

14.09: Financial Crises

Lecture 6: Collateralized Debt and Information Based Panics

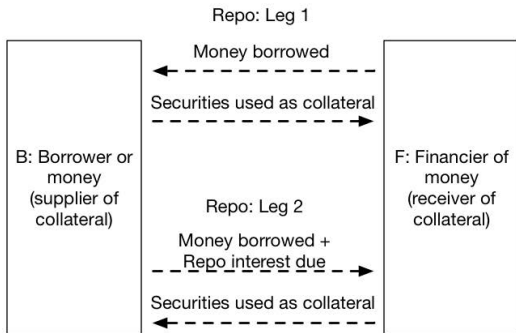
Alp Simsek

Revisiting runs: Is Diamond-Dybvig the whole story?

- Diamond-Dybvig provides a plausible account of runs in history, and after some relabeling, a contributing factor to the subprime crisis.
- However, there is reason to think that it might not be the whole story.
- Recently (and in history), much debt has been **collateralized**.
- An example of collateralized debt is repo (sale-repurchase agreement)...

Roadmap

- 1 Understanding the run on the collateralized debt
- 2 Information insensitivity of collateralized debt
- 3 Information-based panics and the leverage cycle
- 4 Revisiting the run(s) on Bear Stearns



What is repo?

- Repo is effectively a collateralized loan.
- B (the borrower/the bank), receives some money by temporarily giving collateral such as treasuries, MBSs etc to F (the financier).
- B pays back the loan with interest and reclaims the collateral.
- The loan is often short term, e.g., one day, but could also be longer.
- (The deal is technically structured as an initial sale of the collateral and a right to repurchase with a prespecified price that reflects the interest rate—hence the name.)

- As we discussed earlier, the loan usually has a haircut or margin.
- Recall B could borrow $\bar{\rho}$ from the Fs by using 1 dollar of the asset as collateral. The difference, $1 - \bar{\rho}$, would be the REPO haircut.

Table 4
Repo Haircuts
(percent)

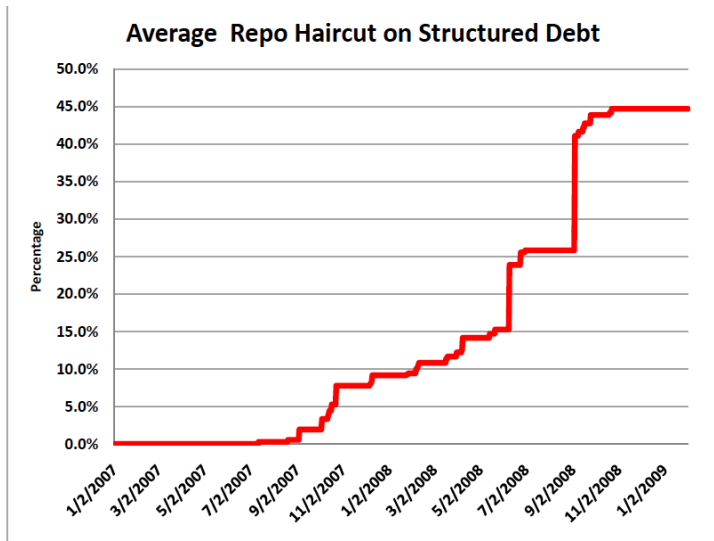
	<i>Repo haircuts (%)</i>			
	<i>Spring 2007</i>	<i>Spring 2008</i>	<i>Fall 2008</i>	<i>Spring 2009</i>
U.S. Treasuries (short-term)	2	2	2	2
U.S. Treasuries (long-term)	5	5	6	6
Agency mortgage-backed securities	2.5	6	8.5	6.5
Corporate bonds, A-/A3 or above	5	10	20	20
Collateralized mortgage obligations, AAA	10	30	40	40
Asset-backed securities, AA/Aa2 and above	10	25	30	35

Source: The data in the first three columns is from the Depository Trust and Clearing Corporation (provided by Tobias Adrian of the New York Fed), with the column for fall of 2008 filled out from reports of investment banks.

Courtesy of the American Economics Association. Used with permission.

Why is Repo important?

- Repo is a huge market. In 2006 Q1, the average amount of outstanding repo (and reverse) agreements were close to \$5.67 trillion. (Source: Stigum (2007), *The Money Market*)
- Daily trading volume over this period averaged \$1.6 trillion!
- And this does not even capture all the repo deals out there.
- Repo is typically used to finance treasuries and safer MBSs.
- But it is also used to finance riskier MBSs (CDOs etc).
- Gorton: There was a run on Repo, in the sense that the haircuts on these types of riskier types of collateral increased...



Source: Gorton and Metrick (2009a).

Courtesy of Gary Gorton. Used with permission.

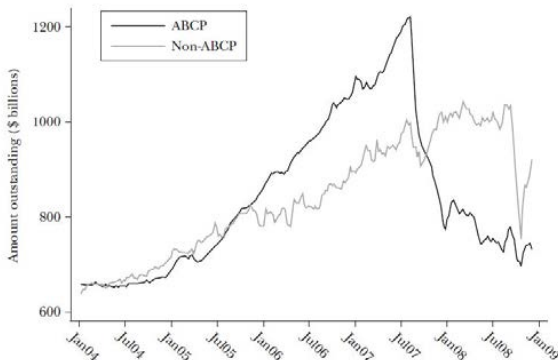
Gorton: There was a run on the repo

Gorton (2010) on your reading list: “The figure is a picture of the banking panic. We don’t know how much was withdrawn because we don’t know the actual size of the repo market. But, to get a sense of the magnitudes, suppose the repo market was \$12 trillion and that repo haircuts rose from zero to an average of 20 percent. Then the banking system would need to come up with \$2 trillion, an impossible task.”

A similar run on asset backed commercial paper

Figure 2

Outstanding Asset-Backed Commercial Paper (ABCP) and Unsecured Commercial Paper



Source: Federal Reserve Board.

Courtesy of Markus K. Brunnermeier. Used with permission.

- ABCP is different than Repo, but conceptually similar. Debt is collateralized by assets in a conduit (set up by a sponsor bank).
- Can we invoke DD to explain the run on repo and ABCP?

Traditional runs are not easy to apply to Repo

- Collateralized debt is conceptually different than bank deposits.
- The traditional run mechanism relies on multiple Fs having claims on the same “collateral” (the banks’ assets as a whole).
- Many Fs are on the same boat, so a coordination failure is possible.
- But in collateralized debt, e.g., Repo, Fs money is backed by specific collateral. Loosely speaking, F is on its own boat.
- Thus, it is not very easy to apply a coordination mechanism.
- So runs on collateralized debt might be driven by other forces.
- Before we get there, let’s think about the economic rationale of collateral...

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From pawn shops to repo

- Repo logic is similar to a pawn shop.
- In a pawn shop, the financier (the lender of money) receives a valuable commodity such as jewelry as collateral. The financier returns the collateral back upon receipt of money with interest.
- Pawn shop is an ancient institution. See Goetzmann and Rouwenhorst (2005), *The Origin of Wealth*, for some fascinating pictures of pawnshop loan records from China circa 662-689 A.D. The records indicate that silk garments were used as collateral at the time.

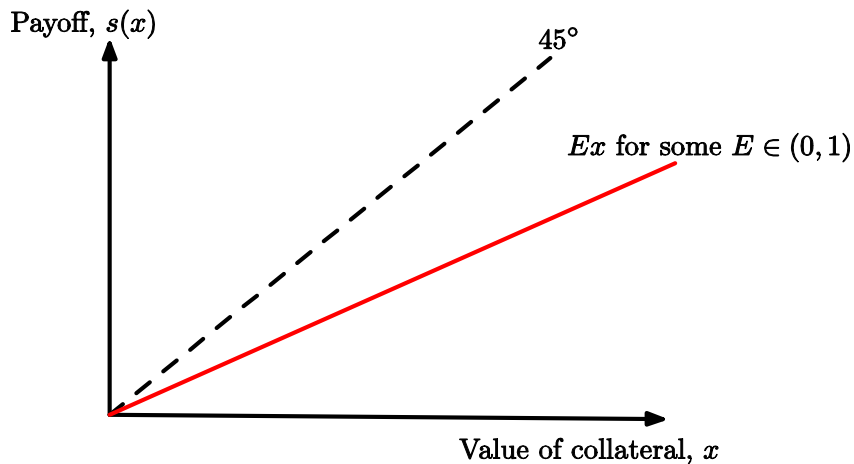
Why collateral?

- The fact that collateral has been used for a long time, and under very different institutions, suggests that it serves an important economic function.
- One rationale: Collateral helps to mitigate **information frictions**.
- Once the loan is secured by collateral, F only needs to have a rough sense that the value of collateral exceeds the amount lent.
- Less need to know B's financial health (less "adverse selection"). Or what B will do with the borrowed money (less "moral hazard").

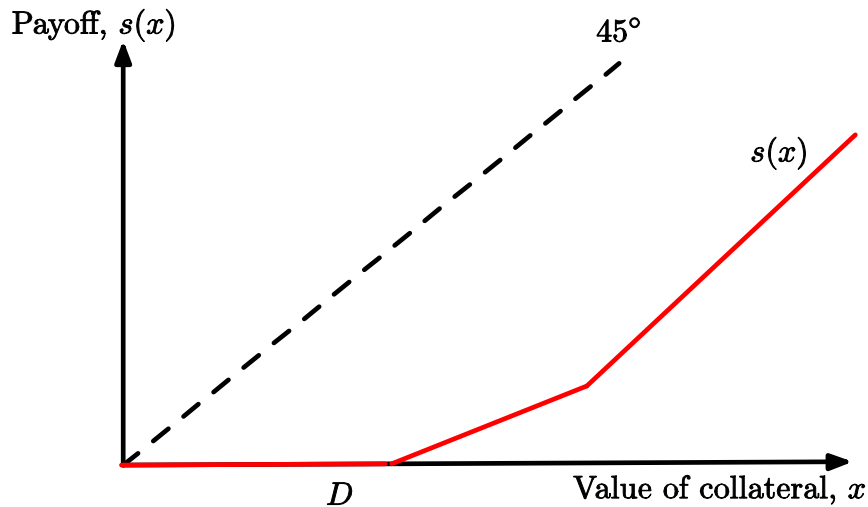
Collateral helps to economize on information costs

- In practice, producing information about borrowers or their actions can be very costly (need credit registries, monitors, courts etc.)
- So one view of collateral is that it allows the flow of credit while economizing on costly information acquisition.
- This can also help to understand the form of the collateral contract.
- It typically takes the form of **debt** as opposed to something else.
- To formalize, suppose B promises to pay back $s(x)$, where x denotes the value of the collateral (on the due date)

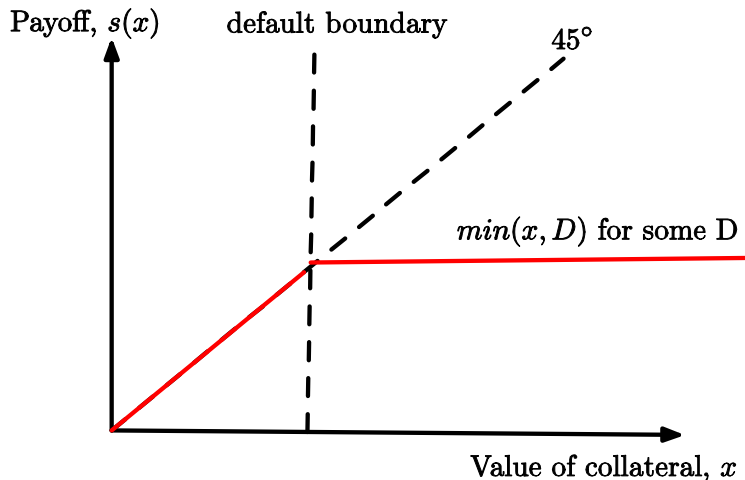
The collateral contract could take this form



Or it could take this form



But instead, it typically takes this form



- B pays back (fixed) D whenever $x \geq D$ but defaults when $x < D$.

Why not have the first two contracts?

- There are actually some nice things about the first two contracts.
- They have reasonable risk sharing properties: Fs share some risk in the sense that Bs' liability is relatively low in low states.
- If we had these types of contracts, crises could be less severe. Why?
- But we do not have these contracts. Why might this be the case?

Debt contract is the least sensitive to information

- Most likely because they are quite sensitive to changes in the value, x .
 - To price them, F would have to know quite a bit info about x .
 - This goes against the logic of using collateral to begin with!
-
- In contrast, debt is largely insensitive to the value of collateral.
 - As long as $x > D$ (flat part), payoff doesn't depend on x at all!
 - This further helps to economize on information/reduces frictions.

Collateralized debt economizes on information costs

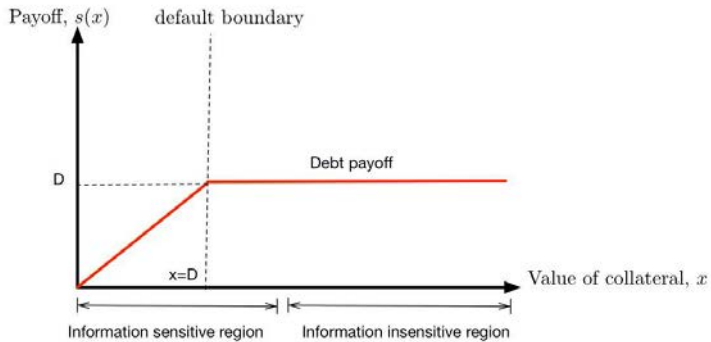
- In fact, in practice contract does not even make reference to the value of the collateral, x . That reference is a construct of our formalism.
- As long as $x > D$, B pays the debt and reclaims the collateral.
- As long as there is mutual understanding that $E[x] \gg D$, parties can borrow and lend without discovering the exact value of x .
- This is probably why even things like old jewelries or silk shirts (presumably very difficult to price exactly) can serve as collateral.

How could they trade so much without knowing much?

- Holmstrom (2015): MBSs could be analogues to old jewelries!
- Remember that trillions of \$s were being exchanged in repo markets.
- MBSs were quite opaque and their pricing was not well understood even by the experts on Wall Street.
- In retrospect, this seemed puzzling to many observers. How could Wall Street trade so much without knowing much? Was nontransparency of these markets a cover for shady deals in the background?
- Note, however, the valuation of jewelries in a pawn shop is not very transparent either...

Because this is what collateralized debt markets are about

- As Holmstrom notes, the Repo market is designed so that---thanks to the information insensitivity of debt---people don't need to know about the value of the underlying collateral.
- Since these markets economize on information, opaqueness could be one of their integral features.
- Thus, nontransparency does not necessarily reflect an anomaly. Moreover forcing these markets to become more transparent might generate unintended adverse consequences (see Holmstrom, 2015, for details).



Comparative statics of debt capacity/margins

- Think of the information insensitive region as $E[x]$ being at least a few standard deviations above D so default is unlikely.
- When this region is greater, all else equal (for a fixed $E[x]$) we can have higher D while still ensuring overcollateralization.
- This might be why safer collateral is associated with lower margins/haircuts.
- It also provides an explanation for the short horizon of Repo/collateralized debt: Collateral is less risky over shorter horizons!

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Crisis: Collateralized debt becomes information sensitive

- What happens if there is a severe shock that reduces the expected value of collateral, $E[x]$, into the information sensitive region?
- This is the Holmstrom and Gorton view of the crisis. Nontransparency of the collateral makes sense in normal times and facilitates liquidity (trade). However, once the collateral becomes information sensitive, nontransparency exacerbates the crisis.
- The liquidity in short-term debt markets rely on overcollateralization as opposed to information and price discovery about the underlying collateral (which is very costly).
- In a crisis, investors are forced to discover information but in a market that was not designed for this purpose (read Holmstrom (2015) for a nice contrast with equity markets---which do facilitate information discovery).

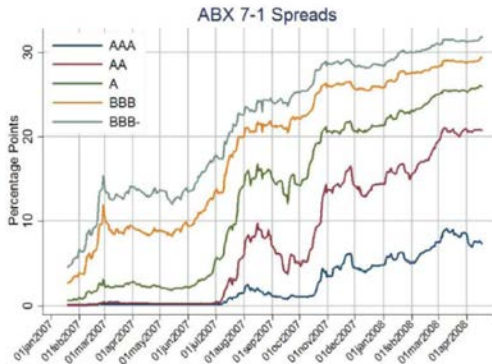


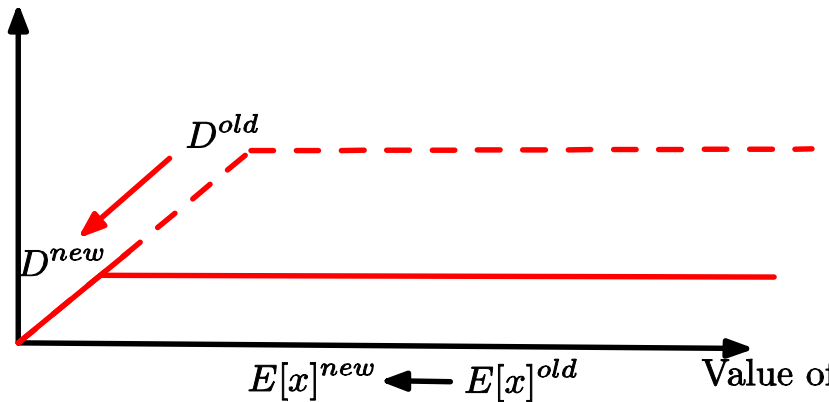
Figure: From Brunnermeier (2009).

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Crisis: Collateralized debt becomes information sensitive

- Start of the crisis: Markets recognize risks in MBS. Valuations fall, but more importantly **they become more uncertain (both figures)**.
- We are suddenly worried about the value of old jewelries, but in an environment that was “designed” to obviate price discovery.
- What would happen to debt capacities?

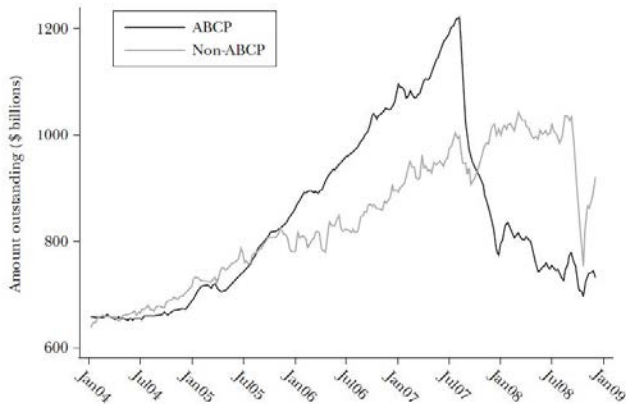
Payoff, $s(x)$



And std (risk) increases

Figure 2

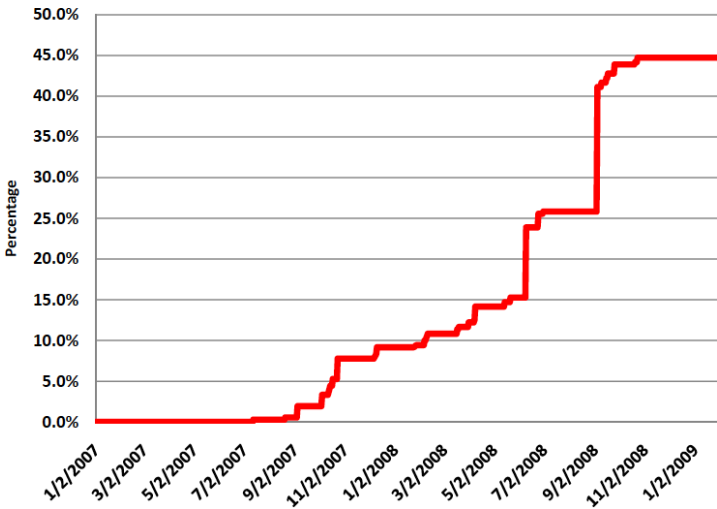
Outstanding Asset-Backed Commercial Paper (ABCP) and Unsecured Commercial Paper



Source: Federal Reserve Board.

Courtesy of Markus K. Brunnermeier. Used with permission.

Average Repo Haircut on Structured Debt



Source: Gorton and Metrick (2009a).

Courtesy of Gary Gorton. Used with permission.

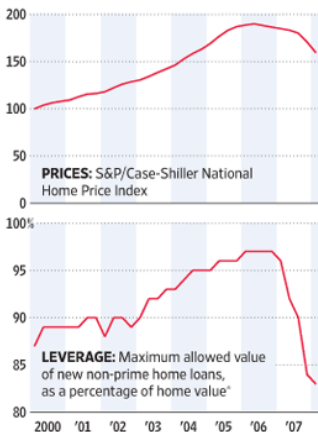
Crisis: “Run” on collateralized debt due to uncertainty

- Consistent with theory, Fs started to run riskier forms of collateral (as opposed to specific institutions, as in DD) starting mid-2007.
- In fact, we had seen another person who made the same point using slightly different language. Do you remember who he/she was?

The Leverage Cycle

Prices of things like houses and bonds tend to rise when banks make it easy to buy them with borrowed money and fall when banks make it harder—a phenomenon Yale economist John Geanakoplos calls the leverage cycle. These charts show the relationship between leverage—the amount of money investors borrow to buy assets—and prices in the U.S. markets for houses and mortgage bonds.

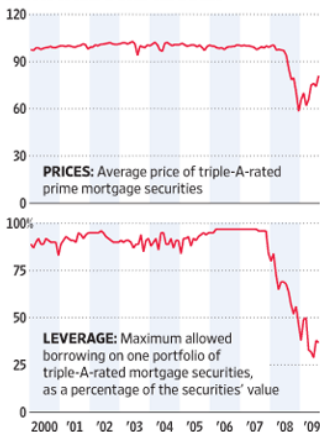
HOUSING MARKET



*Estimate

Sources: Standard & Poor's Financial Services; First American CoreLogic; John Geanakoplos

MORTGAGE-BOND MARKET



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Leverage cycle: Run on collateralized debt due to bad news

- The bottom panels illustrate a measure of $\bar{\rho}$ (pledgeability in the earlier lecture, or debt capacity in this lecture) for different assets.
- Leverage ratios seem procyclical in the sense that they are high in good times (high prices) but low in bad times (low prices).
- Geanakoplos (2009), “The Leverage Cycle” proposed a theory of procyclical leverage based on changes in uncertainty.
- Bad times \implies Uncertainty \implies Nervous lenders \implies Less leverage \implies Amplification....
- Geanakoplos is essentially saying something very similar to Gorton-Holmstrom!
- (But he doesn't explain why there are debt contracts to begin with).

Applying the theories of runs

So we now have two theories of runs:

- DD: Run on specific institutions with unsecured short-term debt.
 - To lesser extent, run also on the secured debt, e.g., Repo, if there are worries about collateral being seized in bankruptcy.
- Holmstrom-Gorton-Geanakopos (HGG): Run on uncertain collateral.
- The first run is quite sudden, the second run unfolds more gradually.
- Let's try to apply them in the context of the failure of Bear Stearns...

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Revisiting the run(s) on Bear Stearns

- By mid-2007, broker dealers such as Bear heavily on Repo financing.
- Bear had the weakest liquidity buffers among all such dealers...

- From the HBS case (Exhibit 2, Bear's balance sheet).
- Data on Q1-2008, 2007, 2006, 2005, 2004 (\$million).

Exhibit 2 from "The Tip of the Iceberg: JP Morgan Chase and Bear Stearns" removed due to copyright restrictions. Please visit <http://www.hbs.edu/faculty/Pages/item.aspx?num=36849>.

Exhibit 7 from "The Tip of the Iceberg: JP Morgan Chase and Bear Stearns" removed due to copyright restrictions. Please visit <http://www.hbs.edu/faculty/Pages/item.aspx?num=36849>.

- By the end of 2007–early 2008, the run on Repo (for riskier assets) had already started and gradually tightened liquidity at these institutions.
- Bear was the most exposed to this run, as the above table illustrates.
- Combined with realized losses, this pushed Bear to the edge...

Exhibit 5 from "The Tip of the Iceberg: JP Morgan Chase and Bear Stearns" removed due to copyright restrictions. Please visit <http://www.hbs.edu/faculty/Pages/item.aspx?num=36849>.

Exhibit 6 from "The Tip of the Iceberg: JP Morgan Chase and Bear Stearns" removed due to copyright restrictions. Please visit <http://www.hbs.edu/faculty/Pages/item.aspx?num=36849>.

Sophisticated lenders had already run

- Some money market funds like the Reserve Primary Fund continued to lend to Bear against riskier forms of collateral.
- (This fund later “broke the buck” and induced another layer of panic)
- But the more sophisticated lenders like Goldman had already stopped lending to Bear against riskier forms of collateral.
- Probably because they knew Bear was facing serious risks.
- This suggests that (somewhat different than in our model) the riskiness of the borrower also plays a role in practice.
- Imagine collateral + borrower reputation providing joint protection.

- The case study on Bear Stearns and JP Morgan Chase on your reading list describes the events that lead to the Bear's failure in March 2008.
- The final days (March 10-14) have all the fingerprints of a DD-type bank run. Financiers (such as hedge funds that receive brokerage services from Bear) start to question Bear's financial health and withdraw their money, which further exacerbates Bear's financial difficulties.
- Interestingly, some Repo financiers also pulled out partly because there were concerns that Repo collateral can be frozen in bankruptcy courts.
- So concerns about bankruptcy courts' dealing with collateral can make Repo loans (temporarily) similar to an unsecured loan.

- Bear Stearns' stock traded around \$140 per share in July 2007.
- The price fell to around \$80 per share by February 2008.
- The price was around \$60 per share on March 11, 2008. It fell to almost zero by March 14. This sudden drop is further indicative of a DD-type run.
- On March 16, Bear Stearns was purchased by JP Morgan Chase, but only after the Fed agreed to backstop losses from the assets on Bear's securities portfolio. So the government had to step in to mitigate the panic (as it is usually the case with runs).
- The initial offer by JP Morgan Chase was around \$2 per share. The offer was later raised to \$10 per share (to avoid litigation by Bear shareholders).

Lessons from the run(s) on Bear Stearns

- My view: HGG mechanism was important to push Bear Stearns to the cliff, creating the conditions that are ripe for a DD type panic.
- (Recall that panics in practice typically happen in bad times.)
- The DD type panic in turn did the final blow and pushed over the cliff.
- So it seems that the two run mechanisms combined to create damage.

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