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Capital regulation and monetary policy with fragile banks

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ABSTRACT

Optimizing banks subject to runs are introduced in a macro model to study the transmission of monetary policy and its interplay with bank capital regulation when banks are risky. A monetary expansion and a positive productivity shock increase bank leverage and risk. Risk-based capital requirements amplify the cycle and are welfare detrimental. Within a class of simple policy rules, the best combination includes mildly anticyclical capital ratios (as in Basel III) and a response of monetary policy to asset prices or bank leverage.

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1. Introduction

The financial crisis is producing, among other consequences, a change in perception on the roles of financial regulation and monetary policy. The pre-crisis common wisdom sounded roughly like this. Capital requirements and other micro-prudential instruments were supposed to ensure, at least with high probability, the solvency of individual banks, with the implicit tenet that stable banks would automatically translate into a stable financial system. On the other side, monetary policy should largely disregard financial matters and concentrate on pursuing price stability (a low and stable consumer price inflation) over some appropriate time horizon. The recent experience is changing this accepted wisdom in two ways. On the one hand, the traditional formal requirements for individual bank solvency (asset quality and adequate capital) are no longer seen as sufficient for systemic stability; regulators are increasingly called to adopt a *macro-prudential* approach.² On the other, some suggest that monetary policy should help control systemic risks in the financial sector. This crisis has demonstrated that such risks can have disruptive implications for output and price stability, and there is growing evidence that monetary policy influences the degree of riskiness of the financial sector.³ These ideas suggest the possibility of interactions between the conduct of monetary policy and that of prudential regulation.

Our goal in this paper is to study how bank regulation and monetary policy interact in a macroeconomy that includes a fragile banking system.⁴ To do this one needs a model that rigorously incorporates state-of-the-art banking theory in a general equilibrium macro framework and also incorporates some key elements of financial fragility experienced in the recent crisis. In our model, whose banking core is adapted from [Diamond and Rajan \(2000, 2001, henceforth DR\)](#), banks have special skills in redeploying projects in case of early liquidation. Uncertainty in projects outcomes injects risk in

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E-mail address: faia@wiwi.uni-frankfurt.de (E. Faia).¹ Kiryl Khalmetzki and Marc Schöfer provided excellent research assistance. We are the sole responsible for any errors and for the opinions expressed in this paper.² [Morris and Shin \(2008\)](#), [Borio and Zhu \(2008\)](#) among others.³ See e.g. [Maddaloni and Peydró Alcalde \(2010\)](#) and [Altunbas et al. \(2010\)](#).⁴ We refer to “banks” and “deposits” for convenience, but our arguments apply equally to other leveraged entities issuing short-term revolving debt like ABSs or commercial paper.

banks' balance sheets. Banks are financed with deposits and capital; bank managers optimize the bank capital structure by maximizing the combined return of depositors and capitalists. Banks are exposed to runs, with a probability that increases with their degree of leverage. The desired capital structure is determined by trading-off balance sheet risk with the ability to obtain higher returns for outside investors in “good states” (no run), which increase with the share of deposits in the bank's liability side.

Our bank's optimal leverage is positively related to: (1) the bank expected return on assets; (2) the uncertainty of project outcomes; (3) the banks' skills in liquidating projects, and negatively related to (4) the return on bank deposits. The intuition is that increases in (1), (2) and (3) raise the return to outside bank investors of a unitary increase in deposits, the first by increasing the expected return in good states (no run), the second by reducing its cost in bad states (run), the third by increasing the expected return relative to the cost between the two states.

Inserting this banking core into a macro model yields a number of results. A monetary expansion or a positive productivity shock increase bank leverage and risk. The transmission from productivity changes to bank risk is stronger when the perceived riskiness of the projects financed by the bank is low. Pro-cyclical capital requirements (akin to those in the Basel II capital accord) amplify the response of output and inflation to other shocks, thereby increasing output and inflation volatility, and reduce welfare. Conversely, anti-cyclical ratios, requiring banks to build up capital buffers in more expansionary phases of the cycle, have the opposite effect. Within a class of simple policy rules, the optimal combination includes mildly anti-cyclical capital requirements and a monetary policy that responds rather aggressively to inflation and also reacts systematically to financial market conditions—either to asset prices or to bank leverage.

The rest of the paper is as follows: Section 2 provides an overview of the related literature. Section 3 describes the model, with emphasis on the banking bloc. Section 4 characterizes the quantitative properties of the model. Section 5 discusses the effect of introducing regulatory capital ratios. Section 6 examines the performance of alternative monetary policy rules combined with different bank capital regimes. Section 7 concludes. Proofs, model details, other sensitivity or empirical analyses are contained in appendices.⁵

2. Related literature

The 2007 financial crisis highlighted the need to analyze how financial intermediaries' behavior affects the macroeconomy and the macroeconomic impact of financial regulation.⁶ In this context also the endogenous diffusion of risk acquired relevance: many argued that banks' risk-taking, arising endogenously from banks' mis-incentives, plays an important role in bringing even a sound and stable economy towards financial instability. The recent financial crisis, as others previously, occurred after a period of stable and sustained growth, as a result of the endogenous formation of risk: the possibility of leveraging at low cost fueled indeed bank risk-taking, a fact well documented by empirical studies (see Altunbas et al., 2010; Jimenez et al., 2012). Our model below is consistent with this evidence.

A recent literature explored the importance of financial shocks (see Jermann and Quadrini, 2012) and risk shocks (see Gueron-Quintana et al., 2011 among others). Our paper is complementary to them, exploring the endogenous formation of risk resulting from bank optimizing behavior in response to shocks and policies.

Finally, our paper is connected with the literature embedding banking into macro models. The vast majority of the papers in this literature focuses on the banks' balance sheet channels, none so far analyzed bank risk and bank runs.⁷ The balance sheet channel is introduced via different settings such as moral hazard problems or bank collateral constraints: some, but not all those papers, are able to replicate the pro-cyclicality of bank capital observed in the data⁸; our paper does replicate that pro-cyclicality. There is then a group of papers focusing on the industrial structure of the banking sector, in the Klein–Monti tradition.⁹ None considers endogenous formation of bank risk and/or bank runs (or liquidity dry-ups).

3. A macro model with bank runs

The starting point is a conventional DSGE model with nominal rigidities. There are four types of agents: households, financial intermediaries, final good producers and capital producers. The model is completed by monetary policy and a skeleton fiscal sector.

⁵ The appendices to this paper can be found online at [[link to EES Website for Appendices](#)] or at www.wiwi.uni-frankfurt.de/profs/faia.

⁶ Attempts to take financial frictions into account pre-existed, but most of the them focused on credit constraints on households and/or firms, without explicitly considering financial intermediaries.

⁷ In the recent crisis, runs did not in general occur on traditional deposits (Northern Rock and a few others were exceptions), but typically on other more volatile forms of funding for banks and conduits, like REPOs and ABSs (Gorton and Metrick, 2010).

⁸ Among the papers which are closer to our also in terms of business cycle behavior of banking variables are: Acharya and Naqvi (2012), Gromb and Vayanos (2010), and Meh and Moran (2010).

⁹ See among other Corbae and D'Erasmo (2011), but also Acharya and Naqvi (2012).

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