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Taming macroeconomic instability: Monetary and macro-prudential policy interactions in an agent-based model

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ABSTRACT

We develop an agent-based model to study the macroeconomic impact of alternative macro-prudential regulations and their possible interactions with different monetary policy rules. The aim is to shed light on the most appropriate policy mix to achieve the resilience of the banking sector and foster macroeconomic stability. Simulation results show that a triple-mandate Taylor rule, focused on output gap, inflation and credit growth, and a Basel III prudential regulation is the best policy mix to improve the stability of the banking sector and smooth output fluctuations. Moreover, we consider the different levers of Basel III and their combinations. We find that minimum capital requirements and counter-cyclical capital buffers allow to achieve results close to the Basel III first-best with a much more simplified regulatory framework. Finally, the components of Basel III are non-additive: the inclusion of an additional lever does not always improve the performance of the macro-prudential regulation.

1. Introduction

In this work we develop an agent-based model (ABM) to study the impact on macroeconomic dynamics of alternative macro-prudential regulations and their possible interactions with different monetary policy rules. The aim is to shed light on the most appropriate policy mix to make the banking sector more resilient and foster macroeconomic stability.

The recent crisis has revealed the fundamental role of credit and more generally of financial markets in triggering deep and long downturns. Ng and Wright (2013) find that in the last thirty years all recessions hitting the U.S. originated in financial markets. More generally, financial crises are not rare events (apart from the calm of the 1930–1970 period), they occur both in developed and emerging economies, and their cost is much more severe than "normal recessions" (Taylor,

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2015). Finally, credit booms can fuel asset price bubbles, leading to deeper recessions and slower recoveries (Jordà et al., 2015; see also Stiglitz, 2015 on the links between credit and deep downturns).

In such a framework, monetary policy is an inadequate tool to achieve both price and financial stability. Given the numerous faults in the global regulatory framework and in banks' risk management practices, a growing consensus has grown to improve macro-prudential regulatory tools in order to better supervise the banking sector and tame financial market instability (Borio, 2011; Blanchard et al., 2013; Zhang and Zoli, 2014; Blundell-Wignall and Roulet, 2014; Gualandri and Noera, 2014). The policy debate is focusing in particular on the adoption, implementation and effectiveness of different macro-prudential tools (Balasubramanyan and VanHoose, 2013; Claessens et al., 2013; Miles et al., 2013; Aiyar et al., 2014; Cerutti et al., 2015), as well as on their impact on macroeconomic outcomes and their relationship with monetary policy (Beau et al., 2012; Kannan et al., 2012; Agénor et al., 2013; Angeloni and Faia, 2013; Lambertini et al., 2013; Spencer, 2014; Suh, 2014).

However, many questions are still open. To name a few, how can one solve the potential conflict between Central Bank's (CB) objectives of price and financial stability (Howitt, 2011)? Should CBs use the policy interest rate to prevent the formation of credit bubbles (Blanchard et al., 2013)? What is the effectiveness of different combinations of macro-prudential tools? In particular, given the increasing complexity of financial markets, do we need complex or simple macro-prudential rules (Haldane, 2012)? Are monetary and macro-prudential policies complementary in increasing the stability of the banking sector and more generally of the whole economy?[1]

These are the questions we are going to address extending the agent-based model (Tesfatsion and Judd, 2006; LeBaron and Tesfatsion, 2008) developed in Ashraf et al. (2011). The model is populated by heterogenous, interacting firms, workers and banks, a Government and a Central Bank. Firms and workers exchange goods and services in decentralized markets. Firms need credit to finance production which is provided by banks according to the macro-prudential regulation. If firms are not able to sell their goods, they can go bankrupt and default on their loans, possibly triggering a banking crisis. The Government bails out banks and levies a sales tax. Finally, the Central Bank sets monetary policies according to different types of Taylor rules and fixes the macro-prudential regulation in the spirit of Basel II or III frameworks.

Our approach consider the economy as a complex, evolving system (Kirman, 1992; Colander et al., 2008), where macro-economic outcomes do not coincide with the behavior of a representative agent, but rather emerge out of the interactions taking place among heterogenous agents (more on that in Farmer and Foley, 2009; Kirman, 2010; Dosi, 2012). Such a research methodology is fruitful to analyze not only how complex market economies manage to coordinate activities in normal times (Howitt, 2011), but especially to study how major crises emerge, pushing the economy outside the stability "corridor" (Leijonhufvud, 1973), in "dark corners" (Blanchard, 2014). As endogenous banking crises are very often at the root of deep downturns, our agent-based approach is well suited to be employed as a laboratory to design and test how different monetary and macro-prudential policies combinations may impact on the resilience of the banking sector and on the overall macroeconomic performance.[2]

First, we test the explanatory power of our model. We find that the model endogenously generates business cycles and banking crises. Moreover the model accounts for the major co-movements of macroeconomic variables (e.g. output, unemployment, credit, inflation, etc.) at business cycle frequencies. Finally, the Okun and Phillips curves are emergent properties of the model.

We then compare the impact of Basel II and III regulations on financial stability and macroeconomic performance, by carefully studying the role (both, jointly and in isolation) of the different components of the Basel III framework. The effects of alternative macro-prudential regulations are analyzed for different Taylor rules focused on e.g. output and price stability, unemployment, credit growth.

Simulation results show that the adoption of the Basel III regulation improves the stability of the banking sector and the performance of the economy vis-à-vis the Basel II framework. Considering the different levers of Basel III and their possible combinations, we find that the minimum capital requirement cum counter-cyclical capital buffer produce results quite close to the Basel III first-best in a much more simplified regulatory framework, thus supporting the plea of Haldane (2012) for simple policy rules in complex financial systems. In particular, the contribution of counter-cyclical capital buffer is fundamental in reducing the pro-cyclicality of credit, thus allowing firms to get more credit during recessions, i.e. when they need it most (Bernanke et al., 1999; Gertler et al., 2007; Christensen and Dib, 2008).

We also find that the relation among the different components of the macro-prudential regulation is not trivial. Indeed, the effects of the adoption of the complete Basel III regulation are much stronger than the summation of the impact of its single components. In addition, the levers of Basel III are non-additive: the inclusion of additional components does not always improve the performance of the macro-prudential regulation.

[1] Empirical findings about the effectiveness of macro-prudential instruments are few due to the scarcity of data, and they mainly focus on the static capital adequacy requirement and the loan-to-value ratio (see in particular Shim et al., 2013; Aiyar et al., 2014; Cussen et al., 2015; McDonald, 2015). A growing literature also uses DSGE models to study the interactions between macro-prudential regulation and monetary policy (see e.g. Angelini et al., 2011; Agénor et al., 2013; Angeloni and Faia, 2013; Zilberman and Tayler, 2014; Kannan et al., 2012; Quint and Rabanal, 2014; Ozkan and Unsal, 2014).

[2] For germane macroeconomic agent-based models with credit and financial markets, see Delli Gatti et al. (2005, 2010), Ashraf et al. (2011), Gai et al. (2011), Battiston et al. (2012), Geanakoplos et al. (2012), Raberto et al. (2012, 2014), Teglio et al. (2012), Dosi et al. (2010, 2013, 2015), Lengnick et al. (2013), Riccetti et al. (2013), Dawid et al. (2014), Poledna et al. (2014), Aymanns and Farmer (2015), Klimek et al. (2015), Krug et al. (2015), Krug (2015), Napoletano et al. (2015), Seppecher and Salle (2015), Da Silva and Lima (2015), van der Hoog and Dawid (2015), van der Hoog (2015), and the papers in Gaffard and Napoletano (2012). See Fagiolo and Roventini (2012, 2017) for a critical comparison of macroeconomic policies in standard DSGE and agent-based models.