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Cyclical adjustment of capital requirements: A simple framework

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ABSTRACT

We present a model of an economy with heterogeneous banks that may be funded with uninsured deposits and equity capital. Capital serves to ameliorate a moral hazard problem in the choice of risk. There is a fixed aggregate supply of bank capital, so the cost of capital is endogenous. A regulator sets risk-sensitive capital requirements in order to maximize a social welfare function that incorporates a social cost of bank failure. We consider the effect of a negative shock to the supply of bank capital and show that optimal capital requirements should be lowered. Failure to do so would keep banks safer but produce a large reduction in aggregate investment. The result provides a rationale for the cyclical adjustment of risk-sensitive capital requirements.

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1. Introduction

Discussions on the potential business cycle amplification effects of Basel II started long before its approval in 2004 by the Basel Committee on Banking Supervision (BCBS, 2004). The argument whereby these effects may occur is well-known. In recessions, losses erode banks' capital, while risk-sensitive capital requirements such as those in Basel II become higher. If banks cannot quickly raise sufficient new capital, they will be forced to reduce their lending, thereby contributing to the worsening of the downturn. However, a reduction in capital requirements makes banks riskier, so there is a trade-off.

The purpose of this paper is to construct a simple model of optimal capital regulation that illustrates this trade-off. The model has a continuum of banks that differ in an observable characteristic (their "risk type") that is related to their incentives to take risk. Banks may fund their investments

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with uninsured deposits and equity capital. There is a moral hazard problem in the choice of risk that implies inefficient risk-shifting under debt finance, which capital serves to ameliorate. A regulator sets risk-sensitive capital requirements in order to maximize a social welfare function that incorporates a social cost of bank failure. This yields a capital charge curve that is increasing in the banks' risk type. We consider a short-run situation (or one with severe capital market frictions) in which bank capital is exogenously fixed, and study the effects of a negative shock to the aggregate supply of bank capital.[1] We show that the optimal response to the shock is to lower capital requirements. Failure to do so would keep banks safer but produce a large reduction in aggregate investment. The result provides a rationale for the cyclical adjustment of risk-sensitive capital requirements.

The paper is closely related to Kashyap and Stein (2004). They present a framework (which is developed in the longer working paper version of their article) in which there is a regulator that cares about bank lending as well as the social cost of bank failure. They conclude that "instead of there being a single once-and-for-all curve that maps risk measures into capital charges, optimality requires a family of point-in-time curves, with each curve corresponding to (...) different macroeconomic conditions." In their model there is a representative bank that maximizes the expected return of a portfolio of different types of risky loans. There is also a regulator that maximizes the expected return of the bank's portfolio minus a reduced-form term that captures the social cost of bank failure. The regulator chooses capital requirements for each type of loan in order to maximize its objective function subject to a capital availability constraint. The shadow value of bank capital is the Lagrange multiplier associated to this constraint. They conclude that when bank capital is scarce, its shadow value will be high, and the regulator should lower capital requirements.

Although their intuition is the same as ours, the models are very different. Kashyap and Stein do not consider the effect of limited liability, ignoring that the convexity of the bank's objective function implies that it would want to specialize in only one type of loans (see Repullo and Suarez, 2004). They also take as exogenous the risk-adjusted discount rate for each type of loan, a variable that should in principle depend on the (endogenous) capital requirement for each type of loan. Finally, they model in a reduced-form manner the effect of capital on the probability of bank failure.

In contrast, our approach does not suffer from these shortcomings. Building on Repullo (2005), in our model a continuum of banks with different risk types have an investment opportunity of size one that may be funded by risk-neutral depositors and outside equity investors. There is an infinitely elastic supply of uninsured deposits at an expected return that is normalized to zero and a fixed aggregate supply of bank capital, so the cost of capital is endogenously determined in equilibrium. After raising the required funds, each bank chooses a risk parameter that, together with its type, determines its probability of failure. The bank's choice of risk is not observed by depositors, so there is a (risk-shifting) moral hazard problem.

We first characterize the equilibrium of the model in the absence of regulation. Interestingly, banks will in general want to have capital in order to ameliorate the moral hazard problem. The trade-off is that capital helps on the moral hazard front, but it is in general more expensive than deposits. In fact, when the cost of capital equals the return required by depositors there is no trade-off, and banks would only be funded with equity.

We then introduce a risk-neutral regulator that faces the same informational constraints as the market, in particular the inability to observe the banks' choice of risk. For this reason, the regulator resorts to using capital requirements to indirectly influence banks' risk-taking. Unlike in the Basel II regulation, which is based on targeting an exogenous probability of failure for all banks, here the regulator maximizes society's welfare subject to the capital availability constraint. The social welfare function incorporates a term that captures the negative externalities associated with bank failures. Of course, if bank failures entailed no social cost, the market equilibrium would be efficient, and bank capital regulation would not be justified. In contrast, when there is a social cost of bank failure, the regulator requires banks to have more capital than they would choose in the absence of regulation. But there is a trade-off: although banks will be safer, aggregate investment will be lower. We show

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[1] This is the same approach as in Holmström and Tirole (1997).

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