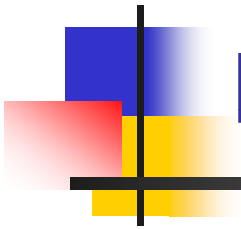

Fear of fire sales and credit freezes

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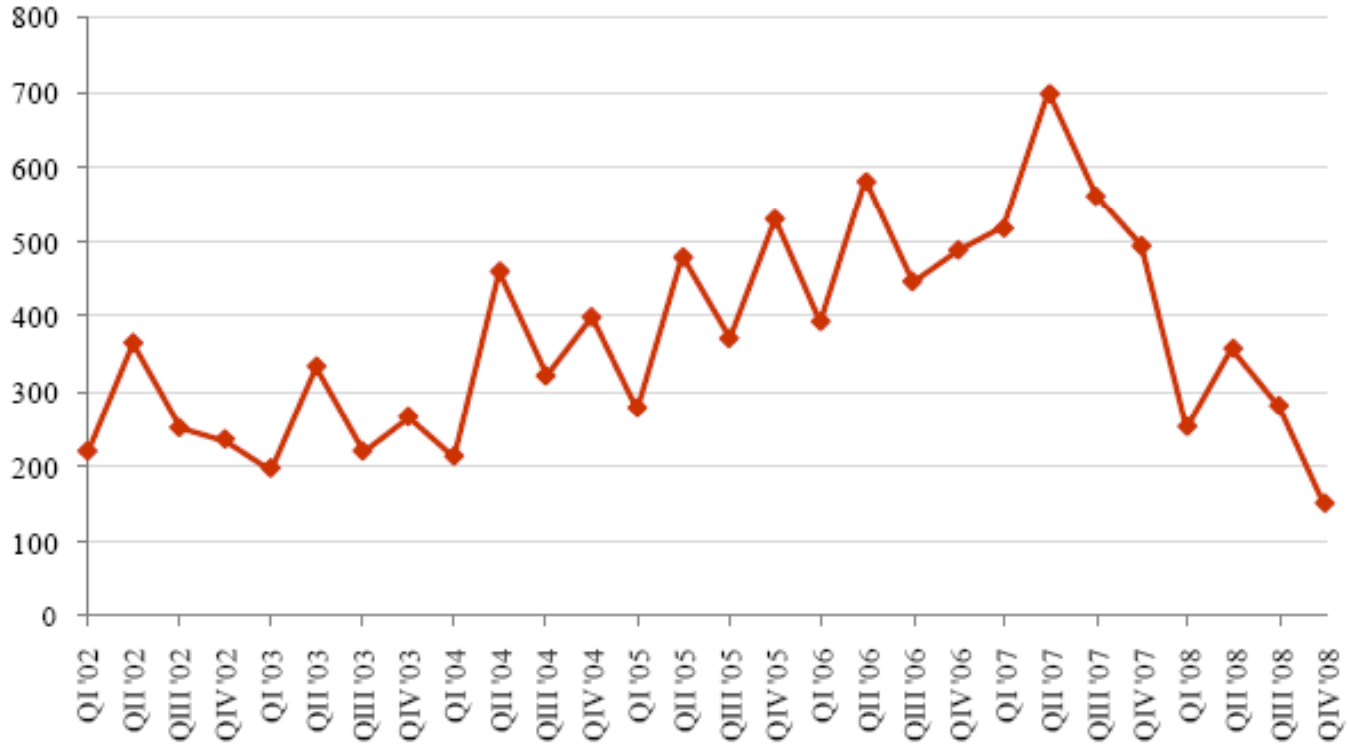
Motivation

- In the ongoing credit crisis arguments that
  - Liquidity has dried up for certain categories of assets such as sub-prime mortgage backed securities
  - Bankers allege a “buyers” strike.
    - Is there not a price at which the market will clear?
  - Term borrowing also seems to be difficult for all, even loans from well capitalized liquid entities appear scarce
- Are the two phenomena related?
- How can the securities and credit markets be unfrozen?

Figure 1: Total Loan Issuance, US Corporate Loans

Compiled from DealScan database of loan originations.

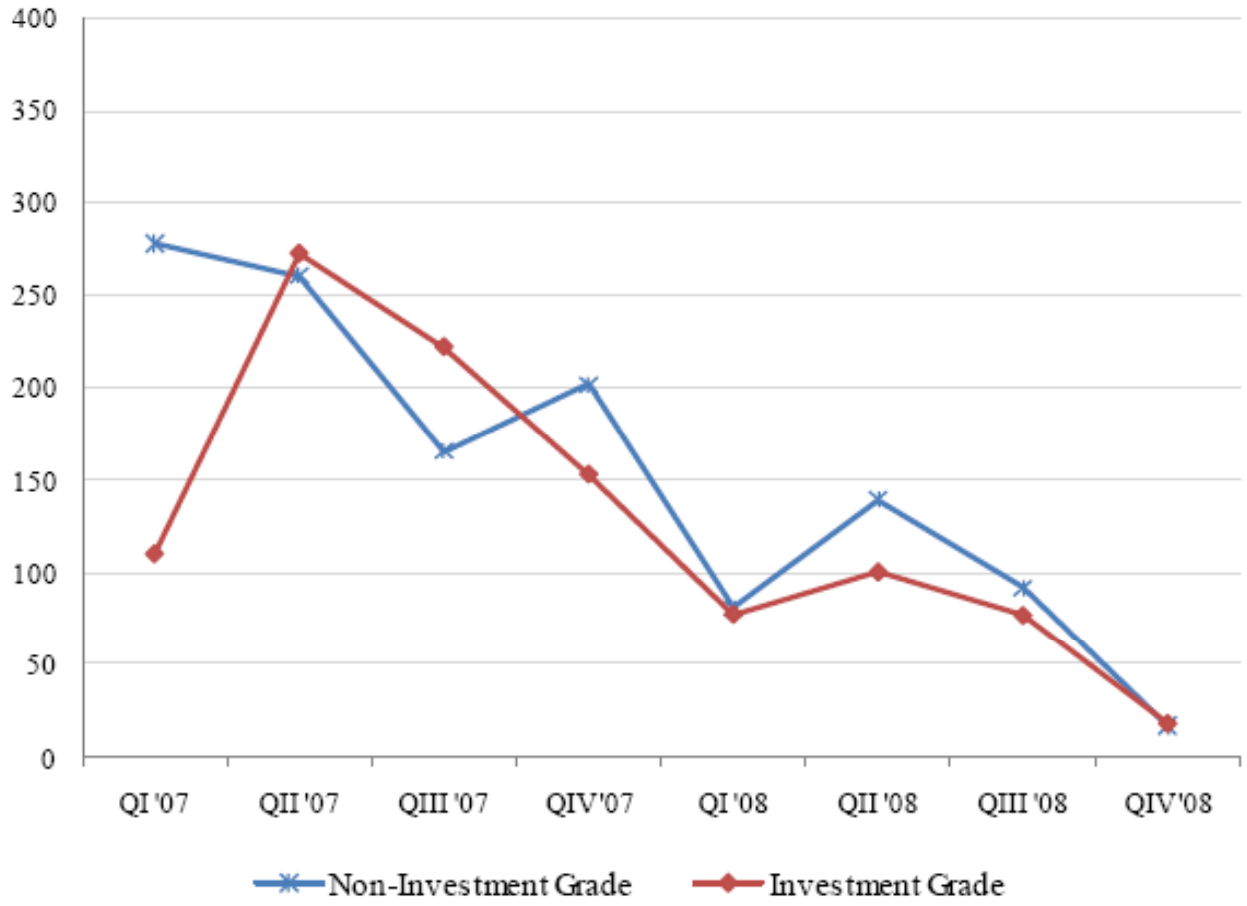
Panel A: Total amount of loans issued (Billion USD)



Source: Ivashina and Scharfstein (2009)

Figure 3: Total Loan Issuance, by Corporate Rating (Billion USD)

Compiled from DealScan database of loan originations. This figure is based on a sub-sample of loans for which credit ratings are available.



Source: Ivashina and Scharfstein (2009)

Simple model -- intuition

- Suppose a group of banks hold assets that have a limited set of buyers
  - Sub-prime mortgage backed securities
  - No information asymmetries with potential buyers
- Let the banks face some probability of a future demand for liquidity
  - Depositor/borrower needs
  - "Lehman" like event and panic
- Illiquid assets will have to be sold at fire sale prices
  - Illiquidity may lead to bank insolvency, runs, and further illiquidity

Intuition -- continued

- Anticipated future illiquidity implies extremely high future returns for potential buyers from having cash.
- Folding back to today
  - Discount on illiquid security today
  - High interest rate required of term loan
- What of securities trading? If high probability of failing conditional on illiquidity, bank will not sell.
  - By selling today, bank raises cash, which bolsters value of deposits, at the expense of equity.
  - Better to hold on – conditional on bank surviving, equity has a lot of value.
  - Price banker wants for securities includes a put option, and is higher than price arm's length investors are willing to pay
  - "Seller's" strike
- Trading and credit freeze because of anticipated fire sales

Basic model

- 3 dates, 0, 1, and 2
- Identical banks own financial assets that pay out Z at date 2.
- Banks financed with demand deposits of face value D
  - Depositors can demand money back at any date
- Local monopoly over deposits so depositors stay in so long as expected return is at least 0.

Liquidity shock at date 1

- With probability q, fraction f of depositors withdraw on date 1.
- Bank can sell assets for P_t per dollar of face value at date t =0 or t=1 to limited set of potential buyers.
- If bank's assets fall below liabilities, bank is run and has to liquidate everything.

Bid price

- Expected returns if security bought at date 1 should equal returns if bought at date 0 so

$$\frac{1}{P_0}Z = q\frac{1}{P_1}Z + (1-q)Z$$

- Therefore

$$P_0^{bid} = \frac{1}{q\frac{1}{P_1} + (1-q)}$$

When will the bank sell? Assume bank not insolvent at date 1

- Selling at date 0
  - It can get a better price than selling conditional on liquidity shock.
  - But it has to sell unconditionally.
  - Cost: $(\frac{1}{P_0}-1)fD$
- Selling at date 1
  - It sells only contingent on the liquidity shock and not otherwise. But at a lower price.
  - Cost: $qfD(\frac{1}{P_1}-1)$
- Equating

$$P_0^{Ask} = \frac{1}{q\frac{1}{P_1}+(1-q)}$$

$$= P_0^{Bid}$$

So if illiquidity is not a reason for a trading freeze, what is?

- Suppose conditional on the liquidity shock, the bank is insolvent if it has not sold at date 0.
- The bank has the option to walk away if it cannot make payments to debt.
- This gives it greater value selling at date 1 than selling at date 0 if the prices were the same as earlier.
- This means $P_0^{Ask} > P_0^{Bid}$
- NO TRADE!

Intuition

- By selling at date 0, bank gives up put option. Hence wants higher price to sell.
- Put differently, banks maximize value conditional on survival, hence better to hold on to illiquid assets
  - States in which bank survives are also states in which illiquid assets recover full value
- If they could, banks would buy more of these illiquid assets at the price unlevered entities would sell at.
  - Doubling up strategy
- How is P_1 determined?

More detail on bank assets

- Let β of a bank's assets be the financial security and (1- β) be loans with face value Z maturing at date 2.
- Loans can be recalled by the bank. The liquidation value at date 1 is uniformly distributed between 0 and Z.
- Loans cannot be sold or liquidated at date 0.

More detail on buyers

- Liquid buyers (private equity, hedge funds, and liquid banks) can buy the financial asset at either date and start with θ in cash.
- These buyers can also make term loans (2 periods) or store cash.
- Available loans returning R or higher is $I(R)$, with $I(1) = \overline{I}$ and $I'(R) < 0$.

Time line

|----------|----------|

Date 0	Date 1	Date 2
Illiquid bank sells securities (or not). Liquid buyers buy securities, make loans, and hold cash.	Liquidity shock hits (or not) and depositors withdraw from banks. Banks decide loans they want to liquidate. Banks sell securities and buyers buy with cash.	Loans and securities pay off. Banker consumes proceeds after paying deposits. Buyers consume.

Arbitrage relationships

- If the date-0 expected return on buying securities at date 0 or 1 is $1/P_0$, this should also be the return on date 0 loans. So amount lent at date 0 is $I\left(1/P_0\right)$
- Since the return on securities sold at date 1 is $1/P_1$, the bank will recall loans with liquidation values greater than $P_1 Z$

Illiquidity and Pricing

- If $\theta - \bar{I} \geq fD$, there is no illiquidity and

  $$P_0 = P_1 = 1$$

- If $\theta - \bar{I} < fD$, the asset trades at a discount to face value.
- For the bank's date-1 need for cash to be met,

  $$(1-\beta)\frac{Z}{2}\left(1-\left(P_1\right)^2\right)+\left[\theta - I(\frac{1}{P_0})\right] = fD$$

  provided bank is solvent.

Illiquidity and insolvency

- Condition for insolvency

$$(1-\beta)P_1 Z.P_1 + (1-\beta)\frac{Z}{2}\left(1-(P_1)^2\right) + \beta P_1 Z \geq (1-f)DP_1 + fD$$

- As P_1 falls, more likely bank becomes insolvent => illiquidity leading to insolvency
- Bank will be run, leading to a further sale of assets, and a potential further fall in P_1 as well as date-0 lending.
- Date-0 trading will stop.
- May be insolvent at date 0 (September 2008?)

Some results

- $f, D \uparrow$ or $\theta \downarrow$ => $P_0, P_1 \downarrow$
- $q \uparrow$ => $P_0 \downarrow$ $P_1 \uparrow$

Proposition 2:

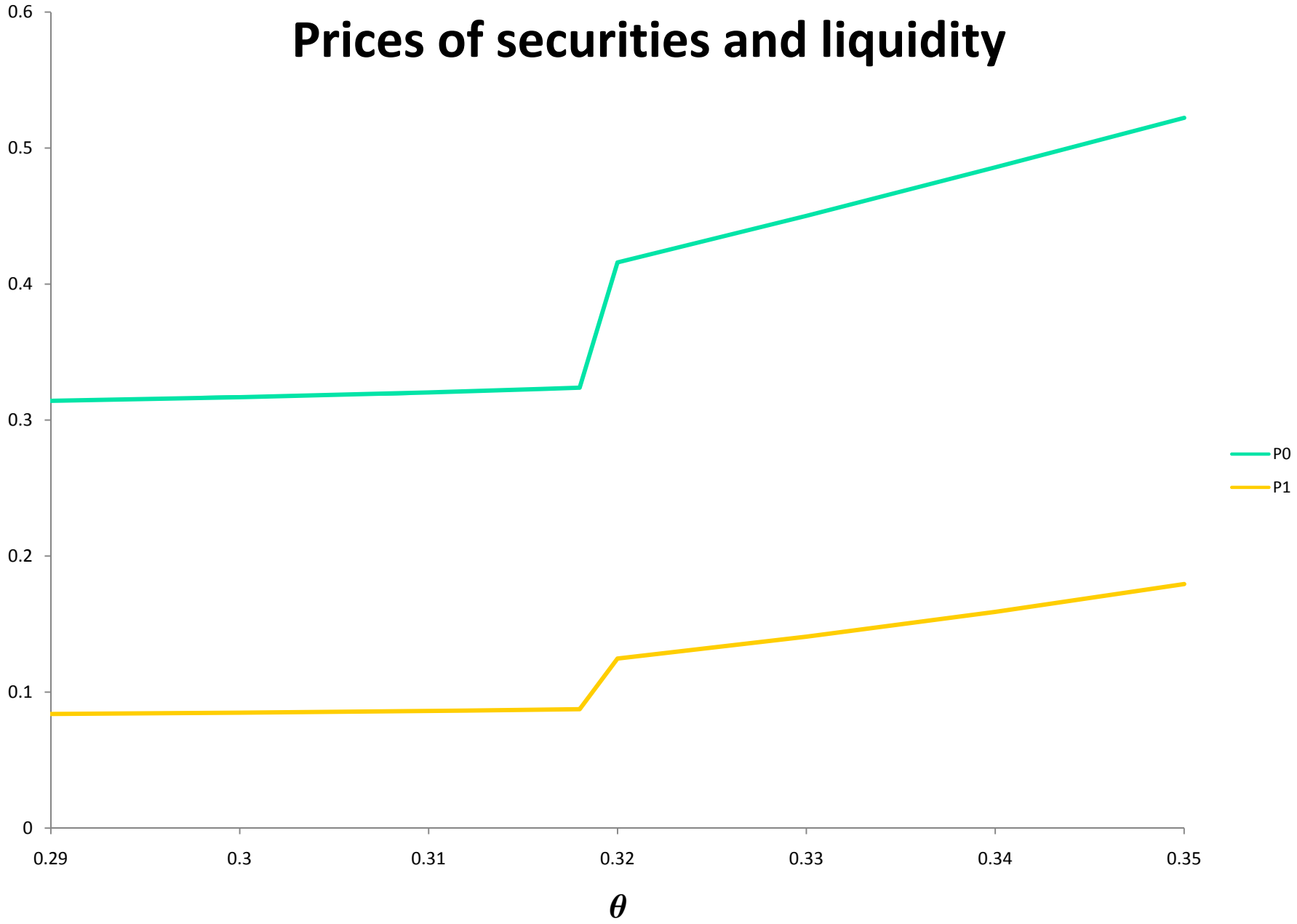
- Date 0 lending is decreased if there is an increase in:

-potential liquidity demand, *f*,

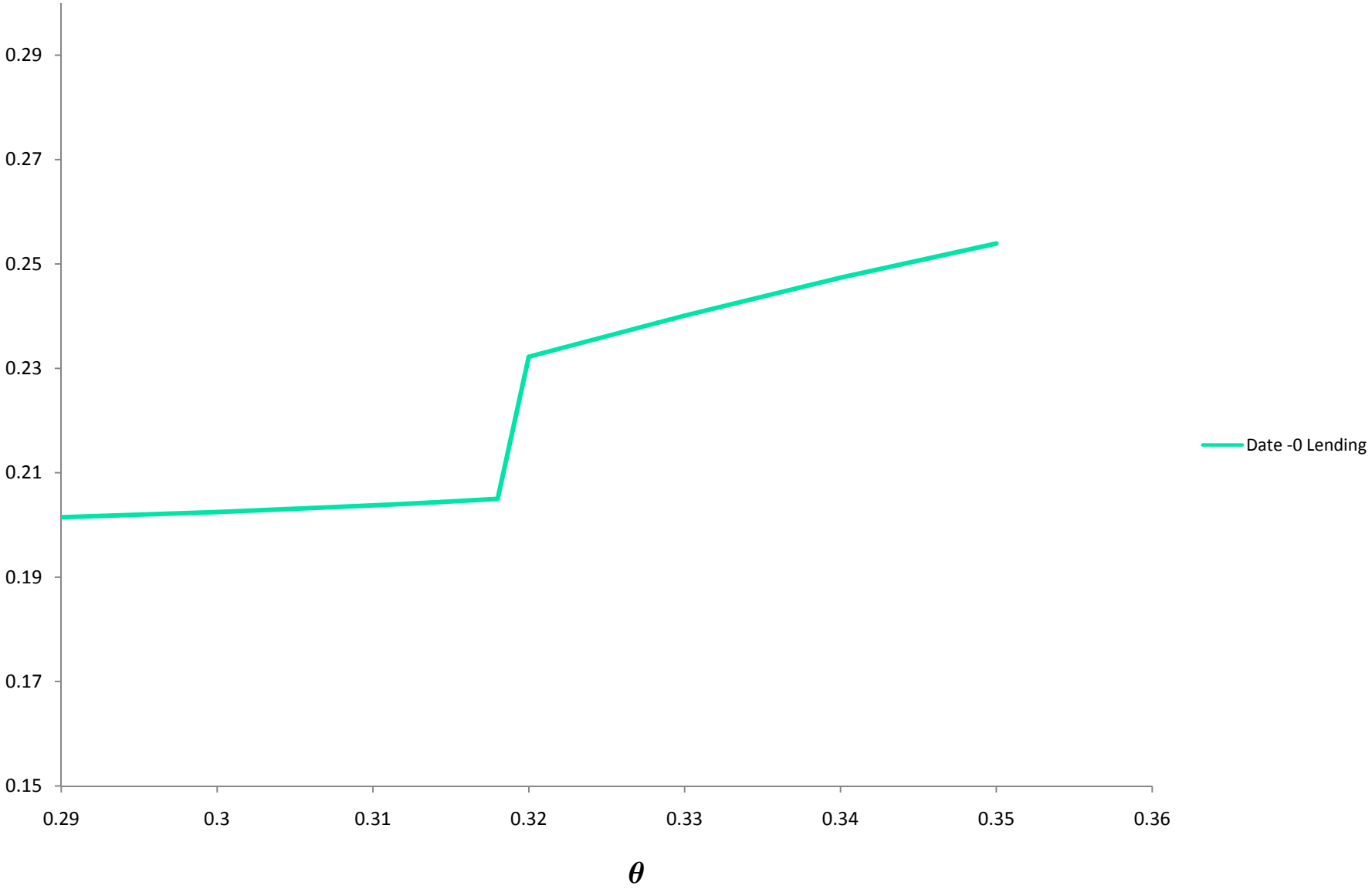
-the face value of bank debt, D, or

-the probability of the liquidity shock, q,

-as well as a *decrease* in the relative size of liquid entities, θ.


Prices of securities and liquidity
0.6
0.5
0.4
0.3
0.2
0.1
0
0.29
0.3
0.31
0.32
0.33
0.34
0.35
θ
P0
P1

Date -0 Lending



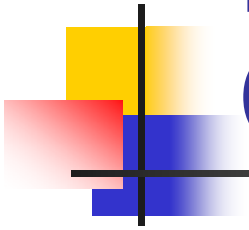
Key Assumptions

- Specialized knowledge rather than asymmetric information
  - Buying capacity
- Liquidity shock
  - Draw down by borrowers or by depositors
  - Panic a la Lehman => inability to roll over debt
- Local monopoly
  - Debt insensitive to interest rates and debt sensitive to bank health
    - Insured deposits/long term debt
    - Overnight borrowing, uninsured demand deposits, cash in brokerage accounts

Related Literature

- Shleifer and Vishny (1992,2009)
- Bolton, Santos, and Scheinkman (2008)
- Heider, Hoerova, and Holthausen (2009)
- Allen, Carletti, and Gale (2009)
- Allen and Gale (2004)
- Diamond and Rajan (2005)
- Acharya, Gale, and Yorulmazer (2009)

Effects of Interventions
(not enough detail to sign welfare)



- Close walking wounded
- Asset purchases with liquidity provided to buyers
- Direct liquidity infusion to banks
- Direct capital infusion

Close banks

- Close banks that are illiquid and near insolvent and likely to dump assets.
- Take securities into entity (RTC) that keeps them off market
- Remove possibility of future fire sale, thus increasing current lending
- Problems
  - How to allocate losses
  - Closing solvent banks

Asset purchases

- Buy assets at date 0 instead of date 1
- But at price buyers want to pay, banks do not want to sell.
  - Risk shifting incentive for buyers? Buyers default in same state.
  - Subsidy (difference in bid ask price)?
- Force asset sales? Supervisory strictures.
  - Will still need liquidity
- Pushing up liquidity in hands of buyers (raise θ) --PPIP.

Liquidity infusion to seller

- Promise to infuse liquidity as needed into banks
  - Limited expertise of government
- Should reduce likelihood of fire sales
- But amount of liquidity needed may be large (Lehman event)
- What if banks become insolvent?

Capital infusion

- Capital issuance
  - Forced?
- Subsidized capital
  - What about shadow financial system?
- Prevent insolvency and run
- Remove overhang of potentially insolvent banks, reduce potential fire sale returns, increase trading and lending.

Capital vs liquidity

- Illiquidity can cause insolvency and vice versa
- Combinations sometimes better than pure capital or pure liquidity infusions.

Final note

- Risky vs illiquid assets
- Suppose P_1 is low because of fundamentals rather than illiquidity
- Similar effect on trading, but no effect on date-0 lending (no future profit opportunities from hoarding cash).
- Liquidity infusion will have no effect.