Bank Runs

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General Topics of Lectures

- Banking panics
  - Brief review of theory
  - Some evidence
  - Evidence from free banking

Theory and Some Empirical Analysis

- Theory
  - Highly stylized
  - Try to draw implications for observations
    - Not like regressions
- Empirical Analysis
  - Compare runs to
    - General historical developments
    - Specific episodes

Bank Runs

- Why pay any attention to bank runs?
  - Literally “history”
- The underlying basis for banking regulation
  - Possibility of runs
  - Bad consequences of runs

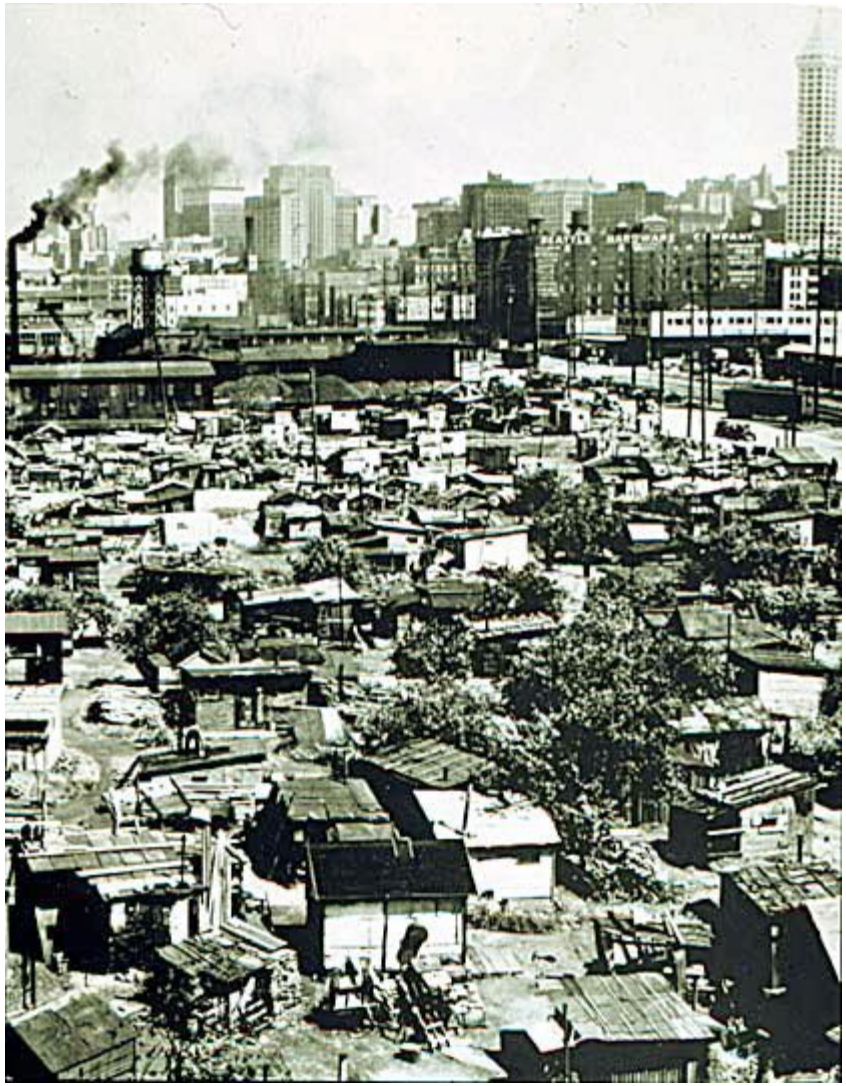
Images of Bank Runs

And Inside the Bank

Consequences for the Economy and People

- Mass unemployment
- Misery for many
  - For much of the 1930s

Hooverville



Banking Regulation

- Lender of last resort
  - Central bank
- Deposit insurance
- Prudential regulation
  - Prudence – caution or circumspection as to danger or risk (fourth of four definitions)
  - Why limit risk of banks?
    - Don’t limit risk of investment banks or mutual funs

What's Different About Banks?

- Banks make loans to many people in the economy
- Banks create money
  - Partly a matter of definition
- Banks have an important role in payment system

Why Are There Bank Runs?

- What is different about banks and mutual funds?
  - Banks have runs
  - Mutual funds have substantial withdrawals but there is little incentive to withdraw one's own funds just because others are withdrawing
- Banks accept "deposits" and guarantee to pay back the value of whatever is deposited
  - Banks do not mark their liabilities to market
    - Value of assets falls
      - Banks promise to pay same amount to holders of liabilities
      - Mutual funds do not
  - Banks have fractional reserves of what they promise to pay

Is A Run on One Bank Important?

- Not obvious why it should be
  - Withdraw funds from one bank
  - Deposit funds in another bank
- Important to shareholders in the bank being run
  - Want to be first

Run on Banking System

- Run on all, or almost all, banks simultaneously
- Withdraw reserves from banking system
- Multiple contraction of bank liabilities
  - Decrease in money supply
  - Can be associated with recession or depression
- Also called “banking panic” but need not be associated with unreasoning fear

Banking Panics and Crises

- Banking crisis and banking panic not the same thing

Banking Panic

- Run on all banks in a banking system simultaneously
- Withdrawal of reserves from banking system
- Multiple contraction of bank liabilities
- Examples
  - U.S. in 1857, 1861, …., 1907
  - U.K. in earlier years up to around 1844
  - Coincidence that end of runs coincides with
    - Creation of Federal Reserve?
    - Bank of England starting to act like a lender of last resort?

Banking Crisis

- Failure of a significant fraction of banks in the economy
  - Many alternative definitions but this is a common component
  - Examples
    - Finland in early 1990s
    - Asian banking systems in late 1990s
    - Argentina a few years ago
  - Generally not a run on banking system, although a banking panic can start

Theories of Banking Panics

- In literature in last half century
  - First is Friedman and Schwartz's *A Monetary History of the United States*
    - Characterize panics in terms of developments for money and economy
    - Informal theory
  - General equilibrium theories more recently
    - Relatively simple economies if want to call theories "general equilibrium theories"

Friedman and Schwartz on Banking Panics

- Use money multiplier to organize analysis

$$M = mH$$

- *M* is the nominal quantity of money
- *H* is the stock of high-powered money
  - Currency plus reserves (*C* + *R*)
- *m* is the money multiplier
- Banking panic involves shift from deposits to currency
- Reserves held by banks withdrawn from banking system to provide currency
- If *H* is not affected, then *m* and therefore *M* fall
- Historical analysis of events in each period

Friedman and Schwartz Evidence

- Banking panics associated with onset of recessions
- Banking panics associated with worse recessions
  - Expectation of worse recession affects probability of banking panic
  - Banking panic may worsen recession

More Formal Theories

- Four general classes of theories
  - Liquidity creation by banks
  - Asymmetric information
  - Regulatory Restriction
  - Medium of Exchange
- Allow for conjectures about results in some cases
  - Not all theories explicitly include the possibility of banking panics
  - Theories do all include, one way or another, the equilibrium result that banks will make an unconditional promise to pay par value on demand

Par Promise and Bank Runs

- There would be no bank runs if deposits were marked to market value
- Hence, theories include the result that deposits are not marked to market

Liquidity Creation by Banks

- Diamond and Dybvig (1983) paper and later developments
- Especially Jacklin (1987 and 1993)

Diamond and Dybvig (DD) Technology

- Three periods
  - Time 0, each agent receives one unit of a good
  - Two technologies
    - Hold good, neither depreciates or appreciates
    - Give unit of good to a firm that has the technology
      - At time 1, produces one unit
      - At time 2, produces $R>1$ units

DD Consumers

- Continuum of consumers who want to consume at either time 1 or 2
- Endowed with one unit of consumption good at time 0
- Consumers do not know probability of wanting to consumer early or late
  - Probability want to consume early is *p*
  - No aggregate uncertainty
    - Fraction of consumers who want to consume early is exactly *p*
- Consumers are risk averse
  - Coefficient of relative risk aversion greater than one

DD Equilibrium

- Firm promises to pay $R_1 > 1$ in time 1
- Firm promises to pay $R_2 > 1$ in time 2
  - $R_2 < R$ to be feasible
- Split the gains with some going to early consumers
- Contract written at time 0 when consumers don't know whether early consumers or not
  - Sell insurance against being an early consumer

DD Banking Panic Equilibrium

- Fraction of consumers withdrawing at time 1 equals the fraction of early consumers in equilibrium just discussed
- What if some late consumers decide to withdraw early?
  - Assume that bank cannot tell who is an early or late consumer
  - Reduces payout available to those at time 2
    - Can reduce payout to less than R_1, in which case all consumers withdraw

Banking Panic Equilibrium

- Why would some late consumers withdraw?
  - No particular reason
  - Sunspots
- Perfect foresight model
  - Foresee that some depositors will withdraw early
    - Hence all depositors will withdraw early
  - Do not make a deposit in bank because payout in banking panic less than one

Sequential Service Constraint in DD

- People who withdraw early get the promised payment of $R_1 > 1$
- Eventually, there is not enough left in bank to pay people more than one unit
  - Technology produces only one unit at time 1
- People who arrive late receive less than one unit
  - Sequential service because cannot go back and change payout to early withdrawals
- All of this is not modeled in the original Diamond and Dybvig paper

Different Strand of Elaboration

- Jacklin (1987 and 1993)
- What if permit an asset market?
- Trade claims to the underlying asset

Financial Markets

- Suppose add the possibility of a financial market
- Then the financial market dominates the banks in the Diamond and Dybvig model
- Financial market not subject to “banking panic” equilibrium
  - Market price of financial asset falls if too many people want to sell financial asset at time 1
  - Hence, people do not attempt to consume early unless they are early consumers

Financial Markets with Limited Participation

- Diamond (1997)
- The DD run partly retained if there is less than 100 percent participation in the financial market

Asymmetric Information

- Banks are “opaque” institutions - Often said
  - Definition opaque – hard to understand or explain
- Probably mean that the assets on banks’ balance sheets are not easily valued
  - For example, loans to individual agents
- Banks have a more precise estimate of their activities than do other agents

Asymmetric Information By Banks

- Those operating a bank have a better estimate of the value of the banks' assets than do others
  - "Others" includes depositors
  - Creates possibility of undervaluing assets if try to value assets at current market value
  - They will be undervalued in the typical three-period model

Development

- Literature
  - Jacklin and Battacharya (1988)
  - Chari and Jaganathan (1988)
  - Calomiris and Kahn (1991)
  - Allen and Gale (1998)
  - And others
- Introduce risk
  - State-dependent equilibrium

Opportunity Set Example

- Opportunity set
  - Two uses of endowment
    - Short term yielding one unit of consumption at time 1
    - Long term yielding greater than one unit of consumption at time 2
- Long term yield is stochastic
  - R_h with probability q
  - R_l with probability 1 - q

Equilibrium

- Consumers same as DD
- Equilibrium similar to DD but
  - Bank can be bankrupt if R_l occurs
  - People can run on bank at time 1 if they suspect that R_l is the actual return
  - Can have informed and uninformed depositors

Equilibrium and Runs

- Runs are a rational response to a bad state of the world in these models
  - Not a sunspot equilibrium as in Diamond and Dybvig
- The limited number of periods is likely to have big effects on equilibrium
  - Reputational equilibrium possible if infinite horizon

Asymmetric Information About Banks

- Some depositors are informed and others are not
  - Gorton and Pennachi (1990), Jacklin 1993

Legal Restrictions

- (Wallace, 1983)
- Legal restrictions prohibit other securities from playing the same role as deposits
  - Answer to “Why not use Treasury bills as money?”
  - Alternative answer due to White (1987)

Medium of Exchange and Payment

- Williamson (1992), Freeman (1996a, 1996b), Green (1997), and McAndrews and Roberds (1999) and others
- Papers not really sufficiently developed to show that financial intermediaries will promise to pay value
- Papers point toward sufficient conditions that are likely to be necessary to have this implication when inside money is created for exchange and payment
- Papers suggest that the use of bank liabilities as a medium of exchange is an important characteristic which sometimes is associated with bank liabilities promising to pay par

Bank Liabilities as a Medium of Exchange

- Recent literature based on payments system
- Par value promised on demand is sometimes derived, sometime assumed
  - Williamson (1992), Freeman (1996a, 1996b), Green (1997), and McAndrews and Roberds (1999)
- Literature focuses on settlement process
  - Debt may be preferable to settle transactions to avoid possibility of price changes

Medium of Exchange and Payment

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Medium of Exchange and Payment One of Setups

- Freeman (1996) and Green (1997)
- Structure of trade among agents requires debt outstanding within the period
- Efficiency requires that the market value of this debt be at face value
  - Otherwise agents subject to uncertainty concerning whether they will be faced with a transaction in which they receive less than face value
  - Depends partly on parameters of the model

Summary Discussion of Theories

- Friedman and Schwartz
- Liquidity creation by banks
- Asymmetric information
- Regulatory Restriction
- Medium of Exchange

General Question

- What can we learn by looking at historical banking?
  - Stylized facts
    - Generality of a theory
  - Counterexamples
- Look at promises to pay par on demand
  - Not discussions of banking panics because solid evidence is sparse

Predictions of Theories

- Liquidity creation
  - Payment at par is promised even though banks hold assets that are illiquid in the short run
- Asymmetric information
  - Payment at par is promised if banks' assets are not marketable
  - Really question of information available to depositors
- Legal restrictions
  - Payment at par is promised if banks are required to do so
- Medium of exchange and payment
  - Payment at par is promised if bank liabilities are used in exchange

Strong Versions of Theories

- Liquidity creation
  - Payment at par is not promised unless banks hold assets that are illiquid in the short run
- Asymmetric information
  - Payment at par is not promised unless banks' assets are nonmarketable
- Legal restrictions
  - Payment at par is not promised unless banks are required to do so
- Medium of exchange and payment
  - Payment at par is not promised unless bank liabilities are used in exchange

What Is A Bank?

- Definition of “bank” and “banking”
- A bank is a firm that
  - Accepts “deposits” of assets and issues liabilities in exchange that can be transferred from one person to another
  - Redeems these liabilities on demand while holding fractional reserves of the assets deposited

Summaries of Banking Histories

- Athens, Fourth Century B.C.
- Medieval Italy
- Japan
- United States
- Discussions based on secondary literature

Athens, Fourth Century B.C.

- Evidence based on surviving court cases and speeches
  - Cohen (1992); Millett (1984, 1991)
- Firms accepted deposits of funds and assets
  - Originally moneychangers
  - Demand and time deposits
  - Ownership of funds or assets transferred by going to bankers' tables
  - Made maritime loans
    - Quite illiquid and risky supported by non-earmarked deposits
  - Fractional reserves
    - Some historians are sure; some are indifferent

Payment and Legal Restrictions in Athens

- Evidence indicates that payment at less than par was considered default
- No evidence for a legal requirement

Implications of Athens for Theories

- Liquidity creation
  - Consistent
- Asymmetric information
  - Consistent
- Legal restrictions
  - Inconsistent with strong version
- Medium of exchange
  - Consistent, but only at bank

Medieval Italy

- Hiatus after fall of Roman Empire
  - 500 to 900 A.D.
  - Evidence from twelfth to fifteenth century
- Private firms in cities throughout Italy
  - Originally moneychangers
- Evidence based on firms' records

Banking in Medieval Italy

- As early as 1100 A.D., banks accepted deposits of funds and assets payable on demand
  - Not always required by law to pay on demand
  - Accepted deposits that could be redeemed only with notice, e.g. fifteen days
- Transferred funds at the bankers' tables
- Loans often even international
- Fractional reserves indicated by failures to pay and concerns about it

Implications of Medieval Italy for Theories

- Liquidity creation
  - Consistent
- Asymmetric information
  - Consistent
- Legal restrictions
  - Inconsistent with strong version
- Medium of exchange
  - Consistent, but only at bank

Tokugawa Japan

- Japan in the 1600s
  - Observations possibly more independent than Italy and Athens
- Japan had a developed financial system by the late 1600s

Banking in Tokugawa Japan

- Crawcour (1961), Tamaki (1995)
- Banks evolved from
  - Moneychangers
  - Wholesale agents and financial agents
    - Made loans to their own enterprises
- Accepted deposits of funds and their receipts passed from hand to hand
  - Recourse to depositor if insufficient funds
  - Recourse to bank if due to bank's difficulties
- Not clear if bank or depositor promised to pay par in gold or silver
  - Authors take it for granted

Implications of Tokugawa Japan for Theories

- Liquidity creation
  - Consistent
- Asymmetric information
  - Consistent
- Legal restrictions
  - Inconsistent with strong version
- Medium of exchange
  - Consistent

Free Banking in the United States

- Free banking – 1850s and 1860s in U.S.
  - Banks issued notes, held state bonds and made loans
    - State bonds were backing for notes
    - Bonds were traded on NYSE
  - Fractional reserves
    - Balance sheets available
  - Legally required to pay par value on notes

Implications of Free Banking for Theories

- Liquidity creation
  - Consistent
- Asymmetric information
  - Not obviously consistent with strong version
- Legal restrictions
  - Consistent
- Medium of exchange
  - Consistent

Money Market Funds in Twentieth Century U.S.

- Not legally required to pay par on demand
  - They do in fact
  - Bear costs to do so
    - Smoothing of interest rate paid relative to market
    - Predictable runoffs of “investments”

Money Market Funds in Twentieth Century U.S.

- Hold marketable short-term securities
  - Some hold U.S. Treasury obligations only
- Can write checks against account in large enough value

Implications of Money Market Funds for Theories

- Liquidity creation
  - Inconsistent with strong version
- Asymmetric information
  - Inconsistent with strong version
- Legal restrictions
  - Inconsistent with strong version
- Medium of exchange
  - Consistent (kind of)

How Do the Theories Fare As Stylized Facts?

- Stylized facts
  - Liquidity creation generally consistent
  - Asymmetric information generally consistent
  - Legal requirement uncommon in these episodes
  - Medium of exchange generally consistent

How Do the Strong Versions of the Theories Fare?

- Liquidity creation inconsistent with money market funds
- Asymmetric information inconsistent with free banking and money market funds
- Legal requirement inconsistent with these episodes except free banking in the U.S.
- Medium of exchange consistent with these episodes except possible money market funds

Table 1
Summary of Evidence

Time and Area	Characteristic						
	Pay Par on Demand	Fractional Reserves	Assets Not Liquid on Demand	Asymmetric Information	Legal Restriction	Negotiable	Medium of Exchange Away From Bank
Ancient Greece	Yes	Yes	Yes	Yes	No	No	No
Medieval Italy	Yes	Yes	Yes	Yes	No	No	No
Tokugawa Japan	Yes	Yes	Yes	Yes	No	Yes	Yes
U.S. Free Banking	Yes	Yes	No	No	Yes	Yes	Yes
U.S. Money Market Funds	Yes	Yes	No	No	No	No	Yes

This table summarizes the characteristics of banking in the times and places examined. The theories are attempting to explain why the banks paid par on demand while holding fractional reserves; hence they are necessary for the episodes to be informative about the theories. Negotiability - which means that the order to pay can be transferred to another - is a characteristic of notes that can be exchanged or of bills of exchange, but not of checks as used in the United States today. "Asymmetric information" is a theoretical term based on what agents know, but is used as a summary column title to denote assets that do not have prices readily available on a reasonably continuous basis. "Legal restriction" summaries whether the institutions were required by statutory law to redeem some deposits on demand at par.

Conclusion

- None of the theories is consistent with all of the observations
- All of the theories can explain one or more observations
- At least one of the theories explains each observation, with the possible exception of money market funds
- Interestingly, the most recent observation is explained least well