Financial Frictions and Macroprudential Policy*

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Incorporating financial intermediaries, with their ability to generate shocks and frictions, into macroeconomic models has recently gained substantial attention of the profession. In this commentary I ask whether the models we generated are ripe to provide valuable, quantitative advice to policymakers, especially those interested in implementing and conducting macroprudential policy. I concentrate on three features of standard DSGE models that, in my view, still make them hard to digest for policymakers: goals of macroprudential policy, assumed terms of lending, and spillovers.

JEL Codes: E44, E51, E58.

1. Introduction

The financial crisis raised many new questions, and economists eagerly started to answer them. Particular attention has been devoted to explaining the interactions between monetary policy, macroprudential policy, the financial sector, and the macroeconomy. A wide range of topics was analyzed, including the impact of financial factors on the economy (e.g., Gerali et al. 2010; Iacoviello and Neri 2010), the optimal behavior of monetary policy in the presence of financial frictions (e.g., Curdia and Woodford 2010; Kolasa and Lombardo 2014), interactions between monetary and macroprudential policies (e.g., Angelini, Neri, and Panetta 2012; Angeloni

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and Faia 2013), and the effects of macroprudential policy (Christensen, Meh, and Moran 2011; Darracq-Pariés, Kok Sørensen, and Rodriguez-Palenzuela 2011), to name but the most prominent topics.

The papers by Quint and Rabanal (this issue) and de Groot (this issue) make an excellent fit with the existing literature. The first takes up a topic of particular importance to policymakers in the euro area—it analyzes the effects of macroprudential policy in a monetary union. The second explains how monetary policy affects risk taking by financial institutions and, as a result, affects the transmission of shocks to the economy.

All in all, the scope of new, fascinating topics and related results is impressive, and it would be hard to claim that the progress of the last years has been small. The argument in this commentary is different. I will argue that despite the enormous progress, policymakers still cannot rely on macrofinancial models in terms of quantitative advice they offer, at least not to the extent that they used to trust models of monetary policy transmission. The point of reference is thus the widespread usage of dynamic stochastic general equilibrium models not only in academic research but foremost in central bankers' practice. Starting with the seminal work of Smets and Wouters (2003), many central banks developed large-scale DSGE models and have used them extensively both for simulations and for forecasting. However, before DSGE models could be employed at central banks, they went a long way from theoretically appealing but useless (in terms of forecasting at central banks, of course) real business-cycle models to New Keynesian models equipped with a rich set of real and nominal frictions that could match the data in a satisfactory manner. Models that could offer reliable, quantitative advice to macroprudential policymakers still have to follow this road.

2. Why Not Yet?

In what follows I will concentrate my attention on three (subjectively chosen[1]) reasons that still make quantitative, policy-relevant predictions from the current class of DSGE models with financial

[1] For other reasons see, e.g., Borio (2012).

frictions debatable. I will start by discussing the gap between goals of macroprudential policy as seen by policymakers and modelers. Next I will show how the widespread modeling assumptions about terms of lending may affect the effects of monetary and macroprudential policies. Finally, I will concentrate on the role of interconnections and spillovers in the financial sector.

2.1 Goals

From many policymakers' perspective, the primary problem with models featuring macroprudential policy is the way they view policy objectives. So far, the literature has mainly adopted Taylor-like rules that determine the macroprudential policymakers' instrument (e.g., loan-to-value (LTV) ratio, capital requirement) as a function of macroeconomic variables. For instance, in Christensen, Meh, and Moran (2011), regulated banks' leverage is a function of the loan-to-GDP ratio. In Angelini, Neri, and Panetta (2012), capital requirements or LTV ratios respond to the growth of output, while in the framework of Prakash, Rabanal, and Scott (2012) capital requirements depend on the growth rate of nominal credit. A clearly countercyclical macroprudential policy rule is also adopted by Angeloni and Faia (2013), where banking capital is assumed to react to deviations of output from steady state. Finally, in Quint and Rabanal (this issue) macroprudential policy reacts to nominal credit growth, or to the credit-to-GDP ratio.

This practice is a direct consequence of adding macroprudential policy to models of the business cycle. Consequently, macroprudential policy has primarily become a business-cycle policy, countercyclical either directly (if it targets output) or indirectly (if it targets loans). This stands in sharp contrast to the way policymakers think about macroprudential policy. On several occasions, institutions engaged in promoting and introducing macroprudential policy—like the Bank for International Settlements, the European Central Bank, the International Monetary Fund, or the European Systemic Risk Board (ESRB)—have expressed their views on its objectives. In its flagship report on macroprudential policy, the ESRB (2014) specifies the goal of macroprudential policy as "preventing and mitigating systemic risks to financial stability." Further, the ESRB also specifies intermediate macroprudential objectives that aim at mitigating systemic risks to financial stability that follow from (i) excessive credit growth and leverage, (ii) excessive maturity mismatch and market illiquidity, (iii) direct and indirect exposure concentrations, and (iv) misaligned incentives and moral hazard.

Comparing the approach to macroprudential policy embedded in macrofinancial models and the objectives expressed by policymakers makes the discrepancy more then evident. Most models do not have much to say about systemic risk. Of the above list of sources of systemic risk, only excessive credit growth and leverage are targeted by policymakers in business-cycle DSGE models. Moral hazard problems appear there as well, but more as a source of financial frictions (as in Gertler and Karadi 2011) than a target for macroprudential authorities. Issues like maturity mismatch or exposure concentration have, to my knowledge, not been incorporated into business-cycle models used for macroprudential analysis.

2.2 Terms

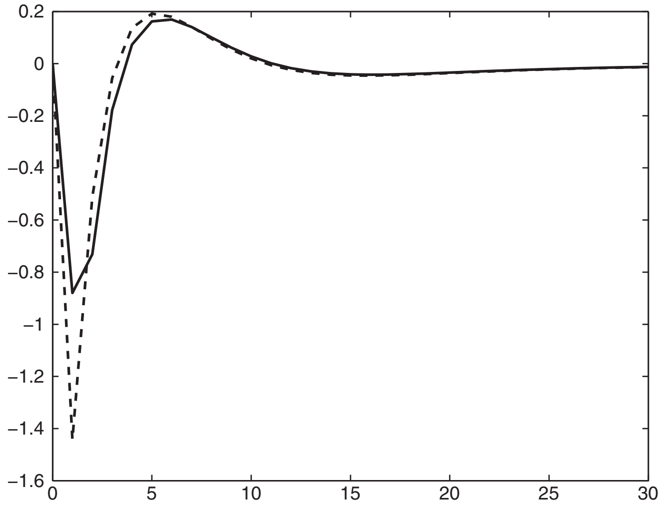
My second reason that explains (or at least should explain) possible mistrust about quantitative predictions of macrofinancial DSGE models is related to the way they design lending. Loans are at the core of financial intermediation and frictions in most models, but with a few off-the-mainstream exceptions these models feature single-period loans. As a consequence, the distinction between floating and fixed interest rates becomes irrelevant. In real life, however, loan length is usually substantially higher than one quarter. The most frequent mortgage loan in the United States is, for instance, a fixed-rate thirty-year loan. While in terms of fixing the rate the United States is more an exception than the rule, in most developed countries mortgages often range to thirty years, and fixed-rate periods can be substantial. According to Campbell (2013), the average initial fixed-rate period is twenty-seven years in the United States, almost twenty years in Denmark, and five to ten years in Belgium, Canada, France, and Germany.

The consequences of assuming single- instead of multi-period loan contracts have been analyzed from several perspectives in the literature. These studies confirm that the usual simplifying assumption may have important consequences on the working of the model. Some of them show that from a central bank's perspective the effects of multi-period (or fixed vs. floating rate) loans may be important. For instance, Calza, Monacelli, and Livio (2013) document, on an empirical basis, that monetary transmission differs between countries with different mortgage market structures (in particular, in terms of fixed vs. floating interest rate). Then they construct a DSGE model with multi-period loans where the distinction between single- and multi-period loans (equivalent to floating vs. fixed rate in their framework) can significantly affect monetary transmission. Justiniano, Primiceri, and Tambalotti (2013) seek to explain the asymmetric behavior of debt after changes of collateral value (debt rises when collateral is higher, but does not fall when collateral declines). They construct a model with multi-period debt and a non-negativity constraint for new loans that explains this phenomenon. Kydland, Rupert, and Sustek (2012) construct a business-cycle model with multi-period mortgages to account for the fact that residential investments lead GDP in the United States and Canada.

The link between lending terms and the transmission of macroprudential policy is analyzed by Brzoza-Brzezina, Gelain, and Kolasa (2014). We construct a New Keynesian model with financial frictions in the form of collateral constraints à la Iacoviello (2005). Borrowing households are allowed to take out multi-period loans collateralized on their housing stock. The collateral constraint assumes that the stock (i.e., the whole portfolio) of loans, multiplied by the gross lending rate, should not exceed the value of collateral multiplied by the LTV ratio. On top of that, similarly to Justiniano, Primiceri, and Tambalotti (2013), it is assumed that new loans granted in a given quarter cannot be negative. In other words, we introduce the realistic assumption that banks cannot force borrowers to accelerate loan repayment if the collateral constraint unexpectedly tightens. Loans are granted with a floating or fixed rate.

In a series of experiments we then demonstrate how various assumptions about lending terms (fixed vs. floating, short vs. long) affect the working of monetary and macroprudential policies. In what follows I report an experiment that seems most relevant to the current commentary. This assumes a contractionary macroprudential policy shock, defined as a decrease in the target LTV ratio by 3 percentage points. For substantially long loans (we assume twenty quarters), this shock is strong enough to push new loans into a negative region. This happens because the collateral constraint requires the stock of loans to decline by more than the steady-state level of

Figure 1. Reaction of Output to a Macroprudential Policy Shock



Notes: This figure shows the LTV shock (–3 percent) under single (dashed) and multi-period (solid) loans (twenty-quarter length). The response is presented as percent deviation from the steady state. The model and more results can be found in Brzoza-Brzezina, Gelain, and Kolasa (2014).

new loans. Since negative new loans are forbidden, they only fall to zero, which dampens the impact of macroprudential policy. One should note that this does not happen when loans are single period. In this case the non-negativity constraint is slack by construction (new loans equal the stock of loans, which must always be non-negative) and macroprudential policy is much more effective than for multi-period contracts. Figure 1 presents the reaction of output in the two analyzed cases. The difference between reaction functions is sizable, as the contraction in output is approximately 40 percent smaller for twenty-period than for single-period loans. Hence, the presence of multi-period loans can substantially weaken the effects of a macroprudential policy tightening.

2.3 Spillovers

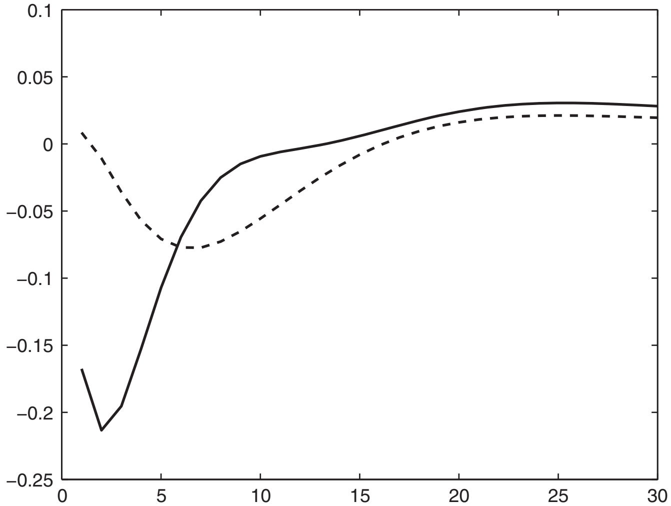
Last but not least, there is the problem of spillovers from country to country and from institution to institution. While the distinction is not unequivocal (international spillovers usually result from connections between institutions as well), from the modeling perspective it is convenient to cover them separately. Both types have played an important role in propagating the last financial crisis, and both should be accounted for in a quantitative framework for macroprudential analysis.

Let us begin with the international transmission of shocks. As is well known from the literature (e.g., Justiniano and Preston 2010), open-economy DSGE models have difficulties in accounting for the extent of international spillovers. This problem has become even more evident during the financial crisis. It erupted in the United States but spread with disastrous force and speed through the global economy. After this experience it has become even more evident that the usual trade links are by far not sufficient to explain the international transmission of shocks. In particular, international links of a financial nature must be accounted for if quantitative predictions are to be drawn from macrofinancial models. We have recently seen some progress in this direction, and selected examples are referred to below.

One source of spillovers could be financial institutions that operate worldwide. Kollman (2013) estimates a two-country DSGE model that features a global bank. This bank can accept deposits and grant loans to households in both countries and is subject to an external capital requirement. This gives rise to a financial friction—if the bank does not hold enough capital, it is subject to a penalty, which then is transmitted to the spread between the lending rate and the risk-free rate. The model is then estimated to U.S. and euro-area data. Financial shocks are able to generate a strong co-movement of domestic and foreign variables. However, taking into account the whole estimated stochastic structure, the correlation of domestic and foreign output still remains below what is observed in the data.

Spillovers can also result from holding foreign assets by domestic agents. This is the path followed by Dedola and Lombardo (2012). In their model investors hold claims on domestic and foreign capital stocks. When asset prices decline in one economy, investors in both countries become undercapitalized and sell both domestic and foreign assets. Hence this channel is a powerful source of international shock propagation. The authors show that it works not only for financial (external finance premium) shocks but also for real (technology) shocks.

Figure 2. Reaction of Domestic Output to a Foreign Interest Rate Shock



Notes: This figure shows the foreign interest rate shock (+0.25 percent) with only foreign (solid) and only domestic (dashed) currency loans in the domestic economy. The response is presented as percent deviation from the steady state. The model and more results can be found in Brzoza-Brzezina, Kolasa, and Makarski (2014).

Yet another international financial linkage can arise from the presence of foreign-currency loans (FCLs). In several countries (inter alia, Austria, Hungary, and Poland) FCLs constitute a substantial share of banks' loan portfolios. Brzoza-Brzezina, Kolasa, and Makarski (2014) constructed a small open-economy model (calibrated for Poland and the euro area) to analyze the consequences of foreign-currency lending for monetary and macroprudential policy. The model features patient and impatient households; the latter are subject to a collateral constraint and are allowed to borrow in domestic or foreign currency. We conclude that the presence of FCLs weakens monetary policy transmission and show that regulatory policy that discriminates FCLs can cause a temporary downturn. In the context of this commentary I will use this particular model to show something different—that international financial linkages in the form of FCLs can substantially strengthen the transmission of shocks between economies. Figure 2 shows the impulse response of domestic output to a foreign interest rate shock in a world with and without FCLs. Clearly the presence of foreign lending boosts international spillovers.

In this context my message about the current stage of model developments is mildly positive. While a clear understanding of which mechanisms are the most important and what should be their relative quantitative importance is still missing, several links have been successfully tested in the context of DSGE models. They are able to make a clear improvement in the international transmission of shocks and bode well for their practical application.

The second source of spillovers—i.e., interconnectedness of the financial system—is much more problematic in my view. The exact extent to which financial institutions are interlinked is unknown, but the numbers are huge by all means. For instance, only the interbank exposures of fifty-three large EU banks amounted in December 2011 to EUR 1.7 trillion (Alves et al. 2013). Several attempts have been made to quantify the consequences of interconnectedness for the stability of the financial system (e.g., Espinosa-Vega and Solé 2011; Memmel and Sachs 2013). However, a convincing integration of these models into the DSGE framework is, to my knowledge, still missing. The road towards this goal is rough and full of obstacles. Let me concentrate on a choice of three of those obstacles.

First, as already mentioned, data is scarce. Interconnectedness has become a global phenomenon, and precise knowledge about all relevant exposures is missing. For instance, as shown by Gauthier, Lehar, and Souissi (2010), probabilities of default change substantially if all interbank exposures are taken into account instead of interbank deposits only. Second, there is the issue of static vs. general equilibrium effects. It is relatively easy to account for the spread of losses between institutions (as a consequence of one institution's default, for instance) in a static (accounting) way. However, as is well known, in times of financial stress financial institutions change the composition of their balance sheets. If done on a massive scale, this can cause fire sales that result in dramatic changes of prices and, as a consequence, increase the losses incurred by everyone. This mechanism, with potentially huge implications for the propagation of contagion, seems the most difficult to model in a quantitatively predictable way. Last but not least, the quantitative importance of DSGE models at central banks followed from their estimation. This allowed, inter alia, for their application in explaining past developments (historical shock decompositions) or forecasting. If this pattern is to be repeated by macrofinancial models, huge technical obstacles must be removed. In particular, the problems described above are inherently non-linear. A bank either defaults or not. Moreover, agents (banks) must be heterogeneous. Unfortunately, our experience with estimating non-linear, heterogeneous-agent models is limited. The application of existing techniques for estimating non-linear models (particle filtering) is currently limited to relatively small models, while realistic macrofinancial models must be large. All in all, interconnectedness seems, in my view, the biggest obstacle on the road towards quantitatively realistic macrofinancial models for macroprudential policymakers.

3. Conclusions

DSGE models provided a lot of valuable quantitative advice to policymakers about the working of monetary policy. After the financial crisis, researchers attempted to redesign these models to account for financial system imperfections and macroprudential policy. In this commentary I discussed selected obstacles that I see on the road towards using this class of models for providing quantitative advice to policymakers. I covered three areas where, in my view, problems arise.

First, in most models macroprudential policy has a countercyclical objective, while macroprudential authorities prefer to speak about containing systemic risk as their main goal. Second, while in most models lending stands at the core of the financial system, lending terms are far from realistic. In particular, loans are assumed to be single period, which makes the distinction between fixed and floating interest rates irrelevant. These unrealistic simplifying assumptions may have a strong influence on the working of both monetary and macroprudential policies. Finally, there are spillovers between financial institutions. The default of one bank can potentially trigger a spiral of bankruptcies through network connections. The obvious consequences are not only of financial but also of macroeconomic nature. This is probably the most difficult problem for modeling macroprudential issues.

All these problems should not overshadow the fact that great progress in modeling was made over the last few years. However, some work still needs to be done.

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