# Discussion of "Monetary and Macroprudential Policy in an Estimated DSGE Model of the Euro Area"*

Olivier Loisel
CREST (ENSAE)

## 1. Introduction

The recent crisis has highlighted the need for a "macroprudential policy" ensuring financial stability. One of the key aspects of this forthcoming macroprudential policy is the setting of bank capital requirements conditionally on the state of the economy—what the Basel Committee on Banking Supervision (2010) calls the "countercyclical capital buffer." This raises the issue of the interactions between monetary and macroprudential policies (see, e.g., International Monetary Fund 2013). On this issue, the euro area has some specificities: it has a single monetary authority (the European Central Bank), a common macroprudential authority (the European Systemic Risk Board), and national macroprudential authorities. How should all these authorities conduct their respective state-contingent policies?

The paper by Quint and Rabanal in this volume (Quint and Rabanal 2014, henceforth QR) takes a welcome first step in addressing this issue. It studies the jointly optimal monetary and macroprudential policies in a dynamic stochastic general equilibrium (DSGE) model estimated on euro-area data. This model has two countries, a single monetary authority, and national macroprudential authorities that cooperate with each other. A number of interesting quantitative results are obtained: in particular, the welfare gain from introducing macroprudential policies is found to be small, and optimal

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Author contact: CREST, 15 boulevard Gabriel Péri, 92245 Malakoff Cédex, France. E-mail: olivier.loisel@ensae.fr.

**Table 1. DSGE Models with Monetary and Macroprudential Policies**

| Code | Paper |
|---|---|
| AAPS | Agénor, Alper, and Pereira da Silva (2013) |
| AF | Angeloni and Faia (2013) |
| ANP | Angelini, Neri, and Panetta (2011) |
| BBKM | Brzoza-Brzezina, Kolasa, and Makarski (2013) |
| BCM | Beau, Clerc, and Mojon (2012) |
| BK | Benes and Kumhof (2011) |
| BMZ | Bailliu, Meh, and Zhang (2012) |
| CDDL | Collard et al. (2012) |
| CGR | Carrasco-Gallego and Rubio (2014) |
| CMM | Christensen, Meh, and Moran (2011) |
| DPKSRP | Darracq Pariès, Kok Sørensen, and Rodriguez-Palenzuela (2011) |
| DPP | De Paoli and Paustian (2013) |
| GLM | Gelain, Lansing, and Mendicino (2013) |
| KRS | Kannan, Rabanal, and Scott (2012) |
| LMP | Lambertini, Mendicino, and Punzi (2013) |
| MR | Medina and Roldós (2014) |
| OU | Ozkan and Unsal (2013) |
| **QR** | **Quint and Rabanal (2014)** |
| S1 | Suh (2012) |
| S2 | Suh (2014) |
| U | Unsal (2013) |

policies are found to have potentially large intranational redistributive effects. In my discussion, I will place the paper in the related literature (section 2), discuss the way the main financial friction is modeled (section 3), and comment upon the policy-optimization exercise (section 4).

## 2. Related Literature

The literature on the interactions between monetary and macroprudential policies has been booming over the past three years. Table 1 lists a number of papers addressing this issue through the lens of a DSGE model. Table 2 lists some features of the models considered

**Table 2. Some Features of These Models**

| Paper | Economy | Main Financial Friction | Financial Sector | Housing Sector | Macropru-dential Instrument |
|---|---|---|---|---|---|
| AAPS | CE | CC | Yes | Yes | CAR |
| AF | CE | BR | Yes | No | CAR |
| ANP | CE | CC | Yes | Yes | CAR & LTV |
| BBKM | MU | CC | Yes | Yes | CAR & LTV |
| BCM | CE | CC | No | Yes | LTV |
| BK | CE | FA | Yes | No | CAR |
| BMZ | CE | FA | No | No | SC |
| CDDL | CE | MH | Yes | No | CAR |
| CGR | CE | CC | No | Yes | LTV |
| CMM | CE | MH | Yes | No | CAR |
| DPKSRP | CE | CC | Yes | Yes | CAR |
| DPP | CE | CC | Yes | No | LTV, TB, & TD |
| GLM | CE | CC | No | Yes | LTI & LTV |
| KRS | CE | FA | Yes | Yes | SC |
| LMP | CE | CC | No | Yes | LTV |
| MR | SOE | CL & FA | Yes | No | RR |
| OU | SOE | FA | Yes | No | SC |
| **QR** | **MU** | **FA** | **Yes** | **Yes** | **SC** |
| S1 | CE | FA | Yes | Yes | CAR & LTV |
| S2 | CE | FA | No | No | SC |
| U | SOE | FA | Yes | No | SC |

**Notes:** Economy: CE = closed economy, SOE = small open economy, MU = monetary union. Main financial friction: BR = bank runs, CC = collateral constraint, CL = costly liquidation, FA = financial accelerator à la Bernanke, Gertler, and Gilchrist (1999), MH = moral hazard. Macroprudential instrument: CAR = capital requirement, LTI = loan-to-income ratio, LTV = loan-to-value ratio, RR = reserve requirement, SC = short cut, TB = tax on borrowing, TD = tax on deposits.

in these papers, namely whether they deal with a closed economy, a small open economy, or a monetary union; the nature of their main financial friction; whether they include a financial sector and/or a housing sector; and the nature of the macroprudential instrument(s) considered.

Table 3 gives some information about the policy-optimization exercises (if any) conducted in these papers, namely whether the objective function is welfare based or ad hoc; whether the model features a representative agent (in which case the welfare-based

**Table 3. Optimization Exercises Conducted in These Papers**

| Paper | Objective Function | Rep. Agent | Optimal Policies | Steady-State Optimization | Strategic Interactions | Nature of the Results |
|---|---|---|---|---|---|---|
| AAPS | AH | No | OSR | No | C | NC |
| AF | W & AH | No (R) | OSR | No | C | NC |
| ANP | AH | No (I) | OSR | No | C & N | NC |
| BBKM | AH | No (I) | OSR | No | C | NC |
| BCM | – | No (I) | – | No | – | NE |
| BK | W | Yes | OSR | No | C | NC |
| BMZ | W | No (R) | OSR | No | C | NE |
| CDDL | W | Yes | OPC | Yes | C | A & NC |
| CGR | W | No (I) | OSR | No | C | NC |
| CMM | W | No (R) | OSR | No | C | NC |
| DPKSRP | AH | No (I) | OSR | No | C | NE |
| DPP | W & AH | No (R) | OPC & OPD | Yes | C, N, & S | A & NC |
| GLM | AH | No (I) | OSR | No | C | NC |
| KRS | AH | No (I) | OSR | No | C | NC |
| LMP | W | No (I) | OSR | No | C | NE |
| MR | W | No (R) | OSR | No | C | NC |
| OU | W | No (R) | OSR | No | C | NC |
| **QR** | **W** | **No (I)** | **OSR** | **No** | **C** | **NE** |
| S1 | W | No (I) | OSR | No | C | NC |
| S2 | – | No (I) | – | No | – | A & NC |
| U | AH | No (R) | OSR | No | C | NC |

**Notes:** Objective function: W = welfare, AH = ad hoc, – = no objective function. Representative agent: I = patient and impatient households à la Iacoviello (2005), R = only one risk-averse agent. Optimal policies: OPC = optimal policies under commitment, OPD = optimal policies under discretion, OSR = optimal simple rules, – = no optimal policies. Strategic interactions: C = cooperation (common objective function), N = Nash game (different objective functions), S = Stackelberg game (different objective functions), – = no strategic interactions. Nature of the results: A = analytical, NC = numerical based on a model calibration, NE = numerical based on a model estimation.

objective function to be considered is the representative agent's utility function[1]); whether policies are optimal within a parametric family of simple rules, or optimal under commitment, or optimal under discretion; whether the steady-state values of the policy instruments are optimized or not; whether policymakers cooperate with each other or play a Nash or Stackelberg game; and whether the optimal policies are obtained analytically or numerically (as well as, in the latter case, whether the model is calibrated or estimated).

Tables 2 and 3 aim at underlying the contribution of QR against the background of this fast-growing literature. As is clear from these tables, for instance, there are at least three differences between QR and the only other paper with a monetary union model (Brzoza-Brzezina, Kolasa, and Makarski 2013). First, the main financial friction is a financial accelerator à la Bernanke, Gertler, and Gilchrist (1999) (not a collateral constraint). Second, the model is estimated on euro-area data (not calibrated). Third, policies maximize welfare (not an ad hoc function). In addition, it is worth mentioning that unlike most of the other papers considered in these tables,[2] QR investigate the intranational and international redistributive effects of policies.

## 3. Financial Friction

The main financial friction in QR's model is a version of the financial accelerator mechanism that is identical to the one used in Darracq Pariès, Kok Sørensen, and Rodriguez-Palenzuela (2011), Suh (2012), and Zhang (2009), and similar to the one used in Unsal (2013). This friction rests on the existence of borrower-specific shocks. Each borrower is hit by an idiosyncratic shock that affects the price of her house, hence the value of her collateral, hence her incentive to default

[1] When the model features several agents, table 3 also indicates whether only one of them is risk averse. This information matters because if only one agent is risk averse, and if the optimization variables are the log-linearized deviations of the policy instruments from their steady-state values, but not these steady-state values themselves, then the welfare-based objective function to be considered should be the risk-averse agent's utility function.

[2] The only exceptions are Carrasco-Gallego and Rubio (2014) and Lambertini, Mendicino, and Punzi (2013), who study the intranational redistributive effects of policies in a closed-economy context.

on her loan. Shocks to the variance of idiosyncratic shocks then affect the aggregate default rate and therefore the business cycle. Such a friction is appealing and welcome in a model with macroprudential policy. Here, I would just like to make two remarks about the specific way this friction is modeled and, accordingly, two suggestions about alternative ways to model it.

The first remark is about the nature of the idiosyncratic shock considered. QR interpret this shock as a "house-quality shock." But it is a house-quality shock of a peculiar nature: one that affects the price of the borrower's house without affecting the utility that she gets from her house. An alternative way to proceed would be to introduce an exogenous stochastic multiplicative factor to the agent's stock of durable goods. This idiosyncratic shock could then be interpreted as a house-quality shock that affects both the price of the borrower's house and the utility that she gets from her house. It could be interesting, in future works considering a similar friction, to investigate the normative implications of this alternative shock, if only as a robustness check.

The second remark is about the link between financial intermediaries and savers. Financial intermediaries are perfectly competitive and risk neutral in QR's model, because their "participation constraint" states that the expected return from granting credit should be equal to the risk-free deposit rate. Thus, they make zero expected profits, but non-zero realized profits (or losses). What happens to these realized profits or losses? QR assume that they are transferred to savers, i.e., that savers collect financial intermediaries' profits or recapitalize financial intermediaries as needed. This assumption seems very reasonable. However, it creates some tension between, on the one hand, the fact that financial intermediaries are risk neutral, and, on the other hand, the fact that they are owned by savers, who are risk averse. An alternative way to proceed would be to assume that financial intermediaries are risk neutral but not owned by savers, that they have their own (linear) consumption utility function, and that they have an endowment of goods (so as to avoid negative consumption). Given that the optimization variables considered by QR are the log-linearized deviations of the policy instruments from their steady-state values, but not these steady-state values themselves, the risk-neutral financial intermediaries would then be indifferent between the various policies considered, and the relevant welfare-based policy-objective functions would still be the utility functions of the risk-averse savers and borrowers. It could be interesting, in future works considering a similar framework, to investigate the normative implications of this alternative assumption, if only as a robustness check.

## 4. Optimal Policies

The goal of QR's paper is to study the jointly optimal monetary and macroprudential policies in the model that they consider. In this last section of my discussion, I would just like to make three remarks about these optimal policies in that model.

The first remark is about the optimal steady-state value of the macroprudential policy instrument. As already noted, QR do not seek to determine this optimal steady-state value—like the bulk of the related literature, as is apparent from table 3. What could be said about this optimal steady-state value in their framework? To answer this question, note that QR introduce macroprudential policy into their model by assuming that financial intermediaries, to supply a quantity $S_t^B$ of loans, need a quantity $\eta_t S_t^B$ of funds, where $\eta_t$ is the macroprudential policy instrument. Now, given the steady-state distortions (monopolistic competition, financial friction), steady-state credit is inefficiently low when the steady-state value $\eta_{ss}$ of the macroprudential policy instrument is equal to one. This suggests that the optimal $\eta_{ss}$ could be strictly less than one, i.e., that the optimal policy should not tax, but on the contrary subsidize, lending by the financial intermediaries at the steady state.[3]

The second remark is about the optimal deviations of $\eta_t$ from its steady-state value $\eta_{ss}$. There are many distortions that affect the model's business-cycle properties: the main (intranational) financial friction, which I have discussed in the previous section; another

[3]Whether the optimal $\eta_{ss}$ is indeed strictly less than one depends in particular on what becomes of the remaining quantity $(\eta_t - 1)S_t^B$ of funds collected by the financial intermediaries. This remaining quantity of funds is not paid as a resource cost by the financial intermediaries (in the process of complying with the macroprudential regulation) nor by the regulator (in the process of implementing its macroprudential policy), because it does not appear in the goods-market clearing condition. It is, presumably, included in the financial intermediaries' date-$t$ profits that are redistributed to savers.

(international) financial friction; price stickiness in the non-durable-goods sector; and price stickiness in the durable-goods sector. It might seem natural at first sight to think of the main financial friction as the primary distortion calling for macroprudential policy. In a monetary union context, however, other distortions may also play an important role in this respect, as optimal national macroprudential policy may partly aim at making up for the absence of national monetary policy. Determining which policy instrument is used to address which distortion under optimal policy could be helpful in understanding the way the model works. One way to shed light on this point would be to remove one or several distortions in turn (i.e., impose $\kappa_B = 0$, $\sigma_{\omega,t} = 0$, $\theta_C = 0$, or $\theta_D = 0$) and see what happens to optimal policies. Another way would be to consider shocks that are perfectly correlated across countries, or consider the closed-economy version of the model ($n = 1$). Still another way would be to allow both monetary policy and macroprudential policy to react to credit developments, and see what the jointly optimal policies look like.

The third remark is about the gains from policy cooperation. QR focus on the case in which the monetary authority plays non-strategically (i.e., follows its estimated rule) and the national macroprudential authorities cooperate with each other (i.e., jointly maximize welfare at the monetary union level). In the working-paper version of their work (Quint and Rabanal 2013), they also consider the case in which the monetary authority plays non-strategically and the national macroprudential authorities do not cooperate with each other (i.e., maximize welfare at their respective national levels in the Nash equilibrium). They compare the welfare levels obtained in these two alternative cases and find that there is no significant welfare gain from cooperation between the national macroprudential authorities. This result is interesting because there is no obvious reason to think that it could have been expected from the model's assumptions. In my view, the issue of the gains from cooperation between the national macroprudential authorities would deserve further investigation, notably by considering alternative strategic interactions between the monetary authority on the one hand and the macroprudential authorities on the other hand. For instance, one may assume that the monetary authority plays Nash with the macroprudential authorities, or that all three authorities play a Stackelberg game in which the macroprudential authorities are the leaders (to capture the fact that the European Systemic Risk Board and national macroprudential authorities in the euro area will probably make their policy decisions less frequently than the European Central Bank).[4]

## 5. Conclusion

The paper by Quint and Rabanal in this volume takes a welcome first step in addressing the issue of the interactions between monetary and macroprudential policies in a monetary union—a pressing issue for the European Central Bank, the European Systemic Risk Board, and the national macroprudential authorities in the euro area. It obtains a number of interesting quantitative results, notably on the welfare gain from introducing macroprudential policies and the intranational redistributive effects of optimal policies. Moreover, as it is, or perhaps slightly amended, Quint and Rabanal's model could be used in future work to investigate the issue of these interactions still further, and in particular to provide a thorough assessment of the quantitative welfare gains from policy cooperation between national macroprudential authorities in a monetary union.

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[4]Angelini, Neri, and Panetta (2011) and De Paoli and Paustian (2013) also consider Nash or Stackelberg games between monetary and macroprudential authorities (as is apparent from table 3), but they do so in a closed-economy context. In this respect, one advantage of Quint and Rabanal's (2013) open-economy framework is that it naturally provides *different* objective functions for the authorities (namely, national welfare functions for the macroprudential authorities and the monetary-union-wide welfare function for the monetary authority).

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