

On Diamond (1984): Intermediaries as delegated monitors

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Theory of Banking

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"Why do investors first lend to banks who then lend to borrowers, instead of lending directly?" D. Diamond (1996)

- Diamond (1984) is a model which investigates:
 - the key role of debt contract in bank lending;
 - the financial technology which gives banks the ability to serve as intermediaries;
 - the importance of diversification within financial intermediaries.

Introduction/2

- Asset services are those provided to the issuers of the assets held by the intermediary, e.g. bank borrowers.
- Relative to an intermediary that provides no asset services, one who provides asset services will concentrate its portfolio on assets that are held at a comparative advantage. Reduced monitoring costs are a source of this comparative advantage.
- Financial intermediaries are special in Diamond (1984) for the composition of the asset side of their balance sheet.

- Monitoring in broad sense means:
 - *screening* project a priori in a context of adverse selection → ex-ante monitoring
 - *preventing* opportunistic behavior of a borrower during the realization of a project (moral hazard) → interim monitoring
 - *punishing or auditing* a borrower who fails to meet contractual obligations → ex-post monitoring
- Diamond (1984) is a model in which monitoring happens ex-post.

Delegated monitoring theory/1

- Financial intermediaries should be delegated the monitoring activity, because they may have a comparative advantage in those monitoring activities relative to small individual investors.
- Monitoring the monitor!
- Necessary conditions for this theory to work are:
 - Economies of scale in monitoring: a bank finances many investment projects;
 - Small capacity of investors relative to the size of the investment project: each project needs the funds of several investors;
 - Low cost of delegation: the cost of monitoring the monitor (bank) must be lower than the gains from economies of scale generated by the bank.

Delegated monitoring theory/2

- Consider an economy in which there are n identical risk-neutral firms, who seek to finance projects
- Initial investment is normalized to 1
- Returns of investment are uncertain, represented by random variables that are identically and independently distributed
- Cashflow \tilde{y} of the investment is unobservable to lenders

Delegated monitoring theory/3

- Investors are small relative to the project size
 - Each investor owns only $\frac{1}{m} < 1 \rightarrow m$ investors are needed to finance one project

- Monitoring
 - Investors are able to observe the realized cash-flow by paying a monitoring cost K

Delegated monitoring theory/4

- Since the project outcome is private information of the entrepreneur, he decides and distributes dividends to the investors.
- Investors can only observe the received dividends.
- The entrepreneur keeps whatever left.
- Thus, the entrepreneur has an incentive to understate the realization of the investment project.

This incentive must be taken care of.

Delegated monitoring theory/5

- Three possible ways of taking care of entrepreneur's incentives to misbehave:
 - + investor relies on optimal debt contract with no monitoring;
 - + investor decides to monitor individually (direct monitoring);
 - + monitoring is delegated to a "third" agent, i.e. a bank (delegated monitoring).
- The least costly among these three will be chosen.

Optimal contract without monitoring/1

- The contract can only be written on observable variables.
- It includes a non-monetary penalty (reputation loss) that protects investors in those cases in which the entrepreneur does not meet contractual obligations.
- Let the non-monetary penalty ϕ be a function of the dividend z distributed to investors, i.e. $\phi(z)$.
- $\phi(\cdot)$ negatively affect the payoff of the entrepreneur, which is given by:

$$E_{z \in [0, \tilde{y}]} (\tilde{y} - z - \phi(z))$$

On the non-monetary penalty/1

- Let h be the lowest repayment that the investor requires to participate in the investment project.
 - If $h \leq z$, then the entrepreneur pays no penalty;
 - If $h > z$, then the entrepreneur pays a penalty since he is not complying with his contractual obligations; and the penalty $\phi(z) = h - z$.
- In the optimal contract $\phi^*(z) = \max(h - z, 0)$

Optimal contract without monitoring/2

- The entrepreneur will maximize:

$$E_{z \in [0, \tilde{y}]} (\tilde{y} - z - \phi(z))$$

- subject to the constraints that

$$\phi^*(z) = \max(h - z, 0)$$

$$\{P(\tilde{y} > h) \cdot h\} + \{P(\tilde{y} < h) \cdot E[\tilde{y}|y < h]\} \geq R$$

where R is the per-project return that each investor demands.

- Within the set of possible investment returns, h is the lowest possible value that satisfies the investor's participation constraint as an equality.

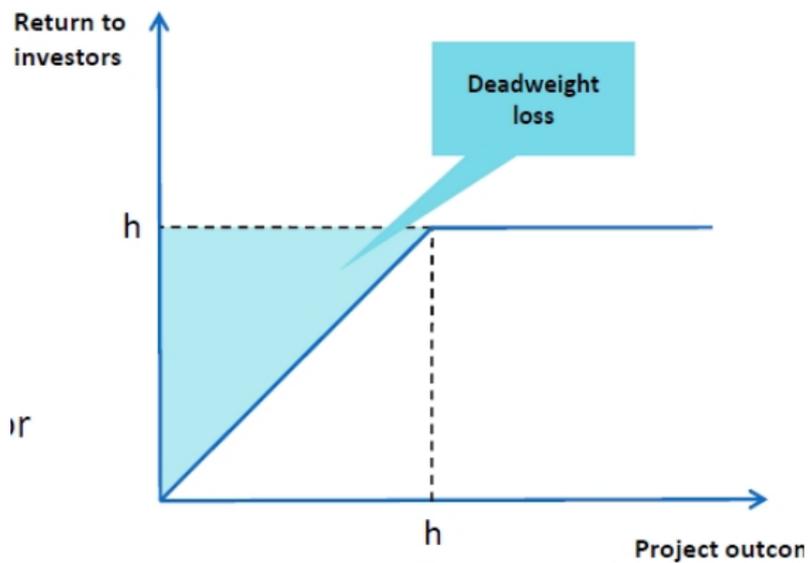
Optimal contract without monitoring/3

- The entrepreneur's optimal payout will have the following structure:

$$D^* = \begin{cases} y & \text{if } y < h \\ h & \text{if } y \geq h \end{cases}$$

- Hence, the optimal contract is a standard debt contract with face value h .
- The non-monetary penalty forces the entrepreneur to pay back the investor whenever possible.
- The non-monetary penalty is a disutility for the entrepreneur which does not make the investor better off.

Optimal debt contract



The monitoring technology

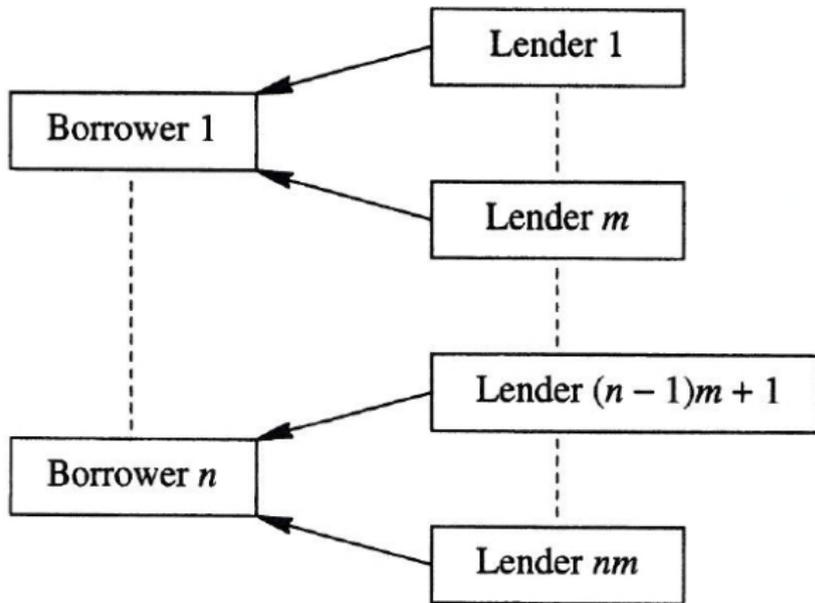
- Monitoring allows the investor to observe the project returns, when they realize.
- Assumptions:
 - each investor can spend $K > 0$ resources to observe the realization of an investment project, y ;
 - monitoring decision is taken at time $t = 0$, investor commits to the decision she takes;
 - investment is profitable, i.e. $E[\tilde{y}] > K + R$;
 - if an investor monitors, the realization y is not observed by other investors, i.e. private nature of information.

Direct lending with monitoring/1

- Each investor monitors the firm he has financed
- If there are n firms that are all financed,
 - $m > 1$ financiers for every firm,
 - and monitoring an individual firm costs K

then, direct monitoring implies a total monitoring cost equal to mnK .

Direct lending with monitoring/2



Monitoring

Direct lending with monitoring/3

- For every firm, direct monitoring is preferred to debt contract if the cost of direct individual monitoring is lower than the expected cost of using a debt contract with no monitoring. That is,

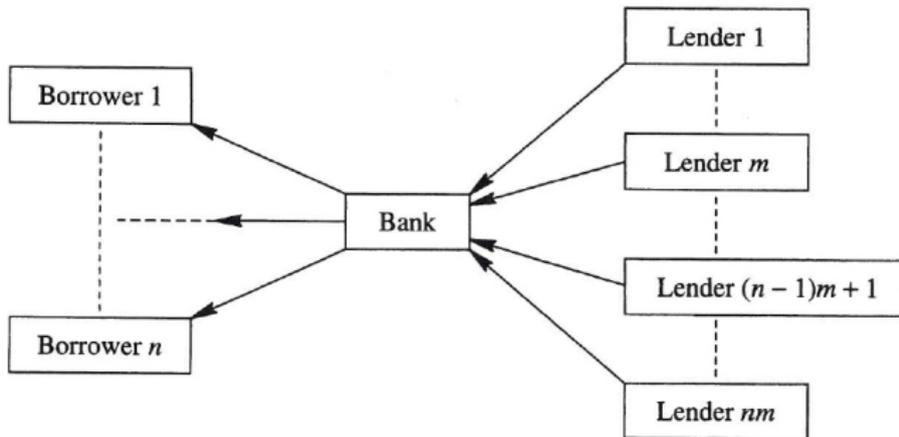
$$mK \leq E_{z \in [0, \bar{y}]}[\phi^*(z)]$$

- Notice that this inequality is less likely with large m .

Delegated monitoring/1

- Assume there exists a financial intermediary, i.e. bank, such that:
 - the bank is risk neutral and has no initial wealth;
 - the bank collects deposits from investors and invests them in the firms' projects;
 - the bank has access to the same monitoring technology of the investors, i.e. it costs $K > 0$ to monitor each investment project;
 - depositors do not monitor the bank, thus she must be given incentives to repay the depositors.

Delegated monitoring/2



Delegated monitoring/3

- The bank is delegated the monitoring activity on investment projects.
- The total monitoring cost reduces to $nK < nmK$ when $m > 1$.
- This delegation is costly from the lenders' point of view. Let D denote the delegation cost to monitor one firm.

Delegated monitoring/4

- Delegated monitoring is viable when the per-project total cost of relying on a bank ($K + D$) is lower than the minimum between the cost of using a debt contract $E_{z \in [0, \bar{y}]}[\phi^*(z)]$ (measured by the expected value of the non-pecuniary penalty) and the cost of direct individual monitoring mK :

$$K + D \leq \min \left\{ E_{z \in [0, \bar{y}]}[\phi^*(z)], mK \right\}$$

where D is the per-project cost of delegation.

- We have to determine D .

Delegated monitoring/5

- If all depositors monitor the bank \rightarrow total cost for the economy is too high: $mnK + nK > mnK$
- Direct monitoring on the bank is not desirable.
- The optimal contract between depositors and the bank is a debt contract with non-monetary penalties.
- The debt contract has the following features:
 - rate on the deposit contract is R_D , i.e. for a deposit of $1/m$ the bank repays $\frac{R_D}{m}$;
 - if the bank announces a cashflow that is not enough to repay all depositors, i.e. $Z_n = \sum_{i=1}^n z_i = \sum_{i=1}^n \tilde{y}_i - nK < nR_D$, she is liquidated.

Delegated monitoring/6

- Depositors have several alternatives with different returns:
 - the debt contract with a return R_D ;
 - the appropriation of intermediary's cash-flow in case of bankruptcy, $\frac{Z_n}{n} = \frac{\sum_{i=1}^n \tilde{y}_i - nK}{n}$;
 - an outside option yielding a safe return R , for example a government bond.

Delegated monitoring/7

- Depositors have several alternatives with different returns:
 - the debt contract with a return R_D ;
 - the appropriation of intermediary's cash-flow in case of bankruptcy, $\frac{Z_n}{n} = \frac{\sum_{i=1}^n \tilde{y}_i - nK}{n}$;
 - an outside option yielding a safe return R , for example a government bond.
- The participation constraint of the individual depositor can be written as:

$$E \left(\min \left\{ \frac{Z_n}{n}, R_D \right\} \right) = R \quad (1)$$

Delegated monitoring/8

- The cost of delegation is equal to the non-pecuniary penalty paid by the intermediary in case of bankruptcy:

$$D = E \left(\max \left\{ \frac{nR_D + nK - \sum_{i=1}^n \tilde{y}_i}{n}, 0 \right\} \right) \quad (2)$$

- Diamond (1984) proves that the expected bankruptcy cost approaches zero as the number of firms n increases.
- In other words, the cost of delegating the monitoring to the bank reduces as there are enough investment projects for the bank to achieve extensive diversification.

Delegated monitoring/9

- Assume that $K < D_1 \rightarrow$ the bank will choose to monitor her borrowers instead of signing debt contracts.
- Delegated monitoring dominates direct monitoring if $K + D < mK$.

Proposition If monitoring is efficient ($K < D_1$), investors are small ($m > 1$), and investment is profitable ($E(\tilde{y}) > R + K$), then financial intermediation with delegated monitoring dominates direct lending as n gets large enough.

Delegated monitoring: comments/1

- Diamond (1984) discusses the key role of debt contracts in bank finance and the importance of diversification within financial intermediaries.
- A financial intermediary can reduce the deadweight loss caused by asymmetric information, by means of monitoring activity and diversification.