). In an alternative scenario, the degree of “leaning against the wind” is half as strong, labelled “alternative MP”. For ease of comparison, we also report the dynamics obtained under the “no MP” setting.

The results of this simulation are reported in Charts 2 below. The top left panel reports the dynamics of output; the top right panel displays the response of investment; and the bottom left and right panels report the dynamics of year-on-year inflation and the annualised nominal interest rate respectively. By construction, all the reported trajectories have a common pattern in the initial 7 periods of the simulation, due to the assumed path for the nominal interest rate under forward guidance.

It is evident from this simulation that in the DSGE model considered here, forward guidance is very effective at combating the effects of the crisis. Now, even under the “no MP” scenario, output declines by 4.6% instead of 7%, since forward guidance substantially enhances demand and reduces the costs of private deleveraging at the same time. The dynamics of investment are a clear illustration of this mechanism.

However, when during the recovery phase borrowing is stimulated by an accommodative monetary
policy stance, the presence of a countercyclical macroprudential policy might partly offset the benefits of forward guidance. Our simulations confirm that such concerns are not founded. Under the calibration considered here, a countercyclical macroprudential policy actually assists forward guidance: the (expected) inflationary burst triggered by forward guidance occurs earlier and is of greater magnitude than when macroprudential policy is absent.

The benefit of forward guidance stems from inflation contributing to re-inflating asset prices, thus, mitigating the effects of a tighter collateral constraint in the recovery phase. At the height of the crisis, the countercyclical macroprudential policy then contributes to relaxing the collateral constraint, attenuating the drop in investment, just as in the benchmark scenario. Signs of conflicting policy appear only much later in the simulation, after about 25 quarters. Past this point, investment is higher when macroprudential policy is switched off. The magnitude of this latter effect is, however, dwarfed by the gains in the recovery phase.
4 | Conclusion

This paper reviews the known tensions between macroprudential and monetary policies. As put forward in the literature, these tensions might become particularly acute in times of severe crisis, i.e. when the zero lower bound on the nominal interest rate is reached, and monetary policy runs out of standard ammunition. Non-conventional monetary policies, be it credit easing, quantitative easing, or even forward guidance, aim at stimulating credit. Thus, by their very nature they may run into conflicting objectives with countercyclical macroprudential policy at some point.

Based on simulations drawn from a canonical DSGE model, we show that these tensions are not quantitatively significant. Quite to the contrary, we find that a countercyclical macroprudential policy actually magnifies the benefits of forward guidance. As these results stem from a highly stylised model, it remains, however, to be investigated whether our results hold in a more elaborate setup.
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