Bank capital shocks and countercyclical requirements: Implications for banking stability and welfare☆

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ABSTRACT

This paper incorporates anticipated and unanticipated shocks to bank capital into a DSGE model with a banking sector. We apply this model to study Basel III countercyclical capital requirements and their implications for banking stability and household welfare. We introduce three different countercyclical capital rules. The first countercyclical capital rule responds to credit to output ratio. The second countercyclical rule reacts to deviations of credit to its steady state, and the third rule reacts to credit growth. The second rule proves to be the most effective tool in dampening credit supply, housing demand and household debt as well as in enhancing the banking stability by ensuring that banks have higher bank capital and capital to asset ratio. After conducting a welfare analysis we find that the second rule outranks the other ones followed by the first rule, the baseline and the third rule respectively in terms of welfare accumulation.

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1. Introduction

During the recent global financial crisis, the Basel II fixed capital requirement principles were not sufficient to maintain the banking stability as many banks had insufficient capital and low capital to asset ratio to withstand the financial crisis. Since the financial crisis, there has been great attention and discussion about reviewing and updating the Basel capital rule framework which aims at the enhancement of banking stability. The Basel III committee proposes a time-varying capital requirement or a countercyclical capital ratio requirement. The main idea of the latter is that the capital requirement increases during a boom phase and decreases during a bust phase.

In this paper, we study different countercyclical capital rules in the event of anticipated and unanticipated shocks to bank capital and their implications for the banking stability and household welfare. We apply a DSGE model with a banking

sector based on Gerali et al. (2010). We extend the model by incorporating countercyclical capital rules and anticipated and unanticipated shocks to bank capital. Our bank capital shocks attempt to capture bank complacency before the U.S. financial crisis and their unpreparedness under the Basel II fixed capital requirement framework.

We introduce three Basel III countercyclical capital rules; the first rule is a countercyclical capital requirement principle responding to credit to GDP ratio, which is primarily recommended by the Basel committee. The second rule is a counter-cyclical requirement reacting to credit vis-à-vis its steady state ratio. The third one is a countercyclical capital requirement rule reacting to credit growth. The baseline rule is represented by the Basel II fixed capital ratio principle. The main purpose of this paper is to seek which of these three rules provides the best outcome in terms of banking stability and welfare.

Firstly, we examine the effects of anticipated and unanticipated shocks to bank capital on the banking stability under the Basel II fixed capital rule. In our work, we utilize the term *instability* of the banking sector when capital to asset ratio is below its steady state. The main finding that under the Basel II fixed capital rule, a positive news shock to bank capital induces banks to be less prudent, hence they reduce the holding of capital to asset ratio. However, when the positive news about bank capital does not materialize, banks suddenly find themselves with a capital to asset ratio below its steady state, an effect that captures the instability of the banking sector.

Secondly, we analyze the effects of bank capital shocks on banking stability under three Basel III countercyclical capital rules. The first and the second countercyclical rules contribute to the banking stability because they induce banks to hold more bank capital than the one by the Basel II principle. Under these countercyclical capital buffer rules, banks have capital to asset ratios above their steady state even though banks anticipate that there will be a positive shock to their capital. Furthermore, the first and the second capital rules are more effective in dampening credit booms, housing demand and household debt compared to the fixed capital rule. The third countercyclical rule does not contribute to the banking stability because it does not induce banks to hold more capital. As a result the bank capital to asset ratio is below its steady state, exactly as in the Basel II case. Furthermore, we find that the second countercyclical capital rule is the most effective tool to enhance banking stability.

Thirdly, we study the implications of Basel III rules for household welfare. The implementation of the first and the second countercyclical capital rule improves household welfare relative to the fixed capital requirement. In particular, the second rule presents the highest household welfare, whereas we find that the third rule is not welfare improving. We conduct a sensitivity analyses, and the results indicate that the second countercyclical rule still provides the highest welfare compared to the other ones.

This paper is related to mainly two areas of DSGE studies: the news shock literature and the literature on macropru-dential policy. DSGE papers with news shocks such as by Beaudry and Portier (2004, 2006), Jaimovich and Rebelo (2009), Christiano et al. (2010) and Karnizova (2010) focus on technology news shocks while Lambertini et al. (2013) on multiple news shocks. However, those papers do not introduce news shocks that are originated within the banking sector while we attempt to explore this event. Next, studies on capital requirements and implications for macroeconomic dynamics in a DSGE framework are also explored, for example Christensen et al. (2011), Angeloni and Faia (2013), Angelini et al. (2014) and Rubio and Carrasco-Gallego (2016). Although our study is more tangible to Angelini et al. (2014) and Rubio and Carrasco-Gallego (2016), yet the main difference is two-fold: we incorporate news shocks and unanticipated shocks to bank capital in order to capture bank complacency prior to the U.S. financial crisis, and we compare different countercyclical capital rules to identify the best one in terms of banking stability and welfare.

This paper is organized as follows. Section 2 describes the DSGE model. Section 3 presents the stochastic processes of anticipated and unanticipated shocks. Section 4 presents benchmark calibration and model parameters. Section 5 introduces the three countercyclical capital rules, while Section 6 shows impulse responses for the investigated economy. Section 7 presents an exhaustive welfare analysis under the benchmark calibration as well as under different horizons of news shocks, while it also investigates the welfare effect of financial distress under three countercyclical capital rules. Finally, Section 8 concludes.

2. Model

2.1. Patient household

The objective function of a representative patient household is

$$E_0 \sum_{t=0}^{\infty} \beta_U^t \left(ln C_{P,t} + \omega ln H_{P,t} - \frac{(N_{P,t})^{\eta+1}}{\eta + 1} \right) \tag{1}$$

where the index P refers to a patient household, β_P is the discount factor, $C_{P,t}$ is consumption, $H_{P,t}$ denotes the holding of housing stock, $N_{P,t}$ labor hours, ω is a weight on housing and η is the Frisch labor supply elasticity.

The patient household consumes and makes deposits $D_{P,t}$ at a bank. The nominal net deposit rate is denoted by $R_{D,t}$ and π_t is inflation rate, so $(1 + R_{D,t-1})/\pi_t$ is the real gross interest rate on deposits. The household purchases houses and real house prices are denoted by q_t. The patient household supplies labor hours for an entrepreneur and earns $(W_{P,t}/P_t)N_{U,t}$, where $W_{P,t}$ is the nominal wage and P_t is the price of consumption goods. It also receives a lump-sum transfer denoted by $\Pi_{P,t}$, which includes dividends from a retail firm and a bank. Our particular household faces the following budget constraint