The role of banking

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What is role of banking

Many theories. Most fall into two main categories

1. Delegated monitoring or screening (information production).Banks are cheaper, more effective than secondary markets at overcoming information and incentive problems between investors and firms (or individual borrowers).
2. Consumption smoothing or liquidity provision. Banks are cheaper, more effective than secondary markets at providing insurance to individuals and firms against idiosyncratic shocks to consumption or production or other needs for cash.

Delegated Monitoring

Diamond(1984) and Williamon (1986) model banks as efficient ways to overcome moral hazard by borrowers.

- Specifically, when savers (investors) lend to borrowing firms, the firms can lie about whether or not the investment pays off.
- Investors can overcome this problem by costly monitoring. If multiple investors are needed to fund a given project, this leads to costly duplication.
- By delegating the task to a third-party monitor, costs savings are possible (the monitor only models each borrowing firm once).
- Problem: how to make sure delegated monitor does his/her job? If investors have to monitor the monitor, where are the cost savings?

Delegated Monitoring (cont.)

- **Key Insight**: have delegated monitor take money from many investors, lend it to many borrowers, promise to repay investors fixed amount (debt/deposit).
  - Diversification means that, if delegated monitor (bank) does its job, it will be unlikely to fail, so expected monitoring costs for investors are small.
  - And it is in banks interest to do its job so that it can collect from borrowers, pay off investors, and keep profits.

Delegated Screening or Information Production

This differs from Diamond and Williamsons work by assuming that the issue is one of ex ante selection rather than ex post moral hazard:

- Potential borrowers may know something about their projects type (adverse selection), or projects may have innate type no one knows initially.
- Investors can discover project type at a cost. Once again, if need multiple investors to fund one project, get costly duplication.
- Once again, solution is to form a bank that takes money from investors, invests in projects after screening project type.
  - Bank gives investors debt claim.
  - Debt claim gives bank incentive to exert ex ante screening effort; otherwise, it gets nothing as residual (equity) claimant.

Delegated Screening or Information Production

Several variations on this theme.

- Leland and Pyle (1977) mention it in passing (discussion tacked on to model of adverse selection between firm and direct investors).
- Campbell and Kracaw (1980) model it more directly, but dont have diversification effects or ex post uncertainty.
- Boyd and Prescott (1986) include uncertainty that can be diversified; also, all agents have potential to be either investors, evaluators (screeners), or borrowers. Using cooperative game theory, they find solution that looks like banks (some agents are depositors, others are bankers who evaluate projects, etc.).

Consumption Smoothing I

Here, the idea is that individuals face shocks to consumption preferences (early versus late), but potential investments are either illiquid (difficult/impossible to sell early) or storageand illiquid investments pay more. Diamond and Dybvig (1983) is the seminal paper in this area.

- If individuals try to self-insure against these shocks, they have to hold a lot of low-return liquid storage asset.
- But if individuals pool (deposit) their funds in a bank, it can invest less in storage asset, more in high-return illiquid asset, achieving better outcomes.
- Problem: what if one depositor claims to have consumption need when he/she does not?
  - This may not make sense if no one else does it (get higher return to waiting).
  - But, if think many others will do it, it becomes a dominant individual strategy.

Consumption Smoothing II

  - This leads to everyone withdrawing early (bank run), which wipes out gains to investing in illiquid assets.
- Various potential solutions; deposit insurance is one, as well see.
- Other authors (whom we will look at) argue that bank runs are not necessarily bad equilibria, may be necessary. Structure of model, assumptions plays a big role.
- Bigger problem: these consumption-smoothing banks invest in real assets, not financial claims, and pay out consumption goods, not money!

Liquidity Provision I

- Models of liquidity provision explicitly model banks as holders and issuers of financial claims (such as loans and deposits).
- Here, the key is giving customers access to cash on short notice at low cost. While securities markets could do this in theory, this is typically limited by problems of asymmetric information (see Market Microstructure Theory) and moral hazard (see Corporate Finance Theory).
- Models of banks as liquidity providers usually focus on overcoming one of these two frictions.

Liquidity Provision and Asymmetric Information.

- Here, the seminal paper is Gorton and Pennacchi (1990).
- They note that some traders in financial markets (informed traders) have better information than others (uninformed traders).
- This is a problem if the uninformed have a sudden need for funds (liquidity needs)liquidating part of their portfolio may involve high transaction costs as dealers try to protect themselves from being picked off by informed traders.
- Solution: form a bank.
  - Uninformed become depositors, informed become shareholders in bank.
  - Bank diversifies across assets. This dilutes impact of informed traders information.
  - And since deposits are debt, they are safer, less affected by insider information about individual borrowers situation anyway.

Liquidity Provision and Moral Hazard I

- Here, the seminal paper is Holmstrm and Tirole (1998).
- They focus on firms need for sudden liquidity, perhaps to take advantage of unexpected investment opportunities, etc.
- Here, if the firm tries to issue securities, investors may be concerned about moral hazard on the part of the firms manager. This limits the firms ability to issue securities, either before or after the liquidity shock.

Liquidity Provision and Moral Hazard II

- Solutions
  - Form banks, which fund firms ex ante and also offer them credit linesessentially, liquidity insurance.
  - Firms pay a fee for their lines, but if they have liquidity needs they draw down the necessary amount. As long as there is no systematic liquidity risk, this achieves the first-best.
  - If there is systematic risk, banks cant diversify that away, and some moral hazard and loss relative to first-best remains.
  - In this case, the government may be able to improve outcomes because it can spread risk intertemporally (lump sum tax in future to cover systematically high liquidity needs now). (CARES Act, anyone?)

Diamond (1984):Key Assumptions

- Each borrower is risk-neutral, has no funds. Each borrower owns a firm that requires funds (one unit total) from m risk-neutral investors
- Firm returns are independently, identically distributed
- Investors have access to two technologies for enforcing contracts:
  - Jointly inflict costless non-pecuniary punishment on borrower. Size of punishment can be function of actual payment received from borrower.
  - Monitor at cost K ex ante. Monitoring lets investor see actual returns

Direct Contracting

- Optimal incentive compatible contract relying on punishment looks like debt with pecuniary penalties equal to shortfall from promised payment h.
  - Incentive compatibility requires that borrower be indifferent between reporting true return and one with smaller required payment.
  - Setting penalty equal to shortfall from max payment minimizes punishment.
  - And debt (investors gets everything or h, whichever is smaller) minimizes expected shortfalls from max payment.
- Optimal contract where all investors monitor is unspecified, but leads to total cost mK, which may be infeasible.
- So either have non-pecuniary punishment (deadweight loss) or duplicated monitoring costs.

Delegation via bank

- Have agent (bank) collect funds from mN investors, lend money to N borrowers.
- Bank monitors each borrower, writes some (unspecified!) contract with each, collects expected amount $R + K + D_N$, where $R/m =$ required return per investor and $D_N > 0$ is some exogenous margin.
- Bank gives investors (depositors) debt claim, total face value $N(R + D_N/2)$; if bank fails to repay, it is punished as above.
- **Main result**: as N becomes large, law of large numbers guarantees bank fails with vanishing probability, and D_N can be made arbitrarily small.
- Thus, diversification allows implementation of delegated monitoring; depositors maintain incentives via punishment w/vanishing probability.

Extensions

For our purposes, main extension has to do with assumption that returns are independent. Diamond shows that if firm returns have observable systematic risk, the main result goes through: either

- Bank uses futures or other derivatives to hedge this risk, diversifies away rest, gives investors debt (deposit) contracts, or
- If appropriate derivatives do not exist, bank gives investors contractual payments that include systematic risk but not diversifiable risk. Essentially, the debt rate is indexed to the observable risk factors.

Summary and Comments

- The paper shows that delegated monitoring can motivate bank to diversify over many firms as an incentive device. Bank issues debt to many depositors, has small chance of failure.
- However, this is more a proof of concept paper than a fully specified equilibrium model. A number of key issues are left unspecified:
  - What is the nature of the contract between the bank and its borrowers?
  - What determines the banks profit margin?
  - What happens when move from partial to general equilibrium?
- Williamson (JME, 1986) addresses all of these issues.

Diamond-Dybvig (1983)

- Three dates $t \in \{0, 1, 2\}$ and a single consumption good (dollar)
- Measure one of the ex-ante identical consumers with a unit endowment at date 0. Consume either at date 1 or 2.
- Liquidity shocks: Preference:

$$u(c_1, c_2) = \begin{cases} u(c_1) \text{ with prob.} \lambda \text{ if impatient} \\ u(c_1 + c_2) \text{ with prob.} 1 - \lambda \text{ if patient} \end{cases} \tag{1}$$

- Asymmetric information: types are consumers' private information
- Investment technology:
  - Long-term investment: one dollar at date 0 yields $R > 1$ dollars at date 2 if the project is completed, 1 dollar if terminated.

Autarky and Optimal Allocation

Autarky: Suppose each consumer acts in isolation. Consumer invests all endowment in the project and liquidates iff she is impatient

$$c_1 = 1 \text{ and } c_2 = R$$

Optimal allocation: Suppose a planner chooses (c_1, c_2, x, y)

$$\max_{c_1, c_2, y} \lambda u(c_1) + (1-\lambda)u(c_2)$$

$$\lambda c_1 \leq y$$

$$(1-\lambda)c_2 \leq y - \lambda c_1 + R(1-y)$$

$$c_1 \leq c_2 \tag{IC}$$

Why is the last condition necessary?

Characterization of optimal allocation

Optimal allocation:

- First ignore the IC constraint (will verify that it will hold)
- we must have $y = \lambda c_1$ and $R(1-y) = (1-\lambda)c_2$
- Using FOC, solution is given by $c_1 \in (0, 1/\lambda)$ that satisfies:

$$u'(c_1^*) = Ru'\left(\frac{R(1-\lambda c_1^*)}{1-\lambda}\right)$$

- This can concisely be written as

$$u'(c_1^*) = Ru'(c_2^*)$$

- If follows $c_1^* < c_2^*$, i.e., IC is automatically satisfied.
- Optimal allocation equates MRS with the technological price.

Optimal allocation and liquidity insurance

- Define $\eta(c) \equiv -\frac{cu''(c)}{u'(c)}$ as the relative risk aversion coefficient.
- Assumption: $\eta(c) > 1$ for each $c > 0$.
- In this case, $c_1^* > 1$ and $c_2^* < R$. Liquidity insurance. (What happens if $\eta(c) = 1$ or $\eta(c) < 1$?)

A Bank Solution I

- Consumers get together and create a bank, and put all their endowment in the bank
- The bank contract: each consumer can ask for c_1^* at $t = 1$ or can wait until $t = 2$ and get a pro-rata share of whatever is left.
- Consumers then play a game where actions are "withdraw" or "wait"
- Let f_j be the number of depositors who arrived in line before consumer j and asked to withdraw and
- Let f be the total number of consumers that will eventually ask to withdraw
- The payoff for an impatient consumer is

Withdraw	Wait
$\begin{cases} c_1^* & \text{if } f_j c_1^* < y^* \\ 0 & \text{otherwise} \end{cases}$	0

A Bank Solution II

- The payoff for the patient consumer if he withdraws at $t = 1$ is

$$\begin{cases} c_1^{FB} & \text{if } f_j c_1^* < y^* \\ 0 & \text{otherwise} \end{cases}$$

- The payoff for the patient consumer if he waits at $t = 1$ is

$$\max\left\{ R\frac{1 - \lambda c_1^* - (f - \lambda)c_1^*}{1 - f}, 0 \right\}$$

Symmetric Equilibrium

Good Equilibrium: "withdraw iff impatient" is a Nash Equilibrium, with a payoff equal to the first best allocation.

- Impatient consumers don't want to deviate because they don't care about future consumption
- Patient consumers don't want to deviate because $c_2^* > c_1^*$

Bad Equilibrium: "withdraw no matter what" is also a Nash Equilibrium

- Given that $c_1^* > 1 \geq y^*$, if everyone tries to withdraw, then the money will run out.
- Therefore, those who wait will get zero
- This equilibrium produces a very bad allocation.

Suspension of convertibility

- One variant of the contract can rule out the bad equilibrium
- The contract states that you can withdraw c_1^* at $t = 1$ as long as less than λ other consumers have withdrawn before you. After that, you are forced to wait
- The payoffs for the impatient consumers are:

$$\begin{array}{cc} \text{Withdraw} & \text{Wait} \\ \hline \begin{cases} c_1^* & \text{if } f_j < \lambda \\ 0 & \text{otherwise} \end{cases} & 0 \end{array}$$

- The payoffs for a patient consumer are

$$\begin{array}{cc} \text{Withdraw} & \text{Wait} \\ \hline \begin{cases} c_1^* & \text{if } f_j < \lambda \\ 0 & \text{otherwise} \end{cases} & c_2^* \end{array}$$

- Waiting is dominant for patient consumers, and runs will not take place.

Government deposit insurance

- Government deposit insurance can always implement first-best:
- Government imposes lump-sum tax on early withdrawers based on aggregate withdrawals. Stores it, pays out surplus to late withdrawers.
  - This eliminates any gain to withdrawing early, even if everyone else is.
  - Also dominates private insurance: government has power to impose taxes; private insurers must hold reserves to make promises credible.

Jacklin's Critique

Jacklin (1987) makes three related points

- Under the Diamond and Dybvig assumptions, you don't really need a bank, equity is good enough
- The Diamond and Dybvig (1983) assumptions are very special. Under more general preferences
  1. you can do more with an bank than with equity
  2. A bank may or may not be able to achieve the first best
- If there is a market, a bank that is useful cannot survive

Who needs a bank?

- Suppose instead of a "bank" consumers set up a "firm"
- The firm invests the first-best amount and issues shares. Each consumer gets one share
- It declares (and commits to) the following dividend policy: a dividend of $d_1 = \lambda c_1^*$ will be paid at $t = 1$ and a dividend of $d_2 = (1 - \lambda) c_2^*$ will be paid at $t = 2$
- Consumers can trade shares in the firm at $t = 1$ (they trade "ex-dividend" - after paying dividends) at a price of p goods per share.
- Supply of shares (impatient consumers sell): $S = \lambda$

Who needs a bank? (cont.)

- Demand for shares (patient consumers perhaps buy):

$$D = \begin{cases} \frac{(1-\lambda)d_1}{p} & \text{if } p < d_2 \\ 0 & \text{otherwise} \end{cases}$$

- Market clearing:

$$\lambda = \frac{(1-\lambda)d_1}{p}$$
$$p = \frac{(1-\lambda)d_1}{\lambda} = (1-\lambda)c_1^*$$

- This is sometimes known as "cash-in-the-market" pricing
- Buyers are at a corner solution. They would want to buy more but have no more money.

Who needs a bank? (cont.)

- Consumption attained by early consumers

$$c_1 = d_1 + p = c_1^*$$

- Consumption attained by late consumers

$$\begin{aligned} c_2 &= d_2 \left(1 + \frac{d_1}{p}\right) \\ &= (1-\lambda)c_2^* \left(1 + \frac{\lambda c_1^*}{(1-\lambda)c_1^*}\right) \\ &= c_2^* \end{aligned}$$

- No need for demand deposits, no risk of bank runs!