The Relationship between Risk and Capital
In Swiss Commercial Banks: A Panel Study

Robert Bichsel and Juerg Blum

5/15/2001

Comment by

Richard W. Kopcke

6/12/2001

I genuinely enjoyed reading this paper for its clarity in applying emerging methods from the finance theory to explore the elusive relationships among capital, risk, and the odds of insolvency. In the best tradition of central bankers, the authors present their work carefully and criticize their findings and techniques honestly. This morning I will take the opportunity to expand a few of the points that they mention in their discussion of their analysis.

I shall begin, however, by expressing some surprise at their characterizing the theoretical consequences of capital requirements as being so ambiguous. My understanding of the theory suggests that greater capital requirements (particularly common risk-based requirements) encourage banks to hold more risky assets. Furthermore, in most circumstances, these requirements also diminish the odds of banks' failing. Perhaps more importantly, the theory predicts that a bank's capital-asset ratio is not a sufficient statistic for the risks that it assumes, especially if it is subject to risk-based capital requirements. (See the attachment.)

Theory suggests that banks choose their capital-asset ratio, their expected returns, and their risks jointly as functions of their capital requirements, their opportunities, their tastes for bearing risk, and other variables. This would imply that equations (1) and (2) are not proper regressions inasmuch as the capital-asset ratio (at least) is correlated with the errors in the equations. In other words, the capital-asset ratio is itself a dependent variable, along with the risk of assets and the odds of failure, in a larger simultaneous equations model. Also, the errors in equations (1) and (2) are not likely independently, identically distributed. The errors might follow a mixed distribution that includes occasional jumps. Often in the banking cycles with which I am familiar, the apparent risk of assets and the odds of failure change abruptly and in concert. The variances of these distributions also likely change just as the vols in assets' returns change over time. Perhaps these might be modeled by including some macroeconomic variables. The paper might discuss the nature of the time-series and bank-specific residuals from these panel regressions.

I believe the authors correctly resisted two-stage estimation procedures. These estimators can generate substantial biases in these cases. Instead, the authors might have considered refining their model by adding an equation for the capital-asset ratio and some indicators of the returns and risks in banks' opportunity sets. Perhaps they might augment their work by estimating the consequences of changes in capital requirements on leverage, risk, and the odds of default.

The part of the study that yields the sharpest results depends on measures of assets' risk, the probability of default, and the capital-asset ratio that are derived from the observed returns on equities and the volatility of those returns. This is an increasingly popular application of options pricing theory: the inference of the risk in an intermediary's book from the performance of its equity. In this case, the authors attribute the observed risk in equity entirely to the risk in assets.

This approach is questionable. It presumes a "pure play," that a bank's equity trades independently of the equity in its holding company's other enterprises. If so, much of the return on a bank's equity derives from fee income, from rents (on core deposits or skillful management of borrowers), from efficiencies in conducting operations, and other such sources. To the degree these sources of income vary with respect to the income earned on assets, the derivation of the value of assets and volatility of the return on assets will be misstated. Furthermore, the bank's equity is an indefinite call option, while the duration of assets is much shorter. The value of a bank's equity might sink considerably if shareholders believe that its ability to earn rents, for example, has fallen for years to come. The value of its assets and the volatility of their returns might not have changed, or at least not have changed as much as the performance of its equity would imply. Finally, this theory assumes that all agents possess the same information and that financial markets are perfectly competitive and efficient. If banks possess proprietary information and influence ("charter value"), then the performance of their share prices will not reflect the performance of their assets when outsiders' assessments of the value of their proprietary rents change. (The options pricing theory supporting the approach taken in the paper also assumes that returns follow a diffusion process – normality with no heteroscedasticity or jumps – and that all assets can be hedged efficiently – for put-call parity to hold.)

The paper also could model directly the volatility of the returns on equity instead of the derived volatility of assets' returns. In this spirit, the probability of failure could be expressed directly in terms of the market value and volatility of equity instead of mapping these characteristics onto assets. This more direct approach to both equations would avoid some of the difficulties that arise by assuming that all the risk in equity is induced by risk in the return on assets.

The paper would help the reader understand the nature of its derived values for assets, the volatility of the return on assets, and the probability of failure by expanding Table 1 and perhaps describing the relation among the variables with graphs. For example, what is the cross-sectional or time-series behavior of the derived value of assets relative to book assets? (The higher average value reported in the table suggests that

banks' income encompasses more than the simple return on assets.) Similarly, we should understand how the derived capital-asset ratio varies with the vol for equity and that derived for assets. The authors mention that the value of $\partial E / \partial A$ is nearly constant, equaling unity. This suggests, from equation (4), that

$$\Delta\sigma_E(c+\Delta c)+(\Delta c)\sigma_E = \Delta\sigma_E \text{ , or}$$
$$\Delta\ln(\sigma_E)+\Delta\ln(c)=\Delta\ln(\sigma_A).$$

Because c is a function of σ_E, exploring the relationship between the derived values of c, σ_E, and E might help us understand why the coefficient on Δc is nearly 1. In other words, the paper should help us understand how the data and the techniques combine to produce the results for $\partial E / \partial A$, the other variables, and the equations.

Once again, I liked the paper because the authors offer some constructive work. I would advise the authors to employ a little more theory in order to set their equations on a firmer foundation. I would also suggest that they describe the nature of their derived data more completely, especially the relationships among their derived data and the market data.

Attachment
To Comment by Richard Kopcke

6/12/2001

A simple theory of portfolio management that is consistent with the theory in the paper shows that a bank's choice of assets depends on its capital requirements (see also Kim and Santomero 1988, cited in the paper).

In a single (market) factor model, a bank holds a portfolio of risky assets (point M in the figure) for which the expected return on assets (R_A) and the volatility of assets' returns (σ_A) are most attractive given its cost of borrowing funds (R_D). The bank selects its optimal degree of leverage (at point 1) along the market line. (The line is straight, assuming the bank and its depositors (or its deposit insurer) agree on the value of the put option that limited liability confers on its shareholder, and assuming the bank pays that risk premium on its deposits.)

If the bank is subject to binding leverage requirements at 1, then it could satisfy these requirements by moving to 2, but this cannot be optimal. By choosing the portfolio M', the bank shifts its market line to a position where the bank's optimal choice of leverage meets the capital requirement (point 3). The combination of expected return on net assets and risk is more attractive at point 3 than it is at point 2. (The dotted line shows all the feasible choices of expected return and risk that are generated by the potential choices for M'.) As a result of the capital requirement, the bank shifts its portfolio of assets from that at M to that at M' – it holds riskier assets.

The same result obtains if the bank's capital requirements are linked to the risk in its assets rather than its leverage. In this case, however, the dashed line curves downward more rapidly. If changes in the deposit rate or in the risks and returns on assets changes the bank's choice of M', its capital-asset ratio will tend to be positively correlated with changes in its assets' risk as long as its risk-based capital requirement remains binding. The magnitude of this correlation depends both on the capital requirement and on the degree to which the requirement is linked to the risk in the bank's portfolio of assets.

Figure for comment by Kopcke