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Central Bank Lending in a Liquidity Crisis

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Solvent banks may appear insolvent in the midst of a liquidity crisis, due to the plunge of their assets' value below their normal value. The responsibility of the central bank is to provide liquidity to the banks that would be solvent under normal economic conditions, at lending terms consistent with normal market conditions.

In a liquidity crisis, banks that have been solvent up to the crisis can lose access to short-term funding and risk failing. As lenders of last resort, central banks typically respond by lending to banks that are illiquid but solvent, against good collateral. For instance, when a severe liquidity crisis hit the U.S. financial system in 2007-2009, the Federal Reserve responded by lending more than $500 billion to depository institutions in generally sound financial condition through the discount window's primary credit program and the term auction facility.[1]

In this article, I explain why solvent banks can lose the ability to borrow in a liquidity crisis and what the appropriate central bank response is. I do so with the help of a model that starts with the basic features of the financial system and outlines the chain of events that can lead to a crisis. The crisis that I describe in the model replicates several features that play an important role in various types of liquidity crises. The value of banks' assets drops below their normal value. Banks that would be solvent under normal economic conditions appear to be insolvent in the midst of the liquidity crisis, so they cannot obtain credit from the market. A contagion mechanism spreads the risk of default from bank to bank. The key lesson from the model is that, to prevent the liquidity crisis from developing into a much more costly economic and financial crisis, the central bank needs to provide liquidity to the banks that would be solvent under normal economic conditions, at lending terms consistent with normal market conditions.

A Model of a Liquidity Crisis

Liquidity crises—in which otherwise solvent banks lose access to short-term funding—may be generated by various types of mechanisms based on information problems, coordination failures, or bank interconnectedness.[2]

The mechanism that I focus on is of the coordination-failure type and is similar to the one that I study in Occhino (2016), where I show how a self-fulfilling-expectations crisis can arise when the value of banks' assets is sensitive to economic prospects while the overhang of banks' liabilities distorts their lending choices.

In the model that we use here, there are two equilibria; that is, the economy can end up in one of two possible outcomes, a normal state or a crisis. The outcome the economy ends up in is determined by the public's self-fulfilling expectations of economic conditions: if the expectations are optimistic, the economy grows normally; if they are pessimistic, the economy collapses.

In the model, the financial system is initially made up of solvent banks, that is, banks with assets greater in value than their liabilities. However, three features of the financial system make the economy vulnerable to a crisis:

- **Fund intermediation**: Banks and other financial intermediaries channel funds from the providers of funds (savers) to the users of funds (borrowers including firms). This function is fundamental for the efficient working of the economy—if the financial system stops intermediating funds, the economy collapses.
- **Maturity mismatch:** The banks' assets (loans and securities) tend to be longer-term than their liabilities (deposits and short-term funding), so banks need to regularly obtain short-term liquidity to fund their long-term assets.
- **Asset sensitivity**: The return on banks' assets is sensitive to economic conditions, so their current value crashes if the public expects that the economy will collapse.

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Because of these three features, the economy can end up in either of the following two outcomes, depending on the public's self-fulfilling expectations of economic conditions:

- A **normal outcome** where the economy and the financial system work efficiently. The public is confident in the financial system, and economic expectations are optimistic. The value of banks' assets is strong. Banks obtain liquidity and extend credit to firms and other borrowers. The economy grows and this confirms the public's initial confidence in the financial system and its optimistic economic expectations.
- A **crisis outcome** made of two stages. In the first stage, a liquidity crisis hits the financial system: The public loses confidence in the soundness of the financial system and in the prospects for the economy, the value of banks' assets plunges, and banks appear insolvent and lose access to short-term funding. In the second stage, the liquidity crisis develops into a full-fledged economic and financial crisis: Banks stop intermediating financial funds, the economy collapses, and this confirms the initial loss of the public's confidence in the financial system and its pessimistic economic expectations.

In the crisis outcome, a contagion mechanism spreads the risk of default from bank to bank: As the risk of default of a given set of banks rises, they lose access to short-term funding and stop intermediating financial funds; this has a contractionary effect on the economy and depresses the value of assets held by other banks, raising their risk of default.

The key insight of this model is that banks that would be solvent under normal economic conditions appear insolvent in the midst of the liquidity crisis, due to the plunge of their assets' value below their normal value. The prospect of an economic collapse depresses the present value of banks' loans and securities and weakens their balance sheets, so that banks appear insolvent, not simply illiquid.

In fact, unless the central bank intervenes in the way that I describe next, the liquidity crisis will end up developing into a full-fledged economic and financial crisis and banks will end up defaulting on their liabilities. This outcome in the absence of central bank intervention leads lenders to expect that lending to individual banks will be unprofitable and explains why banks that would be solvent under normal economic conditions cannot obtain credit from the market in the liquidity-crisis stage.

Central Bank Intervention

In the model, the central bank can prevent a liquidity crisis from developing into a much more costly, full-fledged economic and financial crisis by intervening early in the first stage, by lending directly to banks. With the liquidity received from the central bank, banks can continue to intermediate financial funds, allowing the economy to continue to work efficiently. Over time, economic expectations improve, the value of banks' assets recovers, and the financial system regains the public's confidence and the access to short-term funding. Eventually, banks will be able to fully repay the loans that they received from the central bank.[3]

Note that the central bank intervention determines whether banks will be able to repay their liabilities. A given bank will be able to repay its liabilities if the central bank intervenes and averts the full-fledged economic and financial crisis, but will not be able to repay otherwise.

To be effective in the intervention, the central bank needs to lend to all banks that would be solvent under normal economic conditions, even though they appear insolvent in the midst of the crisis. The reason is that solvent banks appear insolvent in the midst of the liquidity crisis, so providing liquidity only to the banks that appear solvent in the crisis would be equivalent to providing no additional liquidity beyond the amount already provided by the market.

Similarly, the lending terms—the collateral valuation and the lending rate—need to be set consistently with normal market conditions, not with the market conditions prevailing during the crisis. Otherwise, lending at terms consistent with crisis conditions, which would entail low collateral valuations and high lending rates, would be equivalent to providing no additional liquidity beyond the amount already provided by the market and would defeat the purpose of restoring normal market conditions.

Access to a lender of last resort may distort how banks manage their liquidity in advance of the crisis, reducing their incentive to hold liquid assets—a moral hazard distortion that our model does not capture. In principle, setting a lending rate higher than normal may help mitigate this distortion, but it would raise the risk that the central bank intervention may be less effective. As suggested by Bernanke (2008), the most effective way to reduce this distortion is likely by prudential supervision and regulation aimed at ensuring that banks manage their liquidity effectively in advance of the crisis.

These observations are in accordance with the prescription introduced by Walter Bagehot in 1873 that collateral should be good in normal times, not necessarily during the crisis. Bagehot prescribed that the central bank should freely advance "on what in ordinary times is reckoned a good security on what is then commonly pledged and easily convertible," and that

> "advances […] should be made on everything which in common times is good 'banking security.' The evil is, that owing to terror, what is commonly good security has ceased to be so; and the true policy is so to use the Banking reserve, that if possible the temporary evil may be stayed, and the common course of business be restored."

Bagehot did prescribe that loans should be made at a "very high rate of interest," but this should be interpreted as relative to the rate prevailing under normal conditions, not during the crisis. For instance, according to Freixas et al. (1999), Bagehot prescribed "a high rate of interest relative to

the pre-crisis period," while according to Goodhart (1999), he prescribed a rate "above that in effect in the market prior to the panic, but not necessarily above the contemporaneous market rate."

Furthermore, as argued by Bernanke (2008), Bagehot's main rationale for a high lending rate—to discourage unnecessary borrowing and thus protect the Bank of England's limited reserve of liquid assets—is less relevant nowadays, since modern central banks do not face the same limitations in their ability to lend. This suggests that, during crises, modern central banks should lend at rates close to normal. For instance, during the 2007-2009 crisis, the Federal Reserve reduced the spread of the primary credit discount rate over the target federal funds rate from 100 to 25 basis points.

The model we have been considering offers a few additional lessons on the way in which the central bank should provide liquidity.

First, the central bank should intervene rapidly, as soon as the liquidity crisis hits. As time passes, the intermediation of funds gets more and more disrupted, the economy deteriorates, and liquidity problems turn into solvency problems.

Second, the central bank should lend to banks on a system-wide scale, because the value of each individual bank's assets depends on aggregate economic conditions. Lending to few banks on a small scale would not prevent the plunge of bank asset values, the disruption of financial intermediation, and the collapse of the economy.

Third, the central bank should lend to banks directly, rather than provide liquidity to the market through open market operations and then rely on the market to allocate the liquidity among banks. This is because in the crisis banks appear insolvent, not simply illiquid, so the market would fail to extend them credit. Flannery (1996) and Rochet and Vives (2004) describe other examples where direct lending to banks during crises is necessary because the market fails to allocate liquidity efficiently among banks due to information problems or coordination failures—see Bordo (1990) for a review of different views on whether the central bank should provide liquidity directly to banks or only indirectly through open market operations.

Challenges Faced by the Central Bank

The key lesson from our model is that the central bank should lend to the banks that would be solvent under normal economic conditions, and that the lending terms, including the collateral valuation and the lending rate, should be set consistently with normal market conditions. This makes the task of the central bank especially challenging.

One challenge is that it is difficult to assess in the midst of a crisis what the return on a bank's assets will be once normal economic conditions have been restored and whether that bank will be solvent. Goodhart (1999), for instance, argues that it is not generally possible for a central bank to distinguish between insolvent and illiquid banks during a crisis. Measures that are useful for assessing solvency in normal times are not reliable during crises because the market value of banks' assets may be depressed below their fundamental value. For this reason, it may be helpful to rely on information about banks' safety and soundness produced by bank supervisors before the crisis. This makes the constant monitoring and regular stress testing conducted in normal times all the more valuable.

Another challenge is that there may be rules and regulations restricting the ability of the central bank to lend to banks that appear insolvent in the midst of the crisis, at lending terms that do not reflect crisis market conditions. For instance, there are various restrictions on Federal Reserve discount window lending to banks that are undercapitalized[4] and rules require that the collateral's value be computed using market prices, when they are available.[5]

These restrictions help protect the central bank's balance sheet, mitigate moral hazard problems that encourage banks' excessive risk taking, and reduce the potential stigma faced by borrowing banks, that is, the risk that their borrowing may be interpreted as a sign of financial weakness. However, the restrictions may also hinder the ability of the central bank to provide liquidity to banks that, while appearing insolvent in the midst of the liquidity crisis, will be solvent once normal economic conditions have been restored, at lending terms consistent with normal market conditions. When setting restrictions on central bank lending, it is important to take into account the risk that the central bank may not be able to serve effectively as a lender of last resort once a liquidity crisis gets going and that the crisis may develop into a much more costly economic and financial crisis.

Footnotes

1. Gorton and Metrick (2013) and Carlson and Wheelock (2015) review the history of the Federal Reserve as a lender of last resort. The literature on lending of last resort is reviewed in Humphrey (1989), Freixas et al. (1999), Goodhart and Illing (2002, Introduction), Freixas and Rochet (2008 Section 7.7), and Allen et al. (2011, Section 1.2).

2. The literature on liquidity crises is reviewed in Allen and Gale (2008, Introduction), Freixas and Rochet (2008, Chapter 7), and Allen et al. (2011, Chapter 1).

3. One implicit assumption of the model, necessary to explain why a liquidity crisis occurs in the first place, is that the central bank intervention is not perfectly anticipated by the public.

4. See https://www.frbdiscountwindow.org/en/Pages/General-Information/The-Discount-Window.aspx#restrictions.

5. See http://www.federalreserve.gov/monetarypolicy/bst_lendingdepository.htm.

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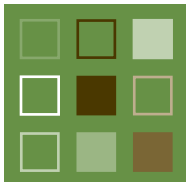

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