Simulation based stress tests of banks' regulatory capital adequacy

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Abstract

Banks' holding of reasonable capital buffers in excess of minimum requirements could alleviate the procyclicality problem potentially exacerbated by the rating-sensitive capital charges of Basel II. Determining the sufficient buffer size is an important risk management task for banks, which the Basel Committee suggests should be approached via stress testing. We present here a simulation-based approach to stress testing of regulatory capital adequacy where rating transitions are conditioned on business-cycle phase, and which takes into account business-cycle dynamics. Our approach is an extension of a typical credit portfolio analysis in that we simulate actual bank capital and minimum capital requirements simultaneously. Actual bank capital (absent mark-to-market accounting) is driven by bank income and default losses, whereas capital requirements within Basel II are driven by rating transitions. The joint dynamics of these determine the necessary capital buffers, given a confidence level for regulatory capital adequacy chosen by bank management. We provide a tentative calibration of this confidence level to data on actual bank capital ratios, which enables a ceteris-paribus extrapolation of bank capital under the current regime to bank capital under Basel II.
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1. Introduction

The macroeconomic consequences of rating sensitive capital requirements have been debated actively during the consultation process on the new Basel Capital Accord. The critics argue that new requirements may amplify the natural procyclicality in banking in that they force banks to significantly cut back lending in recessions (see the views expressed e.g. by Danielsson et al., 2001; Erwin and Wilde, 2001). Therefore risk sensitive capital requirements are thought to trade off greater efficiency in capital allocation across banks against macroeconomic stability.

The effects of the new capital regulation on macroeconomy are likely to depend on the extent to which individual banks find it optimal to hedge against the increased volatility of the minimum capital requirement. In particular, several authors have suggested that the problem of procyclicality resulting from risk sensitive capital requirements be remedied through adjustment of banks' capital buffers (e.g. Borio et al., 2001; Lowe, 2002). It appears that this argumentation has also been adopted by the Basel Committee itself. [1] The idea is that under 'normal' business conditions banks should hold capital over minimum requirements, while this extra capital would be consumed during severe downturns through credit losses and through increases in minimum capital requirements. If the capital buffers were sufficient to outlast a downturn, lending would not have to be severely cut down, and hence there would be no credit crunch accelerating the downturn.

Ideally the question of banks' optimal reaction to Basel II and of the size of the required capital buffers should be analyzed based on an optimizing model of bank behaviour. There is by now a lot of theoretical research which shows that banks optimally hold buffer stocks of capital to protect against the adverse consequences of running out of capital (Estrella, 2001; Furfine, 2001; Hojgaard and Taksar, 1999; Milne and Robertson, 1996; Milne and Whalley, 2001; Peura and Keppo, 2003). This research utilizes stylized models where banks with illiquid portfolios optimize their capital levels subject to minimum capital or liquidity constraints. The research shows that the precautionary capital stocks are the larger the more severe are the financial constraints and the more illiquid or costly to hedge are bank assets. Some of these models have also been calibrated to data on actual bank returns, in an attempt to find out whether the models can explain observed bank capital ratios (Peura and Keppo, 2003). [2] This raises the question of whether the same models could be used

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[1] Basel Committee (2002a) states that 'to help address potential concerns about the cyclicality of the IRB approaches, the Committee agreed that meaningfully conservative credit risk stress testing by banks should be a requirement under the IRB approaches as a means of ensuring that banks hold a sufficient capital buffer under Pillar 2 of the new Accord'.

[2] Furfine (2001) also calibrates his model to bank data, but his goal is not to explain the level of bank capital holdings. He presents evidence that banks reacted to the current Basel Accord by increasing their capital ratios, which suggests that banks' holdings of buffer capital are not purely 'economic capital' (in the standard sense of the term), but a genuine response to minimum capital requirements.