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## Journal of Macroeconomics

journal homepage: [www.elsevier.com/locate/jmacro](http://www.elsevier.com/locate/jmacro)

## Capital adequacy and the bank lending channel: Macroeconomic implications

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### ARTICLE INFO

#### Article history:

Received 19 January 2012

Accepted 17 December 2012

Available online 21 January 2013

#### JEL classification:

O4

E5

#### Keywords:

Banking capital regulation

Bank lending channel

The loan-deposit rate

### ABSTRACT

This paper develops an analytically tractable dynamic general-equilibrium model with a banking system to examine the macroeconomic implications of capital adequacy requirements. In contrast to the hypothesis of a credit crunch, we find that increasing the strength of bank capital requirements does not necessarily reduce the equilibrium quantity of loans, provided that banks have the option to respond to the capital requirements by accumulating more equity instead of cutting back on lending. Accordingly, we show that there is an inverted-U-shaped relationship between CAR and capital accumulation (and consumption). Furthermore, the optimal capital adequacy ratio for social-welfare maximization is lower than that for capital-accumulation maximization. In accordance with general empirical findings, the capital-accumulation maximizing capital adequacy ratio is procyclical with respect to economic conditions. We also find that monetary policy affects the real macroeconomic activities via the so-called bank lending channel, but the effectiveness of monetary policy is weakened by bank capital requirements.

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## 1. Introduction

Capital adequacy requirements (CAR) have become one of the most important banking regulations ever since more than 100 countries world-wide adopted the 1988 Basel Accords. Originally, the goal of the Basel Committee was to strengthen the stability of the international banking system by encouraging banking institutions to boost their capital positions (Basel Committee on Banking Supervision, 1999). Nowadays, CAR are the most common regulation in the banking industry in both developed and developing countries,<sup>1</sup> and as a result bank capital has become an important factor in bank asset–liability management and its importance has continued to increase.<sup>2</sup> For example, the credit crunch in the US was at least viewed partly as a consequence of banks' scrambling to meet the 1992 deadline for CAR under the 1988 Basel agreement (Bernanke and Lown, 1991).

Even though more than 16 years have passed since the regulation began to be implemented, its macro-oriented implications are not completely addressed. Despite the relatively large body of empirical literature that has focused on the related issues, there have been no definitive conclusions with regard to them.<sup>3</sup> In the literature, most studies dealing with CAR focus

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<sup>1</sup> Most of the more than 100 adherents to the 1988 Basel Accords have already expressed intentions to adopt the new version, called Basel II.

<sup>2</sup> Santos claims that "[b]anking is undoubtedly one of the most regulated industries in the world, and the rules on bank capital are one of the most prominent aspects of such regulation".

<sup>3</sup> See Bernanke and Lown (1991), Hall (1993), Berger and Udell (1994), Hancock and Wilcox (1995), and Peek and Rosengren (1995a, 1995b) among others.

on a bank-level analysis of portfolio risk (Koehn and Santomero, 1980; Kim and Santomero, 1988; Keeley and Furlong, 1990), the probability of failure (Dewatripont and Tirole, 1994), and the role of information asymmetries (Repullo and Suarez, 2000). Their analyses largely emphasize the informational microfoundations that are confined to a *partial-equilibrium* setting without taking into consideration the interactions between markets.<sup>4</sup> Few studies attempt to analyze the monetary policy implications and macroeconomic performance of CAR. The main reason for this neglect is that traditional monetary theory has mostly, if not entirely, ignored the role played by bank equity. The bank-related analyses that account for how monetary policy affects the real economy usually emphasize the so-called bank lending channel (the channel of interaction between bank lending and the real sector) and restrict their focus on the role of reserves (or reserve requirements) in determining the volume of bank loans, while treating bank capital as predetermined. However, as criticized by Friedman (1991), “[t]raditionally, most economists have regarded the fact that banks hold capital as at best a macroeconomic irrelevance and at worst a pedagogical inconvenience.” This traditional simplification stands in stark contrast to the importance attached to capital adequacy in the regulation of banks, and thereby gives rise to the difficulty in addressing important CAR-related issues.

In this paper, we develop an analytically tractable *dynamic general-equilibrium* framework to systematically examine the macroeconomic implications of CAR. One of the earliest attempts to examine the macroeconomic implications of CAR was Blum and Hellwig (1995). Under specific parameter configurations, they argue that CAR may potentially amplify demand-side shocks. By following this line of research, Cecchetti and Li (2008) further suggest that CAR can also reinforce the effects of supply-side shocks. Seater (2001) points out that coordinated bank regulation and monetary policy influence both the mean and variance of aggregate output. Although insightful, the results of these studies are based on *ad hoc* IS-LM-style macro models that fail to fully account for endogenous responses of the banking system to regulation. Moreover, their work lacks a micro-foundation, and hence they are unable to perform a welfare analysis. By contrast, Van den Heuvel (2008) constructs a quantitative dynamic model and calibrates the model to US banking data in order to perform a numerical analysis. He finds that the welfare cost of increasing CAR by 10% is equivalent to a permanent loss of consumption of at least 0.1–0.2%. By analogy, Aliaga-Díaz (2005) performs numerical simulations, and his results suggest that banks attempt to anticipate aggregate shocks by accumulating a buffer of capital over the regulatory minimum.

The analytical framework in this paper not only complements the earlier research cited above, but also allows us to provide the intuition on the macroeconomic effects of CAR. Financial intermediation requires real resource costs and provides firms with productive financial services, which give rise to an endogenous loan-deposit spread that affects the real-sector consumption and capital accumulation via the bank lending channel. The analytically tractable model allows us to examine the relationship between the CAR and capital accumulation (and consumption) and to highlight the important connections between the strength of the lending channel and the level of CAR in both *positive* and *normative* perspectives. The normative analysis is particularly important, since it is a new theoretical attempt to come up with the optimal level of CAR in terms of welfare maximization and capital-accumulation maximization.<sup>5</sup> Our theoretical analysis provides new insights into the assessment of the effects of CAR that have never been considered in a formal theoretical setting before.

There are three main results. The first is that increasing the strength of CAR does not necessarily reduce the equilibrium volume of loans, provided that banks have the option to respond to capital requirements by accumulating more equity as opposed to cutting back on lending. This result does *not* support *the hypothesis of a credit crunch*.<sup>6</sup> Given such a result, we show that there is an inverted-U-shaped relationship between CAR and capital accumulation (and consumption), which also stands in sharp contrast to the traditional prediction (see, for example, Santomero and Watson, 1977). The initial level of CAR is crucial in terms of governing the relationship between bank capital regulation and capital accumulation (or consumption). If the strength of CAR is relatively high, then increasing the level of CAR will cause the capital regulation to become too tight, thereby intensifying the distortion of CAR on a bank's asset and liability allocations. Under such a situation, CAR give rise to a harmful effect on capital accumulation (and consumption). By contrast, if the initial capital requirement ratio is relatively low, then appropriately increasing the strength of CAR gives rise to a favorable effect on capital accumulation (and consumption).

Secondly, our welfare analysis indicates that because bank capital requirements damage consumption more than capital accumulation, the optimal capital adequacy ratio for social-welfare maximization is lower than that for the maximization of capital accumulation. Furthermore, the capital-accumulation maximizing CAR is procyclical with respect to economic conditions. This procyclicality provides not only a convincing explanation, but also a solid economic foundation to the empirical finding of Borio (2003) and Bliss and Kaufman (2003) who point out that CAR in general have a procyclical tendency. Thirdly, our study confirms the existence of the bank lending channel. A contractionary monetary policy (implemented by increasing either the federal fund target rate or the reserve requirement ratio) decreases the equilibrium quantity of loans, and as a result capital accumulation and consumption fall in response. However, because banks can change the equity-debt financing mix by accumulating equity rather than by cutting back on loans, stricter CAR make the bank lending channel less powerful. In other words, CAR impinge upon the effectiveness of monetary policy.

Our analytical framework comprises two novel characteristics which distinguish this paper from the previous literature. First, by going beyond the existing macroeconomics literature, the model presented here incorporates a detailed balance sheet of banks in a setting with endogenous bank equity. We also allow banks to make portfolio allocations among assets

<sup>4</sup> Santos (2001) and VanHoose (2006) provide surveys of the literature on the CAR through the 1990s.

<sup>5</sup> Aliaga-Díaz (2005) includes this task in his agenda for future research.

<sup>6</sup> Not all empirical studies support the credit crunch hypothesis, either. See VanHoose (2006) for a survey of the empirical evidence in relation to the CAR.

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