

14.09: Financial Crises

Lecture 5: Maturity Mismatch and Bank Runs

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Liquidity and financial panics

- So far: Focus on leverage and amplification channels.
- Our story is missing a key feature of crises, “panic.”
- Panic can be thought of as a sudden shift in financiers’ behavior that induces them to reduce their lending to banks/institutions.
- Thus, the spotlight on the next few lectures will be on Fs:
 - 1 They might need “liquidity” (Diamond-Dybvig model)
 - 2 They might seek “safety” (Holmstrom-Gorton-Geanakoplos...)
 - 3 They might be institutions, with own problems (Shin-Caballero...)

We will formalize 1 today, and will come back to 2 and 3 later.

Roadmap

- 1 Maturity mismatch and illiquidity
- 2 Liquidity pooling and bank runs
- 3 Potential solutions to bank runs
- 4 Applying bank runs in modern financial markets

Two mismatches: Risk and maturity

Balance Sheet of All Commercial Banks in the U.S. in August 2007
(entries are percentage of total assets)

Assets		Liabilities	
Reserves and cash substitutes	8%	Transaction (checkable) deposits	6%
Securities		Nontransaction deposits (e.g., time deposits, savings deposits)	56%
U.S. government and agency	11%	Borrowings	21%
Other securities	11%	Other liabilities	6%
Loans			
Commercial and industrial	13%		
Real estate	34%		
Consumer	7%		
Other loans	7%		
Other assets (e.g., physical capital)	9%	Bank capital	11%
Total	100%	Total	100%

The instructor's calculations based on the Federal Reserve Statistical Releases.

Two mismatches: Risk and maturity

Bank balance sheets can be viewed as featuring two mismatches:

- ① **Risk mismatch:** Relatively risky assets, relatively safe liabilities/debt.
 - We saw how this can create fragility (especially with high leverage).
- ② **Maturity mismatch:** Longer-maturity assets, shorter-maturity liabilities....

Maturity mismatch

- Bank assets typically make small payments spread over a long horizon. Imagine receiving 30-year mortgage loan from the bank.
- Bank liabilities typically make promises over a much shorter horizon: Imagine making a deposit in a checking/savings account.
- The discrepancy is known as the maturity mismatch.
- The maturity mismatch also creates the possibility of illiquidity...

Liquidity of an asset: Ease of converting into cash

- Recall that the value of a financial asset with a long horizon is,

$$Q_1^{ideal} \simeq \text{Present discounted value of future payoffs.}$$

- Liquidity of a financial asset (broadly speaking): How easily can the asset be converted into cash in a short amount of time.
- How close a value can I get to Q_1^{ideal} over a short amount of time.

Liquidity is arguably low for nontraded assets

- So liquidity is closely related to the fire sales that we discussed.
- For traded assets (such as stocks, bonds, houses), fire sales is a situation in which liquidity “dries up” relative to normal times.
- For assets that are not regularly traded in financial markets, liquidity is a greater concern. Hard to sell even in normal times.
- Historically, bank assets (mortgages etc) not regularly traded.

Liquidity can also be low for traded bank assets

- Trading costs dramatically declined in recent years (IT revolution etc).
- This has converted more bank assets into marketable securities.
- An example is securitization, which converts traditionally illiquid bank assets (e.g. mortgages/loans) into marketable securities (CDOs etc).
- Note that bank assets are typically debt-like (someone else's debt).
- Debt-like securities can be liquid in normal times, but their liquidity can also dry up very quickly at times of uncertainty. Will come back.
- Thus, illiquidity is arguably a concern even if bank assets are traded.

Danger zone: Maturity mismatch with illiquid assets

- Combination of maturity mismatch and illiquid assets can be dangerous.
- Diamond and Dybvig (1983): Formal analysis of this danger zone:
 - 1 Why do the banks feature a maturity mismatch to begin with?
 - 2 How does this arrangement create fragility/runs/panics?
 - 3 What should the policy should do about this?
- Our goal today: Illustrate the DD ideas using a stylized model.

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A model of banks and financiers

- Consider a model with a number of banks (B) and a large number of financiers (F) as before.
- In this case, there are three periods, $\{0, 1, 2\}$.
 - Date 0 is when investments are done as before.
 - Dates $\{1, 2\}$ (previously date 1) when returns might be realized.
- Fs have resources at date 0 as before, say 1 dollar each.
- Fs have no resources at other dates (for simplicity).
- Bs have no resources (can incorporate N_0 but not necessary).

New ingredient: Fs are subject to liquidity shocks

- Previously, we assumed the preferences were, $C_0 + C_1 + C_2$.
- We now assume Fs might experience a liquidity shock at date 1.
- With probability λ (say 10%), must consume at least \underline{C}_1 at date 1.
 - Hard constraint for simplicity—imagine very low utility if $C_1 < \underline{C}_1$.
 - Assume also that $\underline{C}_1 = 1$. Not necessary but simplifies the math.

With probability $1 - \lambda$, linear preferences as before $C_0 + C_1 + C_2$.

The liquidity shocks are independent draws. With a large number of Fs, the fraction of Fs that will have a liquidity shock is exactly λ .

Project choice: Liquidity-return trade-off

Suppose there are two types of projects at date 0:

- Liquid (e.g., cash): Investing 1 dollar yields 1 dollar at the next date.
 - Illiquid (e.g., loan): Investing 1 dollar yields $R > 1$ (say 1.5) at date 2 if completed, but it yields $l < 1$ (say 0.5) if liquidated at date 0.
-
- First suppose there are no banks and each F is on its own.
 - Can hold cash or (unrealistically) make loans. What would she do?

Without coordination, liquidity is wasted

- On her own, each F would put \underline{C}_1 into cash, and $1 - \underline{C}_1$ into loans.
- This ensures she can consume $\underline{C}_1 = 1$, when she needs.
- In the numerical example, invest everything in the liquid asset!
- But the liquidity shock happens only 10% of the time. Most of the time, she would have excess liquidity at date 1 that she doesn't need.
- If you were a social planner, what would you ideally want to do here?

Ideal arrangement: Liquidity pooling

- Invest only the minimally necessary amount in cash, $\lambda \bar{C}_1$.
- In the numerical example, invest the fraction, $\lambda = 10\%$, in cash and the remaining fraction, $1 - \lambda = 90\%$, in loans.
- Return from loans (at date 2) is given by, $R(1 - \lambda) = 1.5 \times 0.9$.
- We could give this to Fs without liquidity shock, so that:
 - Fs who receive a liquidity shock at date 1 consume $\underline{C}_1 = 1$.
 - Fs don't receive a liquidity shock consume $C_2 = R = 1.5$.
- Recall that $C_2(1 - \lambda) = R(1 - \lambda)$ so the resource constraints hold.
- (Other arrangements for date 2 also possible since linear utility).

Banks can implement the ideal outcome

- The agents in our model can also implement this outcome.
- Suppose the banks are perfectly competitive (for simplicity).
- They compete to provide the most attractive contract to Fs.

We can then show there is a competitive equilibrium in which:

- 1 Each B offers the following (ideal) contract to each F:
 - F can deposit 1 dollar to the bank at date 0.
 - Can withdraw $\underline{C}_1 = 1$ at date 1.
 - Or can wait and withdraw $C_2 = 1.5$ at date 2.
- 2 Each F accepts a bank contract (better than investing herself).
- 3 Each bank attracts a large number of Fs (so has sufficient liquidity).
- 4 Fs withdraw only if they actually receive a liquidity shock.

Discussion: Bank liabilities and liquidity pooling

- The contract in this equilibrium resembles various types of bank liabilities in practice: saving deposits, term deposits, short term debt...
- So the model illustrates another function of banks: liquidity pooling.
- Sometimes referred to as liquidity creation/maturity transformation.
- Banks help the economy to invest in less liquid but profitable projects, while meeting the liquidity demand from consumers/firms etc.

Liquidity pools, investment specialists, or both?

- In practice, banks are also investment specialists as we discussed before. They can identify/monitor projects better than Fs.
- But the two roles don't conflict with one another.
- Investment specialist is a function (largely) on the asset side of banks.
- Liquidity pooling/creation is a function (largely) on the liability side.

Resulting maturity mismatch creates a source of fragility

- Liquidity pooling provides an explanation for the maturity mismatch.
- But the mismatch also makes the bank somewhat fragile. Why?
- This is nicely illustrated in the popular movie, *It's a Wonderful Life*.
- See for yourself:
<https://www.youtube.com/watch?v=EOzMdEwYmDU>

Can we capture bank runs in our model?

Recall in the equilibrium we had:

4. **Fs withdraw only if they actually receive a liquidity shock.**

Could it make sense for Fs that don't need liquidity also to withdraw?

- To address this, we need to specify payoffs in these contingencies.
- Let $\tilde{\lambda} \geq \lambda$ denote the total withdrawals. $\tilde{\lambda} - \lambda$ is unforced withdrawals.
- Recall the bank promised $C_1 = 1, C_2 = 1.5$ for early&late withdrawals.
- But it might be unable to meet these promises if $\tilde{\lambda}$ exceeds λ .
- Let $(C_1(\tilde{\lambda}), C_2(\tilde{\lambda}))$ denote the actual payoffs conditional on $\tilde{\lambda}$

Banks' decisions after unforced withdrawals

- The bank has cash (λ) just enough to meet forced withdrawals.
- The bank can also liquidate loans to obtain $l = 0.5 < 1$ at date 1.
- Suppose a bank that faces unforced withdrawals liquidates loans to meet them, as long as it is possible to do so.
- We can calculate the payoffs, $(C_1(\tilde{\lambda}), C_2(\tilde{\lambda}))$, explicitly...

Late payoffs after unforced withdrawals

- When $\tilde{\lambda} - \lambda$ is not too high, we have $C_1(\tilde{\lambda}) = 1$ but

$$\begin{aligned} C_2(\tilde{\lambda}) &= R \frac{\left(1 - \lambda - (\tilde{\lambda} - \lambda) \frac{1}{I}\right)}{1 - \tilde{\lambda}} \\ &= 1.5 \left(1 - \frac{\tilde{\lambda} - \lambda}{1 - \tilde{\lambda}} \left(\frac{1}{I} - 1\right)\right) \\ &= 1.5 \left(1 - \underbrace{\frac{\tilde{\lambda} - \lambda}{1 - \tilde{\lambda}}}_{\text{unforced withdrawals}} \underbrace{\left(\frac{1}{I} - 1\right)}_{\text{cost of withdrawals}} \frac{1}{1 - \tilde{\lambda}}\right) \quad (1) \end{aligned}$$

- The bank meets the unforced withdrawals but at great cost to depositors that withdraw late. Why is the cost so large?

Late and early payoffs after unforced withdrawals

- When $\tilde{\lambda} - \lambda$ is even higher (here, $\tilde{\lambda} \geq 0.55$) the bank is forced into liquidating everything.
- In this case, the late depositors receive nothing,

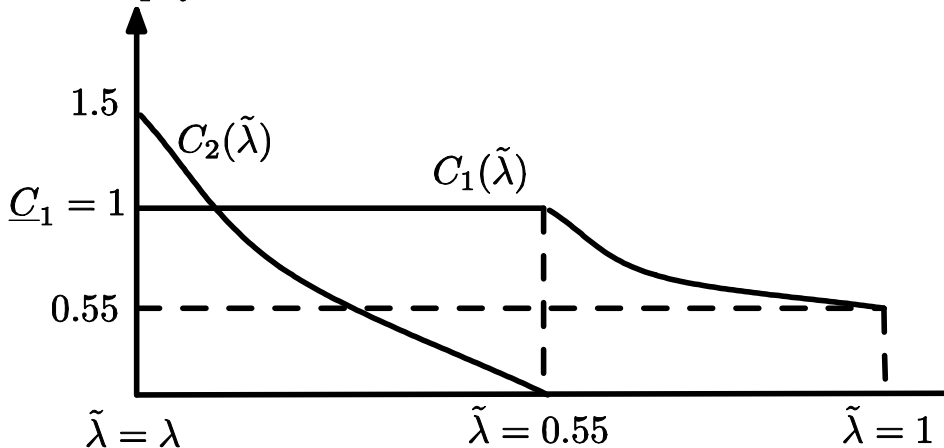
$$C_2(\tilde{\lambda}) = 0$$

and the early depositors receive less than promised,

$$C_1(\tilde{\lambda}) = \frac{\lambda + (1 - \lambda)l}{\tilde{\lambda}} = \frac{0.55}{\tilde{\lambda}} < 1.$$

- The math is not important. What matters is the qualitative effects, which we can illustrate pictorially (combining both cases)...

Actual payoffs

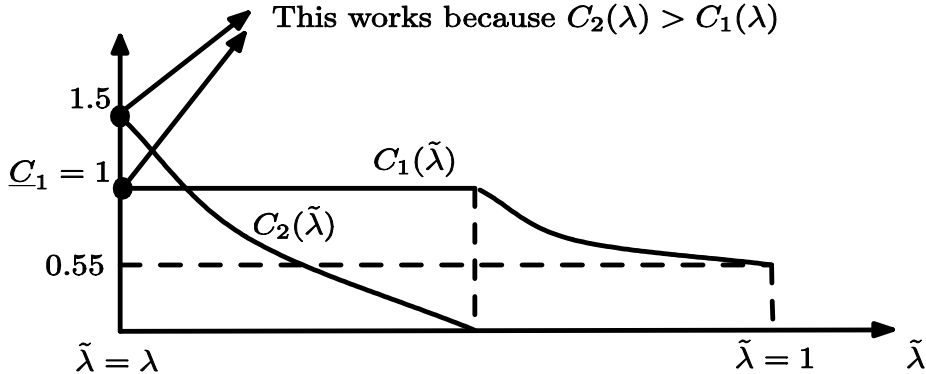


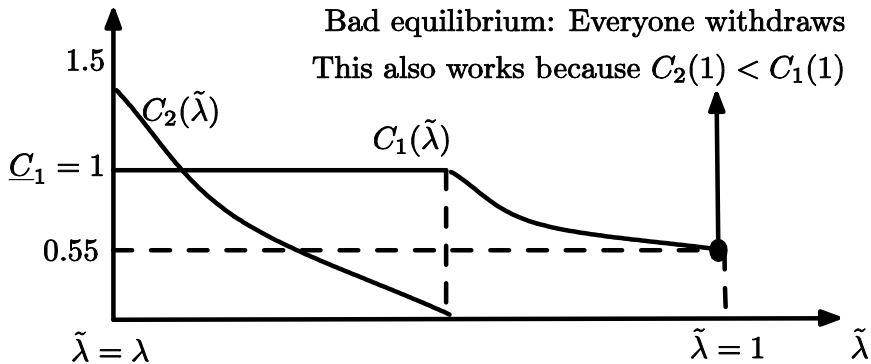
Unforced withdrawal decisions are complementary

- $C_1(\tilde{\lambda}) - C_2(\tilde{\lambda})$ captures the incentive of an F to withdraw unforced.
- Note $C_1(\tilde{\lambda}) - C_2(\tilde{\lambda})$ is increasing in $\tilde{\lambda}$ (in a neighborhood of λ).
- In economics jargon, **unforced withdrawals are complementary**.
- The more I do an unforced withdrawal, the more I force (inefficient) liquidations on the bank, and the more I incentivize you to do so.
- This type of complementarity can lead to multiple equilibria...

Good equilibrium: No unforced withdrawals

This works because $C_2(\lambda) > C_1(\lambda)$





Bad equilibrium formalizes bank runs/panics

- So the earlier liquidity pooling equilibrium still works.
- When no-one withdraws, it doesn't make sense to withdraw.
- But our analysis uncovered an additional possibility: When everyone withdraws, it becomes indeed reasonable to withdraw!
- The bad equilibrium can be interpreted as a **bank run**.
- It provides one formalization of a financial panic.
- It also suggests some potential policy interventions...

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Suspension of convertibility: (Used quite a bit in history.)

- Suppose, the bank temporarily shuts down after λ withdrawals.
- Gives \underline{C}_1 to first λ withdrawals but then stops serving withdrawals.
- The bank reopens at date 2, and pays the remaining Fs $C_2 = 1.5$.

In the model, this kills the bank run equilibrium. Solves the problem!

In practice, this “solution” is problematic for many reasons. Why?

Potential solution: Lender of last resort (LLR)

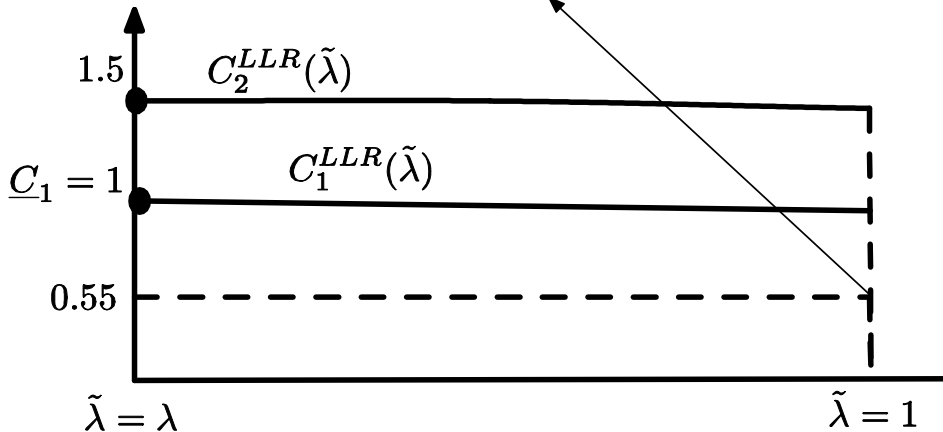
Lender of last resort (LLR): (Many examples in history.)

- Suppose the central bank (e.g., the Fed) has resources at date 1, ultimately backed by the taxation power of the government.
- CB lends to the bank at rate, $1 + r \in [1, R]$, say $r = 50\%$.
- When the bank faces withdrawals, $\tilde{\lambda} - \lambda$, it now chooses to borrow from the CB as opposed to liquidating projects. This implies,

$$\begin{aligned}C_2(\tilde{\lambda}) &= \frac{R(1 - \lambda) - (1 + r)(\tilde{\lambda} - \lambda)}{1 - \tilde{\lambda}} \\ &= R + \frac{\tilde{\lambda} - \lambda}{1 - \tilde{\lambda}}(R - (1 + r)) \\ &= 1.5.\end{aligned}$$

- Unforced withdrawals are less costly in this case. Why?

Bad equilibrium disappears
since $C_2^{LLR}(1) > C_1^{LLR}(1)$



LLR eliminates the bank run equilibrium

- The bank run equilibrium disappears altogether!
- The presence of the LLR circumvents inefficient liquidations—ensures the Fs that withdraw late will not lose their shirts.
- Once we switch to the good equilibrium, there are no unforced withdrawals, $\tilde{\lambda} = \lambda$. LLR facility is not used at all!
- So the main role of the LLR is preventive. **Knowing that there is a LLR in place ensures depositors don't panic.**
- (This is of course extreme. In practice, LLR could be used, e.g., if realized λ unexpectedly turns out higher etc.)

The LLR function has been well understood—and used—historically.

Bordo (1990) on the reading list summarizes **Bagehot's (1873) principles for the Bank (of England) to observe as LLR:**

- 1 Lend, but at a penalty rate: “Very large loans at very high rates are the best remedy for the worst malady of the money market...”
- 2 Make clear in advance the Bank's readiness to lend freely,
- 3 Accommodate anyone with good collateral (valued at pre-panic prices),
- 4 Prevent illiquid but solvent banks from failing..

Does the LLR help to prevent panic?

Bordo (1990): Historical analyses of LLR and the runs/panics.

- Bank of England: Accepted its role as LLR after the panic of 1866.
- The US in the second half of the 19th century: No federal LLR.
- Compare the incidence of runs in the US and the UK between 1870-1933...

Table 1 from Bordo, Michael D. "The lender of last resort: Alternative views and historical experience." *FRB Richmond Economic Review* 76, no. 1 (1990): 18-29 removed due to copyright restrictions. Please see https://www.richmondfed.org/-/media/richmondfedorg/publications/research/economic_review/1990/pdf/er760103.pdf.

Does the LLR help to prevent panic?

- The table compares historical data from the US and the UK during severe business cycle downturns.
- Macroeconomic aggregates such as real output growth from peak to trough relative to trend (first column) are qualitatively similar.
- The table suggests that large recessions/downturns are associated with crises or panics in the US, but not necessarily in the UK.
- Similar evidence for France, Germany, Sweden, and Canada: They all had LLRs and had no banking panics:
“In France, appropriate actions by the Bank of France in 1882, 1889, and 1930 prevented incipient banking crises from developing into panics. Similar behavior occurred in Germany in 1901 and 1931 and Canada in 1907 and 1914.”

Federal Reserve's role as the LLR

- The Federal Reserve was founded in 1914 to serve as the LLR.
- Its role as the LLR precedes its role as price/macro stabilizer.
- Gorton and Metrick (2013) argue that the Fed might have prevented the panic that would have otherwise happened in 1920-1921 recession...

Graph of Federal Reserve Credit extended from 1917-1935 removed due to copyright restrictions. Please see Gorton, Gary, and Andrew Metrick (2013). ["The Federal Reserve and Panic Prevention: The Roles of Financial Regulation and Lender of Last Resort."](#) *Journal of Economic Perspectives* 27, no. 4, p.45-64.

Federal Reserve in the run-up to the Great Depression

- Read Gorton and Metrick (2013) for an interesting discussion of the Fed's early attempts at figuring out the LLR function.
- Initially, loans were underpriced, so banks started to borrow continuously from the Fed—even when they were not in trouble.
 - Is this consistent with the Bagehot's principle?
- In mid-1920's, Fed created a “reluctance to borrow” (via rationing etc).
- This also created *stigma*: Borrowing from the Fed itself became a negative signal about the bank's quality, because—given the reluctance policy—only weak banks would borrow!
- Runs can become more likely when the perception of R falls (appendix).
- So the stigma is a real concern—has also come up in the recent crisis.

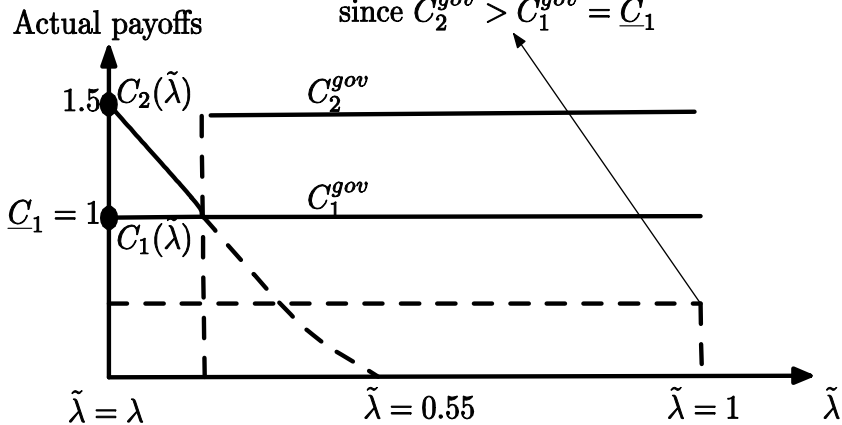
Federal Reserve during the Great Depression

- Gorton and Metrick (2013) argue that the Fed failed to prevent the bank runs that happened in the 1930s (during the Great Recession), in part because of the stigma it created in the 1920s.
- Banks were cautious and reluctant to borrow from the Fed. The LLR function did not quite work as intended.
- After this experience, the U.S. resorted to a stronger solution to prevent runs: deposit insurance...

Deposit insurance: (Example, FDIC in the US implemented in 1933)

- Suppose the government has resources at date 1 as before (thanks to its taxation power), and it guarantees deposit contracts.
- To be specific, let's say that the bank "fails" if it cannot pay at least 1 to its early or late depositors (i.e., if C_1 or C_2 falls below 1).
- If the bank fails, the government takes the bank over and redeems the original promises to depositors.
- Early withdrawal receives $\underline{C}_1 = 1$, late receives $C_2 = 1.5\dots$

Bad equilibrium disappears
 since $C_2^{gov} > C_1^{gov} = \underline{C}_1$



The bank survives
 Business as usual

The bank fails. The government takes over
 the deposits and meets the obligations.

Potential solution: Deposit insurance

- As in LLR, deposit insurance kills the bank run equilibrium.
- Once we switch to the good equilibrium, withdrawals are $\tilde{\lambda} = \lambda$.
- The deposit insurance is not used at all!
- So like the LLR, the main role of deposit insurance is preventive.
- (This is of course extreme. In practice, deposit insurance could be used, e.g., if realized λ unexpectedly turns out higher etc.)

In the U.S., deposit insurance seemed to work as intended, FDIC was created in 1933. Bank failures dramatically declined and remained low---until the S&L crisis of the 1980s.



Source: [Banking and Monetary Statistics](#) and FDIC.

Courtesy of Gary Gorton. Used with permission.

Deposit insurance and LLR can be potentially costly

- So far, we painted a rosy picture of deposit insurance and LLR.
- In the model, we assumed $R > 1$, the bank has a valuable project (the bank is *solvent*) but it can fail due to runs (or *illiquidity*).
- In practice, hard to know if bank is insolvent, illiquid, or both.
- An insolvent bank, $R < 1$, would also experience runs. In this case, the deposit insurance (as well as the LLR) will make losses. Why?

Deposit insurance, LLR, and moral hazard

- This also implies deposit insurance creates some moral hazard.
- As we discussed in the last lecture, a bank can deliberately take risks and end up with $R_L < 1$ in some states. FDIC absorbs the losses.
- Franchise value provides some discipline, but MH is a concern.
- Thus, deposit insurance is typically complemented with insurance fees paid by banks as well as regulation of bank risks/leverage.
- These are sound policies—up to a degree—regardless of whether mistakes or moral hazard is the ultimate cause of bank failures.

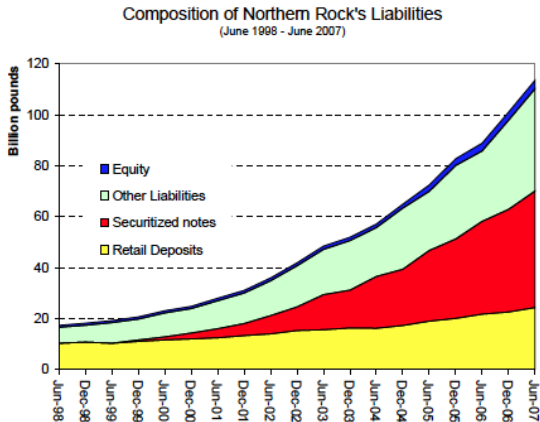
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Shin (2009): A case study of Northern Rock

- Starts as a traditional mortgage bank. Rapid growth in assets starting in 1998 (following the decision to go public).
- **Not exposed to the subprime mortgages**—mostly in prime mortgages.
- But nonetheless, experiences a bank run in 2007.
- The first bank run in the UK since 1866 (Overend Gurney episode).
- At first glance, looks like the textbook Diamond-Dybvig model.
- There are, however, some major challenges when applying the theory...

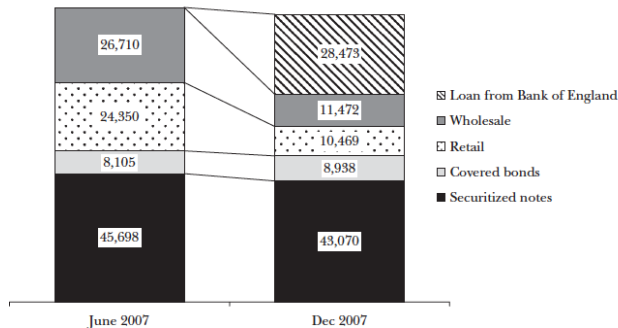
Deposits are only small fraction of liabilities



Courtesy of Hyun Song Shin. Used with permission.

Growth in assets financed by nontraditional types of liabilities.

Figure 3
Composition of Northern Rock's Liabilities Before and After the Run
(millions of pounds)



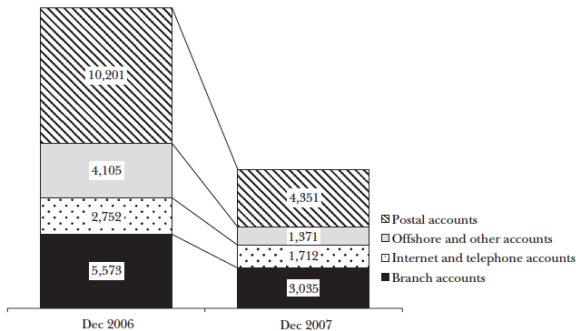
Source: Northern Rock annual report for 2007.

Courtesy of the American Economic Association. Used with permission.

- Securitized deposits not the main problem since long term.
- A decline in both retail deposits and wholesale funds. But...

Figure 4

Composition of Retail Deposits of Northern Rock Before and After Run
(million pounds)



Source: Northern Rock, annual report for 2007.

Courtesy of the American Economic Association. Used with permission.

- Decline is in mostly nontraditional deposits (not branch accounts).

Retail deposits do not seem to be the real problem

- The timing of the crisis is also inconsistent with deposits playing a central role.
- Stressed start on August 9 when the short-term collateralized debt market almost froze.
- Depositor run much later (on September 14), and only after the public announcement of support by Bank of England.
- “Irony of TV images of depositors queuing at the branch offices was that it was the branch deposits that were the most stable.”
- “The damage was already done well before the run by its retail depositors.”
- “Although retail deposits can be withdrawn on demand, bankers have been heard to joke that a depositor is more likely to get divorced than to switch banks.”

Short-term debt is the real problem

Shin (2009) also argues that the real problem was in short to medium term debt (which correspond to the wholesale funds in the earlier table).

Northern Rock saw large outflows of wholesale funds as maturing short to medium term loans and deposits were not renewed.

Some lessons from the Northern Rock

- We will come back to this case for additional lessons in a few lectures.
- The lesson so far is that modern markets are a bit different than the past.
- The problem is **nontraditional deposits** or **short term debt**, often held by other institutions, as opposed to traditional branch deposits.
- But we could still apply the Diamond-Dybvig model, with some relabeling:

Short term debt (of various forms) \longrightarrow Demand deposits.

Larger institutional investors \longrightarrow Small financiers/depositors

Applying DD in modern markets

- So DD model could be thought of as applying in spirit, if not in details.
- Short term debt provides liquidity to the financier-institutions.
- But it creates fragility for the borrowing bank (or bank-like institution).
- In fact, the problem is in a sense more severe because small deposits are explicitly insured by the government (e.g., the FDIC), but short term debt (as well as large deposits) are not.
- This is why many public intellectuals and regulators thought the DD model was a central feature of the crisis...

From Krugman's NY Times column on October 10, 2011:

“One of the great things about Diamond-Dybvig is that it immediately punctures any superficial notion that a bank can be defined by some traditional appearance — that it basically has to be a marble building with rows of tellers, i.e. a depository institution. Any arrangement that borrows short and lends long, that offers investors claims that are liquid while using their funds to make illiquid investments is a bank in an economic sense—and is potentially subject to bank runs. Indeed, what we had in 2008 was mainly a run on shadow banks, on non-depository institutions.”

- <http://krugman.blogs.nytimes.com/2011/10/10/if-banks-are-outlawed-only-outlaws-will-have-banks/>

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From Bernanke's speech at the Kansas Fed Symposium at Jackson Hole, September 2009, "Reflections on a Year of Crisis":

“. . . the events of September and October [2008] also exhibited some features of a classic panic, of the type described by Bagehot and many others. A panic is a generalized run by providers of short-term funding to a set of financial institutions, possibly resulting in the failure of one or more of those institutions. The historically most familiar type of panic, which involves runs on banks by retail depositors, has been made largely obsolete by deposit insurance or guarantees and the associated government supervision of banks. But a panic is possible in any situation in which longer-term, illiquid assets are financed by short-term, liquid liabilities, and in which suppliers of short-term funding either lose confidence in the borrower or become worried that other short-term lenders may lose confidence. Although, in a certain sense, a panic may be collectively irrational, it may be entirely rational at the individual level, as each market participant has a strong incentive to be among the first to the exit.”

Courtesy of the Federal Reserve Board. This content is in the public domain.

- One case where DD forces could have been relevant is Bear Stearns.
- SEC Chairman Cox said the following after the failure of Bear Stearns:

As you will see, the conclusion to which these data point is that the fate of Bear Stearns was the result of a lack of confidence, not a lack of capital. When the tumult began last week, and at all times until its agreement to be acquired by JP Morgan Chase during the weekend, the firm had a capital cushion well above what is required to meet supervisory standards calculated using the Basel II standard.

Specifically, even at the time of its sale on Sunday, Bear Stearns' capital, and its broker-dealers' capital, exceeded supervisory standards. Counterparty withdrawals and credit denials, resulting in a loss of liquidity – not inadequate capital – caused Bear's demise.

- We will discuss this case next time. To prepare, finish reading the
- HBS JP Morgan-Bear Stearns case (from page 8 onwards).

Courtesy of the U.S. Securities and Exchange Commission. This image is in the public domain.

Appendix: Are runs random events as in theory?

- In the above model, runs are purely driven by a lack of coordination.
- Theory doesn't provide guidance about which equilibrium will be played.
- There could be panic without any bad news about the assets or the economy. Panics are as likely in booms as in downturns.
- This feature of the model is not consistent with data.
- Gorton (1988) on the runs during the National Banking Era: "Every time a variable predicting a recession reached a threshold level, a panic occurred."
- Bordo (1990) makes the same point (see the earlier table).

Appendix: Equilibrium selection via global games

- Economic theorists have come up with a partial fix.
- By enriching the model's information structure, we can obtain additional predictions about the likelihood of each equilibrium.
- The analysis is intuitive and suggests the coordination failures (bad equilibrium) are more likely to obtain in bad times.
- This is way outside our scope. To learn more, read Morris and Shin (2001), "Rethinking Multiple Equilibria in Macroeconomic Modeling."

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