AN EXAMPLE OF EFFICIENT BANK RECAPITALIZATION UNDER DEBT OVERHANG

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Model

We use a numerical example to illustrate three results on optimal bank recapitalization.[1]

Let us start with one bank (bank A) that holds risky securities, which pay off either 100 or 0 with equal probability. The bank is financed by equity and debt with a face value of 90. Assuming investors are risk neutral, debt value is 1/2*90=45 and equity value is 1/2*(100-90)=5. The bank can invest in a safe project, which requires an outlay of 5 and yields a discounted value of 6. The net present value (NPV) of the project is one and it should therefore be undertaken.

Let us first illustrate the need for recapitalization. The bank needs to raise 5 from new lenders to pay for the project. If the bank invests, debt value increases to 1/2*(90+6)=48 since in the good state debt holders still receive 90, and in the bad state they now receive 6. The new lenders must receive an expected payment of 5 to break even: they get 10 in the good state. Equity value, however, declines to 1/2*(100-90-10+6)=3. Investing is not in the interest of shareholders even though the project has a positive NPV. This is the debt overhang problem analyzed by Myers (1977).

First result

Our first result is an irrelevance theorem under symmetric information. Consider government interventions to buy back assets or inject equity with voluntary participation by shareholders. The government can offer to purchase assets with a face value of 6 for a cash payment of 5. The cash injection covers the cost of investment, therefore conditional on participation, shareholders strictly prefer to invest. After investing, debt value is 48 and equity value is 1/2*(94-90+6)=5. The shareholders are therefore willing to participate in the program. The net expected cost to the government is 5-1/2*6=2.

Alternatively, the government can offer to buy 3/8 of the bank equity for a cash payment of 5. If the bank participates and invests, debt value is 48, equity value is 5/8*1/2*(100-90+6)=5, and government's cost is 5-3/8*1/2*(100-90+6)=2. Asset purchases and equity injections are therefore equivalent: this is our first main result.

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Second result

Our second result emphasizes the efficiency of equity injections under asymmetric information between the banks and the government. Let us therefore introduce a second bank (bank B) with assets that pay 100 with probability 3/4 and 0 with probability 1/4. Debt value is 67.5 and equity value is 7.5. Bank B can invest in a safe project with an outlay of 5 for a discounted value of 7. After investing, asset value becomes 77, debt value is 3/4*90+1/4*7=69.25 and equity value is 7.75. Investing increases shareholder value, but by only 0.25 out of an NPV of 2 because shareholders are diluted by new investors. Therefore, even though bank B would invest alone, it might decide to take advantage of the government's program.

Assume that the government cannot distinguish bank types, and therefore offers the same programs (described above) to all the banks. We already know that bank A participates in both. Under the asset purchase program, bank B's equity value becomes 3/4*(94-90+7)=8.25, and government's cost is 5-3/4*6=0.5.[2] Under the equity injection program, bank B's equity value becomes 5/8*3/4*(10+7)≈7.97, and government's cost is 5-3/8*3/4* (10+7)≈0.22. The equity injection program implements the same investment (by both types) at a lower cost to the government: this is our second main result.

Third result

Our third result is that an optimal intervention can be implemented with preferred stock and warrants. Suppose that the government still injects 5 in the banks, but now asks for preferred stock with face value 6 plus unlimited warrants at a strike price of 10. Bank A still participates, but bank B does not because its equity value would be 3/4*max(10,100-90+7-6)=7.5, which is lower than its outside option of 7.75. The preferred stock-warrant program therefore implements efficient investment without opportunistic participation and achieves the minimum cost for the government: this is our third main result.

Summary

To summarize, a good recapitalization program improves efficiency along two dimensions: it selects the right banks (the extensive margin) and it minimizes the transfers conditional on participation (the intensive margin).

Notes

[1]The example is based on Philippon and Schnabl (2009).
[2]Note that 69.25+8.25-0.5=77 which is the NPV under investment

References

Myers, S. C. (1977), "Determinants of Corporate Borrowing", *Journal of Financial Economics*, 5, 147-175.

Philippon, T. and P. Schnabl (2009), "Efficient Recapitalization", NBER Working Paper 14929.