

## D Quantifying the policy mix in a monetary union with national macroprudential policies<sup>186</sup>

*In a monetary union, targeted national macroprudential policies can be necessary to address asymmetric financial developments that are outside the scope of the single monetary policy. This special feature discusses and, using a two-country structural model, provides some model-based illustrations of the strategic interactions between a single monetary policy and jurisdiction-specific macroprudential policies. Counter-cyclical macroprudential interventions are found to be supportive to monetary policy conduct through the cycle. This complementarity is significantly reinforced when there are asymmetric financial cycles across the monetary union.*

### Introduction

Macroprudential policy in the euro area is primarily conducted by designated national macroprudential authorities, with a central coordinating and horizontal role for the ECB – especially since the establishment of the Single Supervisory Mechanism (SSM) which granted the ECB some macroprudential powers.<sup>187</sup>

The predominantly decentralised organisation of macroprudential policy-making in the euro area reflects inter alia the still incomplete integration of national banking sectors and heterogeneous financial cycles across euro area countries. In addition, as the single monetary policy mandate is to deliver price stability over the medium term for the euro area as a whole, monetary policy may actually look through financial stability risks building up in specific market segments, jurisdictions or individual countries. Such risks could also have implications for financial stability at the area-wide level. Hence, in a monetary union setting such as the euro area, nationally oriented macroprudential policies have a role to play in ensuring financial stability for all jurisdictions and supporting monetary policy conduct through the cycle. This may be especially relevant in the current circumstances in which the prolonged period of low interest rates combined with non-standard monetary policy measures may have unintended and localised financial stability effects that targeted macroprudential policies could help to alleviate.<sup>188</sup>

Against this background, this article first surveys the ongoing debate regarding the roles of and interaction between monetary policy and macroprudential policy. Second, issues related to the interaction between the two policies in the specific situation of a monetary union are discussed. Third, using a structural macro model extended to a two-country set-up and calibrated to individual euro area countries, the special feature illustrates the importance of country-specific macroprudential policies in the context of monetary union.

<sup>186</sup> Prepared by Matthieu Darracq Paries, Elena Rancoita and Christoffer Kok.

<sup>187</sup> According to the SSM Regulation, the power to initiate and implement macroprudential measures will primarily remain with the national authorities, subject to a notification and coordination mechanism vis-à-vis the ECB; see Article 5 of Council Regulation (EU) No 1024/2013.

<sup>188</sup> See Draghi, M., "Hearing at the European Parliament's Economic and Monetary Affairs Committee", speech, Brussels, March 2015.

## The interaction of monetary policy and macroprudential policy

The global financial crisis revealed, among other things, that price stability may be a necessary condition but is not a sufficient condition for financial stability. At the same time, the recent years' crisis experiences have made it evident that financial instability can feed back to the real economy and hence impinge on the ability of monetary policy to secure price stability.

As a result, in the aftermath of the financial crisis, policy-makers have taken initiatives to establish adequate institutional policy set-ups that can help ensure the concomitant achievement of the price stability and financial stability objectives. One of the main innovations in this regard has been the establishment of a macroprudential policy function targeted at reducing systemic risks to financial stability. In Europe, macroprudential authorities have been set up at the national level across all EU countries, often – but not always – with the central bank in the leading role. At the multinational level in the EU, the European Systemic Risk Board (ESRB) was established in 2011 with the mission of macroprudential oversight of the EU financial system and the possibility to issue warnings and recommendations for remedial actions to relevant counterparts at the national and EU levels. In the context of the establishment of the SSM, the ECB was granted macroprudential powers concerning measures included in the EU legal texts (i.e. CRD IV and the CRR).<sup>189</sup>

Macroprudential policies aimed at increasing the resilience of the financial system as a whole and at mitigating the build-up of financial imbalances can be considered a complementary policy function to monetary policy, focused on price stability, and micro-prudential supervision, focused on the stability of individual financial institutions.<sup>190</sup>

Despite the establishment of macroprudential authorities in various jurisdictions in the advanced economies, there is still limited experience with the implementation and effectiveness of macroprudential policies, of how they should interact with monetary policy and of the synergies and potential trade-offs.<sup>191</sup> With regard to the

<sup>189</sup> See the special feature by Carboni, M., Darracq Pariès, M. and Kok, C. entitled “Exploring the nexus between macroprudential policies and monetary policy”, *Financial Stability Review*, ECB, May 2013. See also Cecchetti, S. and Kohler, M., “When capital adequacy and interest rate policy are substitutes (and when they are not)”, *Working Paper Series*, No 379, BIS, May 2012; Claessens, S., Habermeier, K., Nier, E., Kang, H., Mancini-Griffoli, T. and Valencia, F., “The Interaction of Monetary and Macroprudential Policies”, IMF Policy Paper, September 2013; and Habermeier, K., Mancini-Griffoli, T., Dell’Ariccia, G. and Haksar, V., “Monetary Policy and Financial Stability”, IMF Policy Paper, August 2015.

<sup>190</sup> This article focuses exclusively on the interaction between macroprudential policies and monetary policy, while noting that complementarities, synergies and trade-offs with respect to microprudential oversight are also an important dimension; see the special feature by Boissay, F. and Capiello, L. entitled “Micro- versus macro-prudential supervision: potential differences, tensions and complementarities”, *Financial Stability Review*, ECB, May 2014.

<sup>191</sup> The lack of a clear consensus should also be seen in the light of still limited practical experience with macroprudential policies in the advanced economies; see also the special feature by Kok, C., Martin, R., Moccero, D. and Sandström, M. entitled “Recent experience of European countries with macroprudential policy”, *Financial Stability Review*, ECB, May 2014 and the references quoted therein. See also Bruno, V., Shim, I. and Shin, H. S., “Comparative assessment of macroprudential policies”, *Working Paper Series*, No 502, BIS, 2015; and Cerutti, E., Claessens, S. and Laeven, L., “The use and effectiveness of macroprudential policies: new evidence”, *Working Paper Series*, No WP/15/61, IMF, 2015.

interaction between macroprudential and monetary policies, there are conflicting views about the extent to which in particular monetary policy should provide some support to help achieve financial stability objectives.<sup>192</sup> Owing to the strong mutual dependencies between the two policy functions and reflecting uncertainty about whether macroprudential policy will be able to fulfil all its objectives and get into all of the cracks of the financial system, arguments can be made for assigning some role for monetary policy to complement the new macroprudential policies.<sup>193</sup> According to Smets (2014)<sup>194</sup>, the need to incorporate a role (albeit secondary) for financial stability concerns in the monetary policy objectives hinges on: (i) the effectiveness of macroprudential policies (e.g. the ability to manage the financial cycle); (ii) the extent to which monetary policy (including conventional and unconventional measures) can be a source of financial instability, for example by incentivising bank risk-taking; and (iii) the extent to which monetary policy can avoid being drawn into financial stability concerns, especially in crisis times.<sup>195</sup>

The reputational risk to the central bank as a macroprudential authority also needs to be borne in mind. In cases where explicit financial stability targeting is part of the monetary policy mandate, the potential time-inconsistency problems between the two policy functions can trigger “financial (stability) dominance” and hence may result in inflation bias.<sup>196</sup> To mitigate such credibility concerns, an extensive degree of accountability and communication are needed when the central bank is responsible for both monetary policy and macroprudential policy.

## Macroprudential policies in a monetary union

Notwithstanding the general complexity of managing and coordinating macroprudential and monetary policy interactions, conducting macroprudential policies in a monetary union such as the euro area creates additional challenges.

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<sup>192</sup> Two opposing viewpoints call for either (i) keeping the two policy functions separate, which also implies that pre-crisis price stability-oriented monetary policy frameworks should remain largely unaffected, or (ii) fully merging the monetary policy and macroprudential policy objectives. For proponents of the former viewpoint, see e.g. Bean, C., Paustian, M., Penalver, A. and Taylor, T., “Monetary policy after the fall”, in “Macroeconomic Challenges: The Decade Ahead”, Proceedings of the Federal Reserve Bank of Kansas City Economic Policy Symposium, Jackson Hole, Wyoming, August 2010; and Svensson, L., “The relation between monetary policy and financial stability policy”, *International Journal of Central Banking*, Vol. 8 (Supplement 1), pp. 293-295, 2012. For proponents of the latter viewpoint, see e.g. Brunnermeier, M. and Sannikov, Y., “Reviving Money and Banking”, in Baldwin, R. and Reichlin, L. (eds.), *Is Inflation Targeting Dead?*, VoxEU e-book, 2013.

<sup>193</sup> See e.g. Borio, C., “Monetary policy and financial stability: what role in prevention and recovery?”, *Working Paper Series*, No 440, BIS, 2014; Woodford, M., “Inflation targeting and financial stability”, *Economic Review*, Sveriges Riksbank, pp. 7-32, 2012; and Stein, J., “Monetary policy as financial stability regulation”, *Quarterly Journal of Economics*, Vol. 127, No 1, pp. 57-95.

<sup>194</sup> See Smets, F., “Financial stability and monetary policy”, *International Journal of Central Banking*, Vol. 10, No 2, June 2014.

<sup>195</sup> To the extent that an extended monetary policy mandate including financial stability concerns, as a complement to macroprudential policies, can help prevent the build-up of excessive debt overhangs in pre-crisis periods, it could alleviate the need for monetary policy to engage in post-crisis resolution policies; see also Borio (op. cit.).

<sup>196</sup> See Smets (op. cit.) and Ueda, K. and Valencia, F., “Central bank independence and macroprudential regulation”, *Working Paper Series*, No WP/12/101, IMF, 2012. See also “The importance of macroprudential policy for monetary policy”, *Monthly Report*, Deutsche Bundesbank, March 2015.

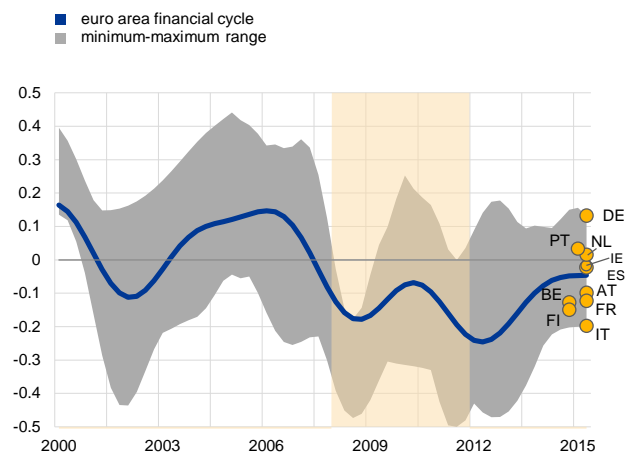
In a monetary union where monetary policy is focused on area-wide developments, macroprudential policies gain more importance in order to counteract possible adverse effects on financial stability of the “one-size-fits-all” monetary policy. In the same vein, the argument for proactive macroprudential policies may even be stronger in a monetary union than elsewhere due to their targeted nature and the fact that they can be adjusted to reflect the heterogeneous financial developments across countries within the monetary union.<sup>197</sup>

### Chart D.1

#### Financial cycles in the euro area are non-synchronous

##### The financial cycle in euro area countries

(Q1 2000 – Q2 2015; y-axis: normalised deviation from historical median)



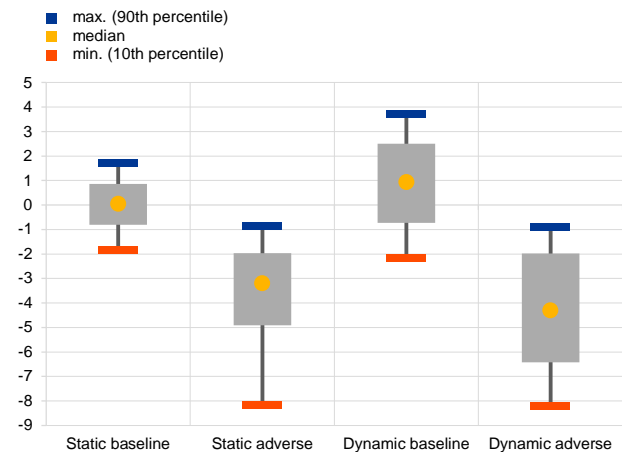
Sources: Bloomberg and ECB calculations.  
Notes: See Schüler, Y., Hiebert, P. and Peltonen, T., “Characterising the financial cycle: a multivariate and time-varying approach”, *Working Paper Series*, No 1846, ECB, 2015. The grey area marks the locations of financial cycles of ten euro area countries (AT, BE, DE, ES, FI, FR, IE, IT, NL and PT). The financial cycle is a filtered time-varying linear combination emphasising similar developments in underlying indicators (total credit, residential property prices, equity prices and bond prices). The yellow area indicates times of financial turmoil (Q1 2008 – Q4 2011). Figures for BE and FI refer to Q4 2014, while figures for PT refer to Q1 2015.

### Chart D.2

#### Notable cross-country differences in banking sector resilience to adverse shocks

##### Euro area banks’ resilience to stress: impact of the AQR and stress-test scenarios on CET1 ratios

(end-horizon compared with end-2013; percentage change, percentiles, interquartile distribution and median)



Source: *Aggregate report on the comprehensive assessment*, ECB, October 2014.  
Notes: “Static” refers to banks for which the stress test was conducted under a static balance sheet assumption; “dynamic” refers to banks for which the stress test was conducted under a dynamic balance sheet assumption (i.e. banks undergoing restructuring plans).

Macroprudential policies are well suited to taking into account national factors, such as the build-up of financial imbalances and the financial system’s degree of resilience.<sup>198</sup> For example, within the euro area the lack of synchronicity of credit cycles points to a need for national macroprudential policies (see Chart D.1). In a similar vein, the finding (in the ECB’s 2014 comprehensive assessment) that banking sectors in different euro area countries substantially differ in their resilience to adverse shocks of a similar nature (see Chart D.2) likewise suggests that macroprudential (and micro-prudential) policies targeting banking groups in specific countries are warranted. Moreover, it is widely acknowledged that expansionary and unconventional monetary policies may have unintended side-effects on the financial

<sup>197</sup> See e.g. Constâncio, V., “Financial stability risks, monetary policy and the need for macroprudential policy”, speech at the Warwick Economics Summit, February 2015.

<sup>198</sup> See Deutsche Bundesbank (op. cit.).

system. Especially in the context of a monetary union with a single monetary policy and the introduction of new, unconventional policy measures (e.g. asset purchase programmes), any potential derived risks to euro area financial stability would most likely need to be addressed by targeted macroprudential policies.<sup>199</sup>

At the same time, macroprudential policies conducted by national authorities may generate cross-border spillover effects and leakages. To mitigate such spillovers, there will need to be a systematic coordination among national macroprudential authorities. Within the euro area, the ECB has a natural coordination role.<sup>200</sup> Furthermore, the ECB's ability to tighten macroprudential policy measures should help in reducing national "inaction bias".

Practical experience with macroprudential policies in advanced economies and how they interact with monetary policy is still relatively scarce, especially concerning operational macroprudential policies in a monetary union. Therefore, model-based simulations can be useful to help gauge the potential effectiveness of and calibration issues related to macroprudential policy implementation (see next section).

## The transmission mechanism of jurisdiction-specific macroprudential instruments

### Calibrating a two-country macro-financial model for the euro area

For the purpose of illustrating the role of national macroprudential policies in a monetary union, a dynamic stochastic general equilibrium (DSGE) model with various macro-financial linkages and consisting of two countries subject to a single monetary policy is employed.<sup>201</sup> The box provides a brief description of the modelling approach.

While a number of studies have analysed the macroprudential and monetary policy interactions in closed-economy settings<sup>202</sup>, there are only a few studies to date that extend the analysis to a multi-country monetary union setting.<sup>203</sup>

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<sup>199</sup> See e.g. Draghi (op. cit.).

<sup>200</sup> In practice, within the euro area the macroprudential policy interaction between national authorities and the ECB works through the Financial Stability Committee of the Eurosystem. This set-up relies on a coordinating role for the ECB to promote analytical tools and to put emphasis on cross-border spillovers and reciprocity; see e.g. Constâncio, V., "Strengthening macroprudential policy in Europe", speech at the conference on "The macroprudential toolkit in Europe and credit flow restrictions", Vilnius, July 2015; and Panetta, F., "On the special role of macroprudential policy in the euro area", remarks at De Nederlandsche Bank, Amsterdam, June 2014.

<sup>201</sup> See Darracq Pariès, M., Kok, C. and Rancoita, E., "Cross-border banking, macroprudential policy and monetary policy in a monetary union", *Working Paper Series*, ECB, forthcoming.

<sup>202</sup> See Carboni et al. (op. cit.) and the references therein. See also Gertler, M., Kiyotaki, N. and Queralto, A., "Financial crises, bank risk exposure and government financial policy", *Journal of Monetary Economics*, Vol. 59, Supplement, pp. S17-S34, 2012; Benes, J., Kumhof, M. and Laxton, D., "Financial crises in DSGE models: selected applications of MAPMOD", *Working Paper Series*, No WP/14/56, IMF, 2014; and Angelini, P., Neri, S. and Panetta, F., "Capital requirements and monetary policy", *Journal of Money, Credit and Banking*, Vol. 46, pp. 1073-1112, 2014.

## Box

### A brief model description

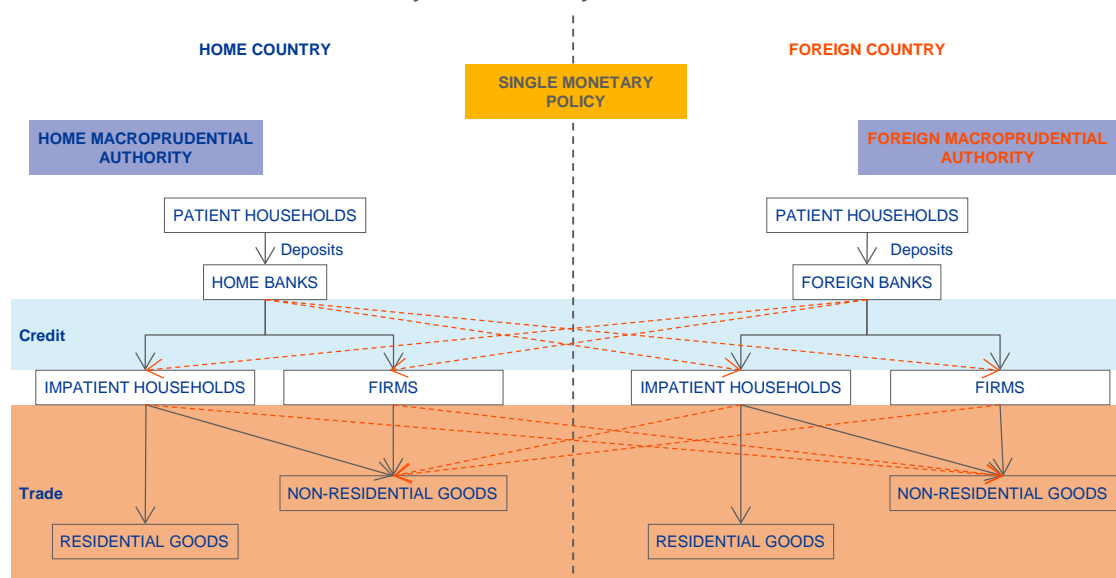
The model is a two-country DSGE model, where the home country represents one country of the euro area and the foreign country represents the aggregation of the other euro area countries. The model was calibrated five times so that each time the home country was calibrated on one of the five largest euro area economies (Germany, France, Italy, Spain and the Netherlands).

The individual economies are modelled following Darracq Pariès et al. (2011)<sup>204</sup> implying that each economy consists of three agents (households<sup>205</sup>, firms<sup>206</sup> and banks<sup>207</sup>) and two sectors producing residential and non-residential goods, respectively. Monetary policy in the model is formalised in terms of an interest rate rule that prescribes a response to inflation, output growth and asset prices.

### Chart D.3

#### A two-country model

##### A schematic overview of the two-country model economy



Notes: Black lines indicate domestic credit and trade transactions. Red dotted lines indicate cross-border trade or credit transactions.

<sup>203</sup> A few recent exceptions include Quint, D. and Rabanal, P., "Monetary and macroprudential policy in an estimated DSGE model for the euro area", *International Journal of Central Banking*, Vol. 10, No 2, pp. 169-236, 2014 and Brzoza-Brzezina, M., Kolasa, M. and Makarski, K., "Macroprudential policy instruments and economic imbalances in the euro area", *Working Paper Series*, No 1589, ECB, 2013.

<sup>204</sup> Darracq Pariès, M., Kok, C. and Rodríguez Palenzuela, D., "Macroeconomic propagation under different regulatory regimes: evidence from an estimated DSGE model for the euro area", *International Journal of Central Banking*, Vol. 7, No 4, pp. 49-113, 2011.

<sup>205</sup> The household sector consists of two types of household, differing in their relative degree of patience. "Impatient" households are financially constrained and borrow from banks in order to buy the residential goods. Residential goods are treated as durable goods and serve two purposes: they can be either directly consumed or used as collateral in the mortgage market.

<sup>206</sup> Firms produce non-residential and residential intermediate goods under perfect competition and face financing constraints.

<sup>207</sup> The banking sector has four business lines (deposit-taking, wholesale, loan book financing and retail loan provision). Banks collect deposits from patient households and provide funds to entrepreneurs and impatient households.

Banks are affected by three layers of financial frictions, which have important implications for the propagation of shocks in the economy. First, banks face risk-sensitive capital requirements as well as adjustment costs related to their capital structure. Second, banks have some degree of market power in the retail market which generates imperfect pass-through of market rates to bank deposit and lending rates. Third, due to banks' imperfect information about their borrowers and hence the costs of monitoring their credit contracts, firms and impatient households face external financing premia which depend on their leverage.

In the model, the two countries are interconnected via trade and banking sector linkages. On the trade side, residential goods are treated as durable goods and are non-tradable, while non-residential goods can be traded across countries. Concerning cross-border credit linkages, it is assumed that households and firms can borrow abroad, as well as at home (see also Chart D.3 for a schematic overview of the key model components including the relevant cross-border linkages).

To explore the potential benefits of tailoring macroprudential policies to national circumstances while taking account of the single monetary policy stance, the two-country model is successively calibrated to capture the banking system characteristics and macroeconomic features of each of the five largest euro area countries, against the rest of the euro area. The cross-country heterogeneity is reflected first through the degree of demand-side and supply-side credit frictions related to: (i) leverage and the credit risk profile of households and firms; (ii) the lending rate pass-through; and (iii) the bank capital channel. Then, countries differ in terms of their size, trade openness and financial interconnectedness.

For the calibration of the banking sector, we use inter alia proprietary granular bank-level stress-test data from the ECB's 2014 comprehensive assessment to set credit risk characteristics (i.e. portfolio-specific probabilities of default or PDs and loss given default or LGD) determining the lending rates. We aggregate individual bank information up to country-level indicators, also taking into account the geographical breakdown of banks' exposures. Bank capital adjustment costs were calibrated based on stress-test data on exposures and capital that were used to compute the target capital ratio at the country level. Country-specific bank interest rate pass-through estimates were used to calibrate the degree of stickiness in retail interest rates across countries, which affects the strength with which shocks to bank balance sheets propagate to the real economy via the cost of bank financing.<sup>208</sup> Household indebtedness is an important structural factor determining how the economy reacts to, for instance, house price shocks. For this purpose, country-specific historical averages of loan-to-GDP ratios for households (sources: ECB and Eurostat) were used to calibrate the degree of private indebtedness at the country level.<sup>209</sup>

With regard to trade and financial linkages, the countries' share of imports and exports in real GDP was used to proxy trade openness (source: Eurostat), while MFI data on intra-euro area cross-

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<sup>208</sup> See Darracq Pariès, M., Moccero, D., Krylova, E. and Marchini, C., "The retail bank interest rate pass-through: the case of the euro area during the financial and sovereign debt crises", *Occasional Paper Series*, No 155, ECB, August 2014.

<sup>209</sup> Technically speaking, in the model, the share of household (housing) loans in GDP is an increasing function of two parameters which capture the share of borrowers and the loan-to-value ratio, respectively. Intuitively, higher steady-state debt levels translate into a higher responsiveness of GDP to house price developments, either via an increase in the proportion of borrowers, or via a rise in the maximum loan-to-value ratio that the bank is willing to grant. As a result, higher debt levels make economies more vulnerable to downward house price corrections.



border credit to MFIs and non-MFIs were used to proxy financial openness.<sup>210</sup> Stronger trade links and/or more pervasive cross-border credit linkages would tend to strengthen spillover effects of macroprudential policies from one country to another.

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### **Taming jurisdiction-specific financial cycles: stabilising properties of macroprudential instruments in the monetary union**

A first step in exploring the interaction between macroprudential oversight and monetary policy in the euro area is to analyse the macroeconomic propagation within the monetary union of selected macroprudential instruments (MPIs), namely: (i) system-wide bank capital requirements; (ii) sectoral capital requirements; and (iii) loan-to-value ratio restrictions. Capital requirements increase the resilience of the banking system as a whole by ensuring adequate buffers to cope with losses. Sectoral capital requirements make lending to certain classes of borrowers more costly and hence prompt banks to reduce their activity in that segment. Restrictions on loan-to-value ratios pertain to the banks' assets side, directly affecting the borrowing constraints of their customers, and hence make the banking system less vulnerable to borrower defaults.

Intuitively two prescriptions would nonetheless hold with respect to the use of alternative MPIs. First, from a domestic perspective, targeted instruments would be superior to non-targeted ones to address sector- or financial segment-specific financial vulnerabilities. At the same time, broad-based signs of financial excesses or uncertainty about the main drivers of financial developments would suggest using instruments that are less intrusive into the asset composition of the banking system. Second, jurisdiction-specific macroprudential instruments may be better suited than the single monetary policy to address asymmetric country-wide developments within the monetary union.

The modelling exercises that follow aim to introduce a quantitative perspective on these aspects and elaborate further on the role of country characteristics, focusing on the five largest euro area countries.<sup>211</sup> For illustrative purposes, we compare the macroeconomic allocations corresponding to a temporary increase in system-wide capital requirements with those resulting from temporary<sup>212</sup> increases of (i) sectoral

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<sup>210</sup> As the interbank market is the major channel of financial cross-border linkages, total credit (i.e. loans and debt securities) granted to both MFIs and non-MFIs was used rather than direct loans to foreign households and firms. In this way, the effective size of cross-border credit spillovers across countries was captured.

<sup>211</sup> For the euro area as a whole, Carboni et al. (op. cit.) covered domestic aspects of the MPIs' transmission mechanisms. We refer the reader to this publication for more details and focus here on the cross-country spillovers and monetary policy interactions in a monetary union.

<sup>212</sup> If we considered permanent changes in the capital requirements, the short-term responses of the economic allocations would not change. In this case, however, over the long run the positive effects of the macroprudential policies considered here might outweigh their short-term negative impact, as the economy might reach a new steady state characterised by a more resilient banking system.



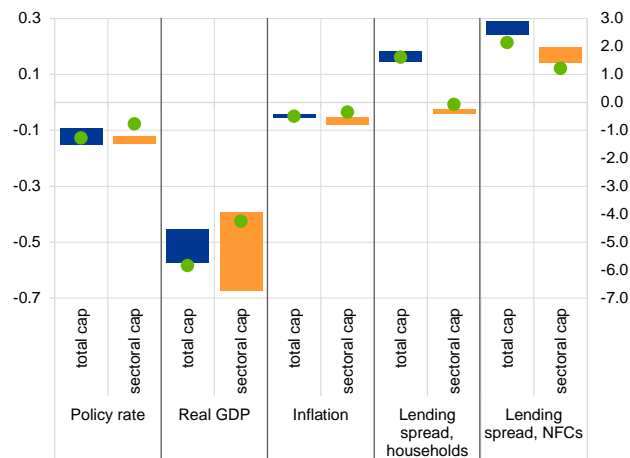
capital requirements on non-financial corporate loans and (ii) caps on the loan-to-value ratio.<sup>213</sup>

Charts D.4 and D.5 show the impact of the macroprudential measures on real economic and financial variables of home and foreign economies, respectively, for the five calibrations. Each bar illustrates the dispersion across the different calibrations of the impact of an increase in the system-wide capital requirements (orange) and of the sectoral capital requirements (blue) on the policy rate, real GDP, inflation and lending spreads after two years. The diamonds represent the average across countries after two years when financial cross-border linkages are shut down. Only results for system-wide capital requirements and sectoral risk weights are shown. The results for the loan-to-value ratio cap are qualitatively similar to the latter case.

**Chart D.4**  
Macroprudential tightening measures negatively affect economy... but impact mitigated by monetary policy...

**Transmission of macroprudential policy measures in “home” country under endogenous single monetary policy**

(real GDP (percentage deviation from baseline, left-hand scale); inflation (percentage point deviation from baseline, left-hand scale); interest rates (percentages, right-hand scale))

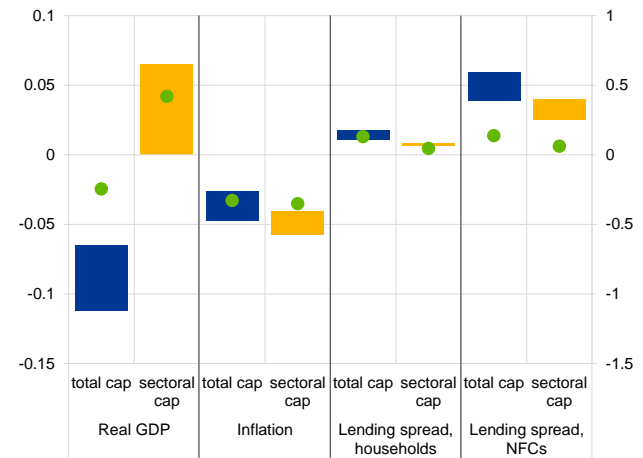


Source: ECB calculations.  
Notes: Coloured ranges indicate the cross-country dispersion of results and green diamonds indicate the simple average impact across countries without taking into account financial cross-border linkages. "Total cap" refers to system-wide bank capital requirements, whereas "sectoral cap" refers to sectoral capital requirements on loans to non-financial corporations.

**Chart D.5**  
... and the measures produce non-negligible cross-border spillovers

**Transmission of macroprudential policy measures in “foreign” country under endogenous single monetary policy**

(real GDP (percentage deviation from baseline, left-hand scale); inflation (percentage point deviation from baseline, left-hand scale); interest rates (percentages, right-hand scale))



Source: ECB calculations.  
Notes: Coloured ranges indicate the cross-country dispersion of results and green diamonds indicate the simple average impact across countries without taking into account financial cross-border linkages. "Total cap" refers to system-wide bank capital requirements, whereas "sectoral cap" refers to sectoral capital requirements on loans to non-financial corporations.

In response to higher regulatory system-wide capital requirements (i.e. broad-based capital buffer requirements, such as a counter-cyclical capital buffer, systemic risk buffer and G-SIFI buffer), banks react by charging higher margins on new loans and curtailing the provision of credit symmetrically to domestic households and firms,

<sup>213</sup> The macroprudential measures have been calibrated so that the loan growth of the targeted sector (i.e. households for the loan-to-value measure and firms for the sectoral risk weights) decreases by 1% on average over the first year.

albeit to different degrees.<sup>214</sup> The resulting contraction in both investment and private consumption depresses capital and house prices, which exacerbates the propagation effects through financial accelerator mechanisms (as the decline in collateral values tightens borrowing constraints). The impact on the economy of the macroprudential tightening is, however, mitigated by an accommodative response of monetary policy.

System-wide capital requirement measures have, on average, a larger effect on the macroeconomic variables of the domestic and foreign economies than more targeted macroprudential measures. At the same time, it is notable that the sectoral risk weight measure targeting corporate loans results in more dispersed macroeconomic effects across countries. This feature can be explained by the current high dispersion of PDs of non-financial corporations across euro area countries. In particular, curtailing credit to firms has the strongest effects on the real GDP of southern European countries which determine the very high dispersion towards more negative values of the real GDP response and are characterised by higher risk weights for these loans. PDs are less dispersed across countries for the retail loan book and hence measures targeting the household sector (such as loan-to-value ratios or sectoral risk weights on mortgage loans) in general lead to less heterogeneous macroeconomic propagation across euro area countries.

In terms of cross-border spillovers, macroprudential measures in the targeted jurisdiction are transmitted to the rest of the euro area through various channels. Trade linkages propagate the expenditure slowdown for the domestic economy into weaker foreign demand for the other country (see green diamonds in Charts D.4 and D.5). Banks' cross-border loan exposures create direct financial spillovers: the deleveraging pressures of domestic banks lead to funding pressures on foreign banks, which ultimately lead to a tightening of the credit conditions offered to their local customers.<sup>215</sup> Finally, in a monetary union, domestic shocks are transmitted abroad through the monetary policy reaction. In particular, the monetary policy response may provide a shield for macroeconomic allocations in the domestic economy, provided that the country is large enough and monetary policy has scope to accompany the bank balance sheet adjustment at times when capital buffers are increasing. However, this may ease the liquidity conditions in the rest of the euro area and contribute to macroeconomic heterogeneity within the monetary union. According to our simulations, system-wide capital requirements generate larger and negative cross-border spillovers to the foreign country, while the sectoral capital requirements on non-financial corporate loans even generate a positive GDP response. In this second case, the accommodative monetary policy seems to play a more relevant role than the negative effects arising from the decline in foreign demand.

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<sup>214</sup> As the average risk weights on credit to firms are higher than those on credit to households, according to the data used in the model calibration (see box), banks reduce their corporate loan book by more than they reduce credit to households.

<sup>215</sup> This assumes full reciprocity of the macroprudential measures to be imposed also on foreign branches operating in the "home" country and ignores any leakages of targeted activities to non-regulated entities (such as shadow banks); see also the special feature by Fahr, S. and Zochowski, D., "A framework for analysing and assessing cross-border spillovers from macroprudential policies", *Financial Stability Review*, ECB, May 2015.

## Cross-country heterogeneity and the scope for macroprudential support to monetary policy conduct through the cycle

The potential interactions between monetary policy and macroprudential policies in a monetary union can also be illustrated with the two-country DSGE model. The following theoretical results are to some extent model-specific and should be considered with caution. At the same time, they shed some light on the role of macroprudential policy through the cycle, also from the perspective of high and persistent cross-country heterogeneity within the monetary union.

The simulation exercise relies on a calibration of the model for two regions: one region corresponds to the countries less affected by the financial crisis and the other region covers the rest of the euro area.<sup>216</sup> Within the confines of this theoretical framework, the scope for macroprudential policies is evaluated through the joint optimisation of an interest rate policy rule for the single monetary policy and counter-cyclical capital rules for the two regional macroprudential authorities. We focus on cooperative policy arrangements.<sup>217</sup>

In order to convey the stabilisation trade-offs, the results are presented in terms of a policy efficiency frontier in the output and inflation volatility space: the efficiency frontier portrays, for all sets of policy-makers' preferences, the output and inflation volatility implied by the corresponding optimised rules. Four configurations are examined. First, we derive the efficiency frontier in the absence of macroprudential intervention and with the full set of estimated business cycle shocks (blue line in Chart D.6). This would span the reference set of macroeconomic allocations against which the benefits of macroprudential support could be assessed. The optimised monetary policy rule responds to output and inflation, but also to debt and asset prices, which could be interpreted as vindicating to some extent "leaning against the wind".

Second, counter-cyclical capital rules are introduced, reacting to credit, asset price dynamics and cyclical economic conditions. This induces an inward shift of the efficiency frontier (yellow dotted line in Chart D.6): macroprudential support to monetary policy enables a superior performance in terms of macroeconomic stabilisation. In addition, the introduction of counter-cyclical macroprudential policies limits the extent to which the central bank incorporates specific signals from credit and financial markets in its systematic monetary policy conduct through the cycle (i.e. the optimised Taylor rule coefficients for credit or asset prices). At the same time, the optimised counter-cyclical capital rules lead to excessive volatility in banks' balance sheets, which could be difficult (and sub-optimal) to implement in practice.

Consequently, the third exercise assumes that policy-makers' loss functions also weight the fluctuations in bank leverage through the cycle. In this case, the inward

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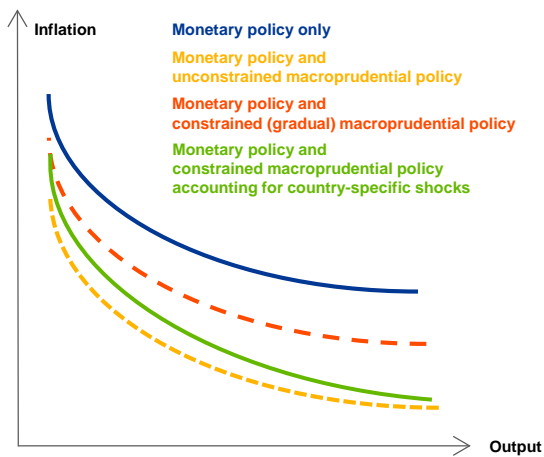
<sup>216</sup> The stochastic distributions of real and financial shocks are estimated on the basis of observed macroeconomic variables for the two regions, allowing for cross-regional correlations in each type of economic disturbance.

<sup>217</sup> Technically speaking, the optimised policy rules minimise a menu of loss functions, or policy-makers' preferences, that weight output and inflation volatility as well as credit or asset price fluctuations. Darracq Pariès et al. (2011, op. cit.) conduct a similar exercise in a closed-economy context.

shift of the associated efficiency frontier compared with the reference case is much less pronounced (red dotted line in Chart D.6). With some degree of macroprudential gradualism and implementation constraints, the case for monetary policy to lean against financial factors would still be warranted, as suggested by Smets (op. cit.).

**Chart D.6**  
**Macroprudential policies targeted at country-specific shocks can alleviate the burden on a single monetary policy**

Efficiency frontier between output-inflation policy outcomes



Source: ECB calculations.

The fourth and final exercise is the same as the previous one, but only considers asymmetric financial shocks as cyclical drivers (green line in Chart D.6). It reveals that within the monetary union macroprudential policy support to monetary policy is most suited to a situation where there are financial shocks (as compared with real and nominal shocks) and where the shocks are asymmetric across countries. In such cases, there is scope for targeted counter-cyclical macroprudential policy to alleviate somewhat the need for monetary policy to “lean against the wind”.

**Curtailling the side-effects of a low interest rate environment**

The preceding analysis has shown that through the expansionary phase of the financial cycle, monetary and macroprudential policy may reinforce each other. In crisis times, however, they may conflict, as in the current low-yield environment. The side-effects of abundant liquidity and exceptionally low interest rates

across the maturity spectrum may materialise through financial imbalances in some market segments or jurisdictions.

Should financial stability risks emerge, this would probably require tighter macroprudential requirements precisely when the central bank intends to loosen its stance. The articulation of such policies would entail major calibration and implementation challenges. Failing to act appropriately on the macroprudential side would let the asymmetric financial imbalances develop further within the monetary union, putting an extra burden on the single monetary policy. At the same time, given the limited experience in conducting macroprudential interventions, there is a risk of an inefficient policy mix, with a more accommodative monetary policy for the euro area as a whole and tighter macroprudential conditions in some parts of the euro area.

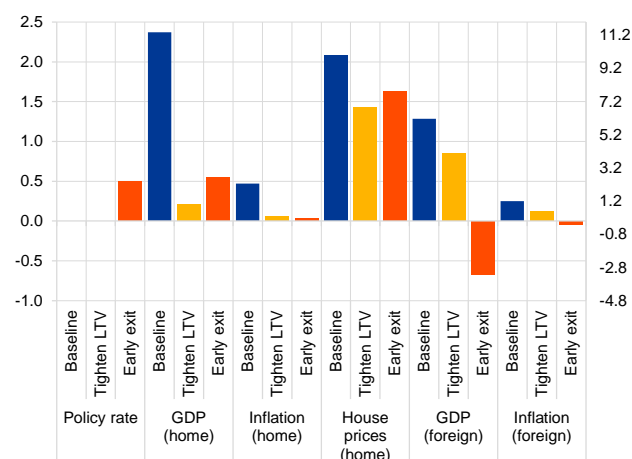
Admittedly, at the current juncture, signs of housing market overvaluation together with rapid credit expansion in some jurisdictions are not visible. Nonetheless, we will illustrate here the situation in which macroprudential instruments can be efficiently set to mitigate the risks of overheating in some housing market segments, on the back of the central bank asset purchase programme and the policy rate at its lower bound. As shown in the previous section, MPis targeted at the jurisdiction at risk would be appropriate to address this source of systemic risk.

## Chart D.7

### Targeted macroprudential interventions to curtail financial imbalances in the housing market

#### Leaning against house price bubbles: LTV ratio measures versus monetary policy

(cumulated responses after two years: real GDP (percentage deviation from baseline, left-hand scale); inflation (percentage point deviation from baseline, left-hand scale); policy rate (percentage point deviation from baseline, left-hand scale); house prices (percentage deviation from baseline, right-hand scale))



Source: ECB calculations.

Notes: "Baseline" refers to scenario with unchanged monetary and macroprudential policies over a two-year horizon assuming 10% growth in home country house prices. "Tighter LTV" refers to scenario where a cap to LTV ratios is introduced in the home country while monetary policy is assumed unchanged. "Early exit" refers to a scenario of increasing monetary policy rates, while macroprudential policy is kept unchanged.

The scenario analysis is based on the same model calibration as in the previous section. We consider the risk of a region-specific gradual rise in house prices by 10% over a two-year horizon, fuelled by positive housing demand factors and loose credit supply conditions on loans for house purchases. In the model, buoyant construction activity, together with the relaxation of financial constraints for the household sector, support the growth momentum and consumer spending in the booming region. The baseline simulation assumes that monetary policy is unchanged for two years. Against this background, two situations are contrasted. In the first scenario, we assume that there is a counter-cyclical macroprudential intervention in the booming region through a cap on loan-to-value ratios, while monetary policy is kept constant. In the second scenario, the early exit from the exceptionally loose monetary conditions assumes that the short-term interest rate starts rising in line with the model-based policy rule over the last three quarters of the simulation. The respective simulations are presented in Chart D.7. It turns out that the macroprudential measures are able to contain the asset price increase in the booming region and to better shield the rest of the euro area. By comparison, the early tightening of monetary policy to

mitigate house price growth in the domestic economy delivers significantly more cross-country heterogeneity and negative cross-border spillovers.

## Conclusion

There are synergies and trade-offs between monetary and macroprudential policies. These interactions may become even more pronounced in a monetary union where monetary policy by definition will be focusing on area-wide economic and financial conditions. In such circumstances, macroprudential policies targeting imbalances building up at the national level within the monetary union can help to achieve better policy outcomes in terms of price and financial stability.

The macroprudential policy framework in the euro area with its distinct role for national designated authorities, in conjunction with a central coordinating role for the ECB, should be conducive to designing targeted macroprudential policies, while also taking into account the single monetary policy stance. This set-up should also make it possible to address potential unintended side-effects on financial stability that may arise in a context of highly accommodative conventional and unconventional monetary policy.