Banking Crises and Real Activity: Identifying the Linkages

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I interpret some key aspects of the recent crisis through the lens of macroeconomic modeling of financial factors.

JEL Codes: E0, E50.

1. Introduction

The recent recession—now known as the "Great Recession"—featured a disruption of financial intermediation of the like not seen since the Great Depression. One of the great challenges macroeconomists face is to adjust existing models to account for these events, as well as the implications for economic policy. Efforts are rapidly under way. A good deal of this new research is surveyed in Gertler and Kiyotaki (2010).

In this commentary I would like to first give an overview of the research that links banking crises to macroeconomic activity. I will then describe how recent data suggests these linkages were at work during the crisis. Finally, I will briefly interpret some of the findings in this session's papers in light of the way these linkages work.

One theme of my comments is that the recent modeling work suggests that credit spreads are likely to be a more reliable indicator than credit quantities of financial distress that feeds into the real economy.

2. Modeling Real/Financial Linkages

In this section I sketch how recent macro modeling incorporates financial factors. I begin by describing the basic way a financial crisis can have detrimental effects on real activity. Key to this notion is the existence of limits to arbitrage which, roughly speaking, permit

a gap to emerge between the expected return to capital and the riskless rate that is too large to be explained by risk preferences. The excess required return to capital implies a higher cost of borrowing. In this way, financial factors affect real activity.

I then describe the circumstances in which the origins of a financial crisis might be a banking crisis. In this situation, limits to arbitrage allow a wedge to emerge between the bank lending rate and the riskless rate. The excess bank lending rate in turn pushes up the required cost of capital. Next, I describe how endogenously determined balance sheet constraints (stemming from information/enforcement problems) can be the source of limits to arbitrage. Finally, I discuss the mechanism by which a crisis induces a tightening of these balance sheet constraints, which in turn forces up the spread between the expected return to capital and the riskless rate. The sharp rise in the excess return to capital, in turn, depresses real activity.

2.1 Financial Crises: Basic Concepts

Let R_{kt+1} be the gross rate of return to risky capital, R_{t+1} the gross riskless interest rate, and $\Lambda_{t,t+1}$ the representative household's stochastic discount factor. Then under frictionless financial markets, arbitrage ensures that the difference between the expected discounted return to capital and the discounted safe rate is zero:

$$E_t \Lambda_{t,t+1}(R_{kt+1} - R_{t+1}) = 0. \tag{1}$$

Equation (1) is a basic feature of conventional quantitative macroeconomic models that abstract from financial market frictions. Standard procedure is to log-linearize this equation. This yields up to a first-order equality between the expected return to capital and the riskless rate, where both variables are expressed in terms of deviations from their respective steady-state values. How monetary policy affects investment demand in these models then works as follows: Due to nominal rigidities, the central bank is able to manipulate the riskless rate. Then by arbitrage, the required expected return to capital changes one for one with the riskless rate. Investment demand then moves inversely with changes in the required return to capital.

With capital market frictions, the picture can change substantially. For simplicity, assume that households are able to perfectly

insure idiosyncratic consumption risk so that we can still work with the representative household's stochastic discount factor. However, suppose that there exist frictions in the process of channeling funds from households to non-financial firms that impede perfect arbitrage. Then, in general, the expected discounted return to capital can exceed the discounted riskless rate:

$$E_t \Lambda_{t,t+1}(R_{kt+1} - R_{t+1}) \geq 0. \tag{2}$$

The basic idea underlying macro models with financial frictions is to incorporate mechanisms that move this rate gap countercyclically. Then the way financial propagation mechanisms work to enhance business fluctuations is to push up the cost of capital relative to the riskless rate in downturns. This magnifies the overall investment drop, which in turn magnifies the recession. In booms, the mechanism works in reverse. This notion of how financial factors propagate real activity dates back to Bernanke and Gertler (1989).

Within this framework a financial crisis is manifested by a sharp increase in $E_t \Lambda_{t,t+1} R_{kt+1}$ relative to $E_t \Lambda_{t,t+1} R_{t+1}$. The increase in the spread is a product of an explicitly modeled disruption of financial markets. The sharp increase in the cost of capital produces a collapse in durable goods spending.

2.2 Banking Crises

Up to this point we have said nothing about financial institutions. Now suppose that we introduce financial intermediaries—"banks" for short—that transfer funds between households and non-financial firms. Further, let R_{bt+1} be the (possibly state-contingent) bank lending rate.

Then with frictionless financial markets,

$$E_t \Lambda_{t,t+1} R_{kt+1} = E_t \Lambda_{t,t+1} R_{bt+1} = E_t \Lambda_{t,t+1} R_{t+1}. \tag{3}$$

In this case, to arbitrage ensures that the expected discounted return to capital equals expected discounted bank loan rate, and in turn that the latter equals the discounted riskless rate.

With capital market frictions, the following set of inequalities holds:

$$E_t \Lambda_{t,t+1} R_{kt+1} \geq E_t \Lambda_{t,t+1} R_{bt+1} \geq E_t \Lambda_{t,t+1} R_{t+1}. \tag{4}$$

In this instance, there may be impediments in the flow of funds between households and banks, as well as between banks and non-financial borrowers. That is, limits to arbitrage can introduce a wedge between $E_t\Lambda_{t,t+1}R_{bt+1}$ and $E_t\Lambda_{t,t+1}R_{t+1}$, and also between $E_t\Lambda_{t,t+1}R_{kt+1}$ and $E_t\Lambda_{t,t+1}R_{bt+1}$.

As before, a financial crisis is manifested by a sharp increase in the gap between $E_t\Lambda_{t,t+1}R_{kt+1}$ and $E_t\Lambda_{t,t+1}R_{t+1}$. The source of the increase in this gap, however, could either be a disruption of the flow of funds between non-financial borrowers and banks (i.e., an increase in $E_t\Lambda_{t,t+1}R_{kt+1} - E_t\Lambda_{t,t+1}R_{bt+1}$) or between banks and depositors (i.e., an increase in $E_t\Lambda_{t,t+1}R_{bt+1} - E_t\Lambda_{t,t+1}R_{t+1}$), or both.

In a banking crisis, there is a sharp increase in $E_t\Lambda_{t,t+1}(R_{bkt+1} - R_{t+1})$.

2.3 Banking Crises and the Capital Constraint

At the core of a banking crisis are limits to arbitrage in the flow of funds between banks and depositors. We next explore how these limits may come about.

Let L_t be loans, N_t bank equity, ϕ_t the bank's maximum feasible leverage ratio (assets to equity), ϕ^R the regulatory maximum, μ_t the discounted excess return to capital $E_t\Lambda_{t,t+1}(R_{kt+1} - R_{t+1})$, and σ_t the standard deviation of returns to the bank's portfolio.

To the extent banks have private information about their activities and/or it is costly for depositors to enforce repayment, the quantity of (uninsured) deposits a bank can attract will depend on its equity capital. Roughly speaking, with agency/enforcement problems present, how much a bank can borrow will vary positively with its ability to cushion creditor losses. Equity capital provides such a cushion. Beyond these natural market forces, there may be regulatory capital requirements. In the United States, for example, regulatory capital requirements are imposed on commercial banks to offset the incentives for risk taking afforded by deposit insurance. Investment banks, by contrast, did not face formal capital requirements.

The capital constraint may be represented as follows:

$$L_t \leq \phi_t N_t, \tag{5}$$

with

$$\phi_t = \min[\phi(\mu_t, \sigma_t), \phi^R]$$
$$\phi_1 > 0, \phi_2 < 0.$$

Overall, the ratio of the bank's assets to equity cannot exceed ϕ_t, which is the minimum of the natural limit due to agency/enforcement problems $\phi(\mu_t, \sigma_t)$ and the regulatory maximum ϕ^R. In general, the latter depends positively on the excess return μ_t and inversely on the degree of risk, measured by σ_t. Intuitively, if depositors perceive the bank can earn high excess returns, they are willing to tolerate more leverage. However, as the perceived risk increases, they tolerate less.

When the leverage constraint is binding, arbitrage between the bank rate lending and the riskless rate is precluded. The economy is in a situation with

$$E_t\Lambda_{t,t+1}R_{kt+1} \geq \ E_t\Lambda_{t,t+1}R_{bt+1} > E_t\Lambda_{t,t+1}R_{t+1},$$

where the inequality between $E_t\Lambda_{t,t+1}R_{bt+1}$ and $E_t\Lambda_{t,t+1}R_{t+1}$ is strict. The excess in the bank lending rate over the riskless rate translates into an excess return on capital over the riskless rate.

In a banking crisis, the limits to arbitrage tighten. This can occur because bank equity N_t drops sharply (as a result of losses on bank assets) and/or because there is a significant increase in risk. The former produces a sharp drop in bank lending, given the maximum leverage ratio ϕ_t. The latter produces a decline in the maximum leverage ratio, and thus causes bank lending to drop, for any given level of bank equity.

In the general equilibrium, the contraction in lending produces a fall in capital prices, thus leading to an increase in excess returns $\mu_t = E_t\Lambda_{t,t+1}(R_{kt+1} - R_{t+1})$. The rise in the required return to capital, of course, depresses durable goods spending. This is the way that banking crises affect real activity.

Note also that the increase in the excess return can raise the maximum leverage ratio. Thus, though declines in bank equity and increases in perceived risk work to reduce bank lending, the rise in the maximum leverage ratio works to moderate this effect to some degree.

Keep in mind, however, that what is critical for the real economy is not the overall level of lending per se, but rather the overall credit market distortion as measured by the excess return $E_t\Lambda_{t,t+1}(R_{kt+1} - R_{t+1})$.

2.4 The Volatility of Bank Equity

The last piece of the puzzle involves the evolution of bank equity. Let D_t be deposits. Then, by the accounting identity that assets must equal liabilities, bank loans equal the sum of bank equity and deposits:

$$L_t = N_t + D_t.$$

Suppose, as is largely consistent with evidence, banks find it prohibitively expensive to issue new equity and instead accumulate net worth via retained earnings. Bank equity then evolves as the difference between the gross return on assets and the gross cost of liabilities, net any dividend payments, Div_t:

$$N_t = R_{bt}L_{t-1} - R_tD_{t-1} - Div_t.$$

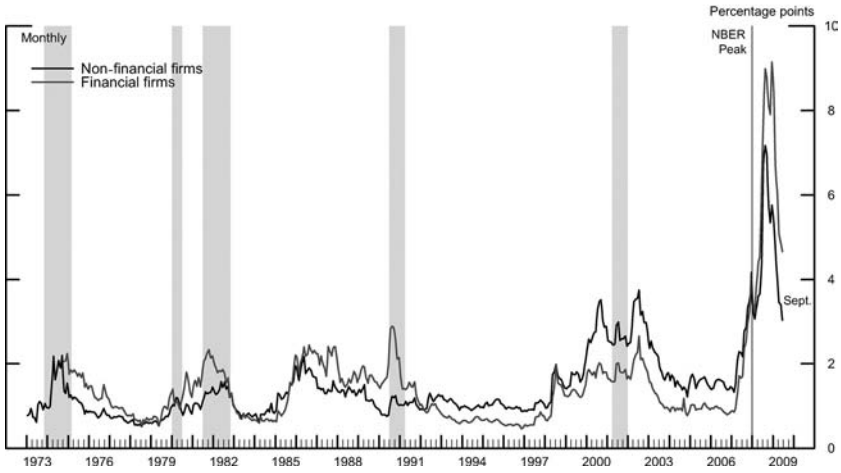
Given $L_{t-1} = \phi_{t-1}N_{t-1}$,

$$N_t = [(R_{bt} - R_t)\phi_{t-1} + R_t]N_{t-1} - Div_t. \tag{6}$$

Overall, volatility in the ex post net return on assets, $R_{bt} - R_t$, induces volatility in N_t. The overall effect is magnified by the size of the leverage ratio ϕ_{t-1}. Seen from this vantage, equations (5) and (6) capture in a simple way how the recent financial crisis played out. Losses on sub-prime mortgages at highly leveraged investment banks and (to a lesser degree) commercial banks induced a sharp contraction in the equity capital of these institutions. This in turn forced a sharp contraction in the assets of these institutions, leading to a sharp increase in return spreads.

It is true that the contraction in N_t can be moderated to some degree by a reduction in dividends Div_t. However, since dividends cannot turn negative, it is not possible to offset a sharp drop in N_t. In addition, for reasons we don't completely understand (e.g., signaling, etc.), banks seem reluctant to cut dividends, even when they are in distress.

Figure 1. Credit Spreads on Senior Unsecured Bonds



3. Credit Spreads vs. Credit Quantities during the Crisis

The underlying theory suggests that credit spreads should rise sharply during crises. It is less clear about the implications for credit quantities. We address each of these phenomena in turn.

3.1 Credit Spreads

Credit spreads normally move countercyclically. These movements are not necessarily signs of unusual distress. However, during the Great Recession the increase in credit spreads was off the charts.

Figure 1 plots indices of spreads between corporate debt and similar maturity government debt. The data is from Gilchrist, Yankov, and Zakrasjek (2010). For the 1981–82 recession, the most severe post-war recession until the Great Recession, credit spreads climbed only modestly, roughly 100 basis points for financial firms and about 50 basis points for non-financial firms. Note that financial distress is not thought to have been a significant factor in this downturn, which was driven mainly by tight monetary policy aimed at disinflating the economy.

The behavior of spreads is radically different in the current recession. For non-financial firms, spreads rose from under 200 basis

points on average to nearly 700 in the wake of the collapse of Lehman Brothers in September 2008. Spreads for financial firms rose even further, climbing from roughly 100 basis points before the crisis to roughly 900 basis points around the Lehman collapse. There is also a slight lead in the increase in the financial firm spread.

The behavior of spreads is consistent with the notion of a banking crisis developed in the previous section. The sharp deterioration of financial institutions' balance sheets brought about by losses on sub-prime loans along with the associated increase in uncertainty curtailed the ability of these intermediaries to obtain funds. The net effect was a sharp increase in the cost of credit these institutions faced, which was presumably passed along to non-financial borrowers. Note that non-financial corporations that issue bonds directly on the open market still typically rely on commercial banks for working capital finance either directly or indirectly by using bank back-up lines of credit as collateral for open-market credit. Undoubtedly, the stress on financial firms contributed significantly to pushing up the non-financial spread.

To the extent that the movement in these spreads reflected increasing credit costs, they help account for how the financial crisis contributed to the collapse in durable goods spending. Again, the overall behavior of these spreads is consistent with the mechanism linking banking crises to real activity described in the previous section. Conversely, it would seem difficult to explain the movement in these spreads in a setting with frictionless financial markets. In Gertler (2009) I discuss some other evidence that points to a banking crisis being at work.

3.2 Credit Quantities

As I have noted, the theoretical mechanism does not have sharp implications for the behavior of credit quantities. With this in mind, I interpret recent events.

It is first important to consider investment banks along with commercial banks. Overall, the events were consistent with a "capital crunch" in investment banking. Losses on mortgage-backed securities induced significant depletion of equity in highly leveraged investment banks. Losses in equity values combined with increased uncertainty limited the ability of these banks to obtain funds, along

the lines that the previous section suggested. As a result, securitized lending collapsed. Credit spreads on these instruments shot up, again consistent with the theory discussed earlier.

For commercial banks, the dynamics played out differently: These banks entered the crisis well capitalized. As events progressed, however, they experienced a combination of equity losses and increases in the demand for bank credit. The former stemmed from exposure to mortgage-backed securities, though not to the same extent as investment banks. The latter resulted from (i) a take-down of credit lines (Ivashina and Scharfstein 2009) by firms short on cash as the crisis unfolded and (ii) the absorption of assets being shed by investment banks, stemming from either explicit or implicit commitments to these institutions. For both these reasons there was an initial increase in commercial bank lending. As Ivashina and Scharfstein note, it would clearly be incorrect to interpret this increase in bank lending as reflecting the absence of a financial crisis.

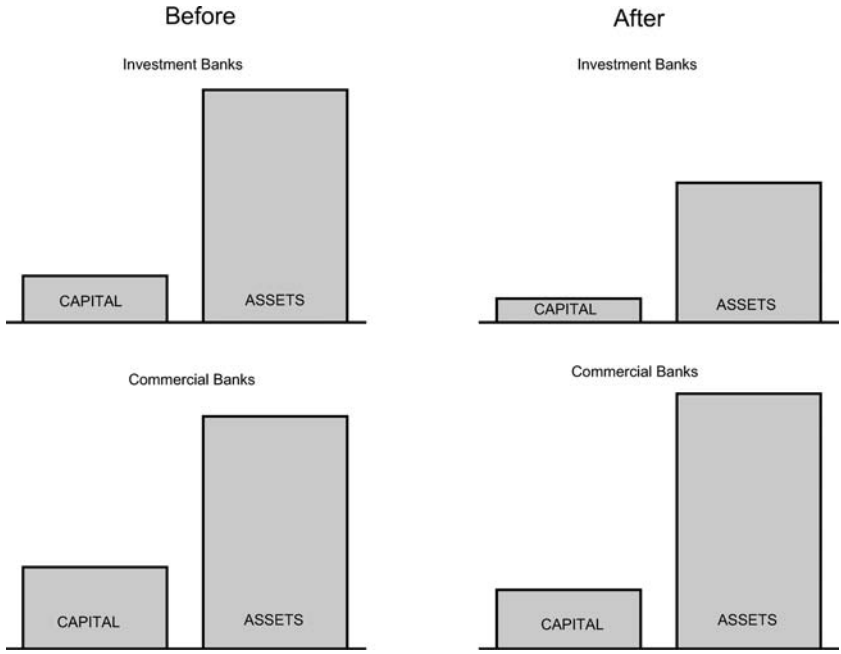
Figure 2 portrays the balance sheets of investment and commercial banks as the crisis unfolded. As the figure makes clear, even though commercial banks entered the crisis well capitalized, their capital was not sufficient to easily absorb assets sold off by investment banks. The net effect was a fire sale of securitized assets, leading to falling prices and rising expected returns to assets. Limits to arbitrage, of the type we described earlier, kept these prices and returns from quickly returning to normal.

4. Some Remarks on the Session Papers

4.1 The Impact of Equity Injections on Bank Lending

It is clear that the equity injections under the Troubled Asset Relief Program (TARP) did not lead to a proportionate increase in bank lending. Here I agree with Berrospide and Edge (this issue) that banks do not maintain constant leverage ratios. Indeed the theory laid out in section 2 suggests that, in general, banks will not have constant leverage ratios, even if they are capital constrained. Sorting out the impact of the TARP on lending will ultimately require a formal model where one can ask the questions of what would have happened to lending had the TARP not been enacted. I think a

Figure 2. Changes in the Level and Composition of Bank Lending and Capital over the Crisis



credible view is that there would have been an even greater contraction in lending.

Beyond these considerations, I think the authors' estimates of the effect of capital on lending may be too conservative. The sample period they study does not contain much variation in bank capital. Missing from the sample are the two periods where bank capital shortage was thought to be a problem: the post-Lehman-collapse period and the capital crunch of the late 1980s. In addition, the way they control for loan demand may be problematic. It fails to capture the initial countercyclical increase in loan demand at the onset of a recession as firms desire to borrow to meet fixed payments as cash flows begin to decline. However, even if we accept Berrospide and Edge's estimates, there is reason to think that bank capital played an important role in the current recession. The disruption of interbank and other liquidity markets likely enhanced the value of

capital. In addition, many observers credit the TARP for stabilizing credit markets, as evidenced by the across-the-board reduction in credit spreads that followed this and related interventions.

4.2 The Forecasting Power of Bank Capital Asset Ratios

If one can identify exogenous shifts in bank capital asset ratios, then the theory suggests these shifts should help forecast real output. Jimborean and Méssonier (this issue) present strong evidence of this forecasting power. Berrospride and Edge (this issue) present somewhat weaker evidence. Interestingly, these authors show that a one-standard-deviation innovation decrease in the capital asset ratio leads to a roughly 0.2 percent decline in output growth. The drop in the capital asset ratio during the Great Recession was nearly ten standard deviations, implying a 2.0 percent decline in output growth, a rather substantial effect.

Of course, the identification approach in each case (Choleski decomposition) does not rule out possible unobservable factors being at work. In either case, these facts are interesting to interpret.

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