Comment

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Introduction

This paper makes three important contributions. First, it develops a new set of facts about the recent financial crisis. Second, it presents some empirical work that helps identify: (a) the disruption of bank credit in the midst of the crisis and (b); how this disruption influenced real activity. Third, the paper offers a list of facts that crisis models should explain and then proceeds to present a sketch of a prototype framework.

To organize my comments, I begin with a conceptual discussion of financial crises and banking crises in particular. In light of this conceptual framework, I then discuss the way the authors' identify a disruption of bank credit. I also use the conceptual framework to interpret the authors' main findings. A key insight that comes from all this analysis is that credit spreads are a more useful indicator of credit supply disruptions than are credit quantities. Finally, I argue that existing macro models of financial crises (e.g., Gertler and Karadi 2012) are in fact consistent with the main facts the authors present.

Some Basic Concepts

In this section I describe conceptually what is meant by a financial crisis that leads to a disruption in the supply of credit that can affect real activity. For simplicity, I suppose that borrowing is done to finance capital investments. But the same logic applies to other forms of borrowing (e.g., for home mortgages, inventories, etc.).

Accordingly, key to the notion of a disruptive financial crisis 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 for a return to capital implies a higher cost of borrowing. In this way, financial factors affect real activity. I will first use this notion to characterize a financial crisis in general and then extend the analysis to describe a banking crisis in particular.

Financial Crises

Let R_{kt+1} be the gross rate of return to risky capital; R_{t+1} 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 ensure 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 nonfinancial 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.

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 nonfinancial 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 the 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 nonfinancial 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 nonfinancial 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 $E_t\Lambda_{t,t+1}(R_{bkt+1} - R_{t+1})$.

Note that this analysis points directly to credit spreads as an indicator of financial market disruptions, as opposed to credit quantities. In

this regard, the recent evidence supports this interpretation. Gilchrist and Zakresjek (2012) analyze the behavior of credit spreads for both nonfinancial and financial corporations from the early 1970s through 2010. The first is the spread between the return on an index of nonfinancial corporate debt and the return on the ten-year Treasury bonds. The second is a similarly constructed spread for financial corporations. Countercyclical movements in each spread are not necessarily indicators of unusual financial distress since defaults (and thus default risk) typically increase in recessions. However, the increase in both spreads during the recent recession was off the charts and likely symptomatic of unusual financial distress. Further, the sharp increase in the spread for financial institutions is consistent with the notion of a disruption in financial intermediation that ultimately affected the cost of credit from nonfinancial borrowers. Generally, to the extent the movement in the spreads reflects the behavior of the cost of credit during the crisis, their behavior offers a fairly natural explanation for the collapse in durable goods spending during the time frame around the Lehmann collapse.

One question the figure raises is how did the disruption in intermediary credit (as suggested by the financial corporate spread) translate into the cost of open market credit (suggested by the nonfinancial spread). The authors' interpretation (which I share) is that a tightening of intermediary credit leads firms at the margin to attempt to obtain open market credit. The increase in demand for open market credit by these "marginal firms" in conjunction with frictions in the supply of this type of credit leads to an increase in open market rates.

In particular, households supply deposits to banks and open market credit directly to nonfinancial firms. Banks use deposits and equity capital to make loans to firms. Nonfinancial firms obtain credit from banks and directly on the open market from households. Of course, some firms are not sufficiently creditworthy to issue open market debt, thus they rely exclusively on bank credit. On the other end of the spectrum are firms with sufficiently financial strength to rely mostly on open market credit. In the middle are firms that actively exploit both margins.

A credit supply disruption emerges when banks take losses on their loan portfolios that lead to sufficient losses in their equity capital. The decline in equity capital then forces banks to contract credit supply. Bank loan rates increase as a result, leading firms at the margin to substitute to open market credit. Open market rates then increase, along

the lines we discussed. The across-the-board increase in borrowing rates then leads to a decline in economic activity.

Identifying Credit Supply Effects

Identification Issues

While we can be conceptually clear about what constitutes a disruption in credit supply, identifying such an episode in the data is a nontrivial undertaking. A central problem is that variation in bank loans alone does not reveal the underlying cause. Around the business cycle peak, bank loans tend increase relative to output. Around the trough, bank loans decline with output. Unfortunately, movements in loan demand complicate the identification of supply effects.

Around the business cycle trough, loan demand is procyclical. Thus, simply from examining credit aggregates alone, it is not possible to disentangle whether bank lending is low in a recession due to demand or supply. Complicating matters further is that around the business cycle peak, there is a countercyclical element to loan demand. As cash blows begin to decline after the peak, firms need to raise short-term borrowing to finance fixed expenditures and inventories. For the current recession, loans actually increase over the early phase of the crisis. However, the rise in loans is entirely due to take-downs of existing loan commitments. New loan commitments actually decline.

In principle, to identify loan supply effects, one needs to do a counterfactual: What would loans have been in the absence of commitments?

An alternative approach, pioneered by Kashyap, Stein, and Wilcox (1993, henceforth KSW) is to compare the behavior of bank versus nonbank credit. In particular, to identify credit supply effects following a monetary tightening, KSW study the behavior of the financing "mix" between commercial bank loans and commercial paper, where:

$$mix = \frac{\text{bank loans}}{\text{bank loans} + \text{commercial paper}}.$$

In particular, KSW find that following a monetary tightening, the mix variable declines. The authors interpret this behavior as evidence of a credit supply effect. It is consistent with the following interpretation: as bank credit tightens relative to open market credit, firms substitute from bank loans to commercial paper.

While the mix variable is appealing, the use of aggregate data in constructing this index opens up potential identification problems. Unobserved heterogeneity may be an issue if the firms using bank loans differ from those using commercial paper. In particular, a decline in the mix following a monetary tightening could reflect either: (a) individual firms substituting from bank loans to commercial paper, as the authors suggest; or (b) differential borrowing behavior by firms that use bank loans versus those using commercial paper.

A shred of evidence suggesting that it may be the latter comes from Bernanke, Gertler, and Gilchrist (1996). These authors show that following a monetary tightening, large firms increase short-term borrowing (presumably to finance unsold inventories and other fixed short term expenses) while small firms cut back. This differential behavior could reflect easier access to credit markets by large firms relative to small firms. Since large firms make greater use of commercial paper, the behavior of the mix variable could reflect differential behavior of large versus small firms, as opposed to bank credit supply effects.

Authors' Identification Approach

The authors address the identification problem by using firm-level data. In particular, they restrict the sample to firms that have access to both bank and bond finance. Being able to track the borrowing behavior of individual firms mitigates the problem of unobserved heterogeneity. Though it does not eliminate it, as I discuss later.

One additional advantage of the authors' approach worth emphasizing is that they are able to make use of price data as well as quantity data. The behavior of the price data, furthermore, supports the interpretation they want to give to the quantity data. In particular, the authors show that loan rates in fact jumped over the crisis period, in a way that one would expect following a disruption of bank credit.

For the loan quantity data, the authors analyze the behavior of firms that issue new debt in a given time period. In particular, they estimate logit regressions of the following form:

$$P_{it} = c_{it} + bZ_t + aX_{it} + e_{it},$$

where P_{it} is a dummy variable conditional on a new debt issue, which takes the value of unity if there is a bond issue and zero if a bank loan. Variable Z_t is an indicator of the macro state and X_{it} is a vector of firm-level controls.

Essentially, the regression the authors run measures how the ratio on new bond issues to total new issues (bonds plus bank loans) varies with the macro state. The authors interpret movements in this ratio as substitution by individual firms between bank and nonbank credit. Since the authors are not tracking individual firms directly, however, this interpretation may be problematic if bond issuers and bank loans issuers are behaving differently over the sample. However, since the authors are able to restrict the sample to firms that participate in both bank and bond markets, selection bias is likely less a problem here than with the use of aggregate data. In addition, as I noted earlier, the bank loan rate data supports the credit supply hypothesis that the authors advance.

"Facts" for Macro Models to Explain

The authors' empirical analysis leads them to conclude that any model of banking/financial crises should capture the following four sets of facts: (1) a disruption in the flow of bank credit; (2) a sharp increase in credit spreads; (3) a rise in open market credit relative to bank credit (i.e., bond financing relative to bank loans); and (4) procyclical bank leverage ratios. The authors then conclude that most macro models of financial crises can capture (1) and (2) but not (3) and (4).

Here I demonstrate that the model in Gertler and Karadi (2012) can in fact account for all four facts. The model is a standard new-Keynesian DSGE modified to allow for banks that transfer funds from households to nonfinancial firms. An agency problem leads to a limit on the amount of funds that banks can intermediate that depends on the strength of their respective balance sheet positions. One difference from the standard formulation (e.g., Gertler and Kiyotaki 2011) is that firms can also issue debt on the open market. Limited participation by households in the supply of direct bond finance introduces constraints on the flow of funds through this channel.

Figure C1 reports the effect of a shock to asset quality that precipitates a financial crisis (see Gertler and Karadi [2012] for details). The size of the shock is adjusted to produce a percentage decline in output similar to what occurred in the recent crisis (see the second panel in the top row). The decline in asset quality produces a sharp contraction in the net worth of banks (see the second panel in the bottom row). The leads to a contraction in bank loans (see the second panel in the middle row) and a rise in the spread between the loan rate and government bond rate (see the third panel in the top row). Thus, the model captures
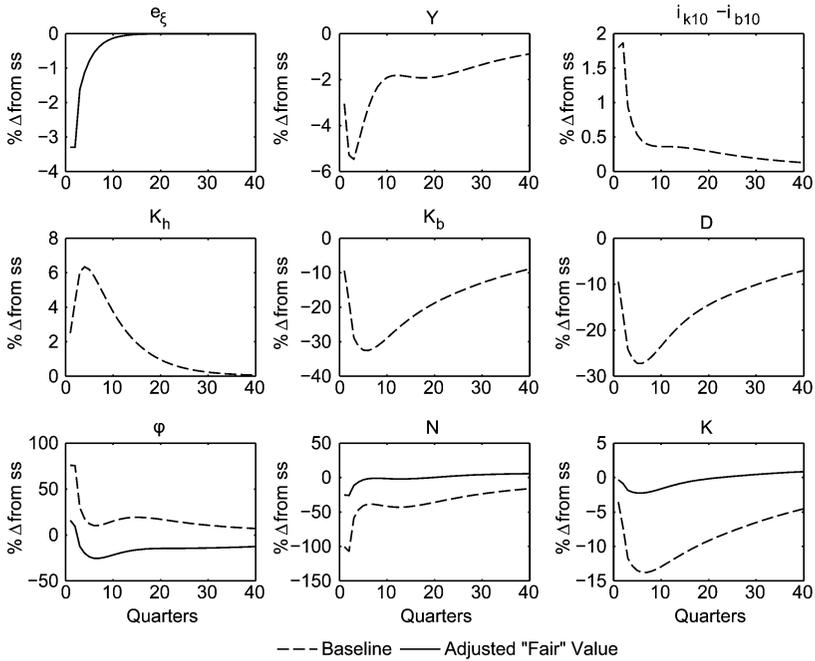
Fig. C1.   Crisis experiment with adjusted "fair" book values and market values

facts 1 and 2. It also captures fact 3: new bond issues increase as the tightening of bank lending induces firms to substitute to open market credit (see the first panel in the middle row).

Finally the model is able to match the cyclical behavior of bank leverage ratios, assuming the leverage ratios from the model simulations are constructed the same way they are in the data. In particular, in the data, bank equity is computed as the difference between assets and liabilities, where assets are measured using a mixture of book value and fair value accounting, in roughly equal parts. Fair value accounting, further, uses market prices when available, but during a liquidity disruption where trade may be disrupted, instead uses a "normal" value, which is effectively a smoothed value. Thus, bank equity as measured in the data is less procyclical than true market values would suggest. Since leverage is procyclical and measured equity is relatively acyclical, measured bank leverage ratios are thus procyclical. By contrast, equity in the model is in terms of market value, which is highly procyclical, leading to a countercyclical leverage ratio (see the first panel in the third row). However, when bank equity in the model is measured the same

way as it is in the data, then the model leverage ratio becomes procyclical, as the first two panels of the bottom row indicate.

Concluding Remarks

This is a very nice paper. Along with Becker and Ivashina (2011), it introduces an important research agenda: investigating microdata to understand the transmission of financial crises.

Endnote

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