Conflict of Interest and the Separation of Commercial and Investment Banking

Raghuram G. Rajan
University of Chicago

ABSTRACT

In recent years, economists have claimed the Glass Steagall act, which separates commercial from investment banking, inhibits efficiency. They argue that the legal separation of functions shields investment banks from welfare improving competition. This paper uses the tools of modern finance theory to show that such arguments against the act are misleading. More specifically, in an un-regulated world, the conflict of interest that develops when a commercial bank handles both functions for a firm may cause it to be an inefficient underwriter of the firm's public issues. At the same time, it may be very difficult for the firm to use an efficient, independant investment bank as an underwriter. This paper suggests that the welfare losses to separating the function of lending from that of underwriting are an empirical matter, rather than a foregone conclusion and deserve further study.

---

1This paper is a revised version of Chapter 3 of my Ph.D dissertation at M.I.T. The paper emerged from a series of discussions with Stewart Myers. While he is responsible for this paper being written, he bears no responsibility for any mistakes. I am grateful to David Scharfstein and Jeremy Stein for their encouragement and for valuable comments on an earlier draft. I thank Nandu Narayanan for his comments.
Introduction

Banks in the United States are prohibited from underwriting corporate securities under the Glass-Steagall act passed in 1933. A major concern of the framers of the act was that the conflict of interest, engendered when the functions of commercial lending and underwriting are combined under one roof, had led to the abuse of public trust by commercial banks and their securities affiliates. Economists have since argued that the abuses the act was meant to prevent were largely illusory. Further, they claim, the act inhibits efficiency, as the legal separation of functions shields investment banks from welfare improving competition from commercial banks. In this paper, we show that regardless of the merits of the original arguments for the act, the efficiency arguments against the act are misleading. More specifically, in an unregulated world, the conflict of interest that develops when a commercial bank handles both functions for a firm may cause it to be an inefficient underwriter of the firm's public issues. At the same time, it may be very difficult for the firm to use an efficient, independant investment bank as an underwriter. This paper suggests that the welfare losses to separating the function of lending from that of underwriting are an empirical matter, rather than a foregone conclusion and deserve further study.

A major concern motivating the framers of the Glass-Steagall act was the need to resolve the conflicts of interests that develop when the same organization handles the functions of commercial and investment banking. The specific abuses created by conflicts of interest were (see Benston (1990)) (i) Banks were investing their own assets in securities with consequent risk to commercial and savings deposits. (ii) Unsound loans were made to shore up the price of securities or the financial position of companies in which a bank had invested its own assets. (iii) A commercial bank's financial interest in the ownership, price, or distribution of securities tempted bank officials to press their banking customers into investing in them.

The first abuse stems from opportunities opened to commercial banks when the two functions are

---

2 Walter(1985), Benston(1990)

3 Even as recently as 1971, the President's Commission on Financial Structure and Regulation stated that the decision to separate commercial and investment banking "was prompted by the conflicts of interest that develop when the same organization handles two functions." It asserted "The possibility of conflict of interest would still exist if banks were again permitted to underwrite ... the Commission strongly recommends the continued prohibition against bank underwriting of private securities issues."
combined. Yet, banks have similar opportunities even otherwise. Banks do not need to invest in securities in order to hold risky assets, as the present crisis in the banking system demonstrates. In fact prohibiting banks from investing in risky securities may force them to satisfy a preference for high returns by investing in risky real assets thus distorting decisions in the economy even more. The abuse here is a result, not of conflict of interest, but of agency problems or moral hazard.

The potential for the second 'abuse' exists even if the two functions are separated. In fact, what is termed an abuse may be a value maximizing activity. An investment bank has to decide whether to 'stabilize' the issue price whenever it underwrites a new issue. Also, banks bail out distressed firms for profitable well-understood reasons. It is not clear how the incentives of financial institutions are changed when the functions are combined.

The third abuse is the only one which is a direct consequence of the change in the bank's incentives (i.e the conflict in its interests) as a result of housing both functions under one roof. However, rational investors will discount appropriately for the bank's financial interest. These investors cannot lose.4

Because there seems neither a theoretical basis nor empirical evidence for the purported abuses by the national banks and their affiliates, it has been suggested that the act was merely a political response to public hysteria surrounding the Great Crash of 1929 and the subsequent bank failures.5 Further, research6 shows that commercial banks have an informational advantage, obtained during the process of lending to a firm, over outside potential investors. It follows that they must have economies of scope in the business of underwriting.7 Therefore, economists argue, not only are the benefits to separation of functions illusory, but

---

4 Empirical work by Simon(1989) confirms that investors on the NYSE, before the Securities act of 1933, did not make abnormal returns, which one would expect if investors were systematically being defrauded.

5 Walter(1985), Benston(1990)


7 In describing the motivations for national banks to go into the securities business, Peach(1941) says that "the task of investigating the credit standing of prospective issuers was considerably lessened by the information already in possession of national banks in connection with short term loans to the same corporations."
also the act may prevent firms from enjoying the direct efficiency gains of bank underwriting.

Our paper shows that this argument is misleading. The problem we examine is exemplified by a bank which has risky loans outstanding to a firm. If additional bank loans are costly, the firm will fund new investment via the stock market. When a firm uses its bank to certify it to the market (the primary function of the underwriter in our model\(^8\)), the bank has an incentive to certify the firm as being good, if only to get some of its loan paid back or to avoid being forced to fund the firm's investment. This conflict of interest is pervasive in economies where banks perform both roles. For example:

"It is the Hausbank (in Germany) which traditionally leads the issuing consortium of banks for an equity issue. Some claim this is a conflict of interest because funds raised through such issues are often used to repay the loans provided by the same Hausbanks." Euromoney (Nov 1986 p104).

Also "J.P Morgan will shortly underwrite a $56 million equity issue by Amsco International...the first underwriting of a common stock by a commercial bank since the Glass-Steagall act...The Amsco prospectus innocently relates that $10.4 million of the proceeds will be used to reduce debt to Morgan Guaranty Trust and Morgan Bank of Delaware." The Economist (2nd March 1991 p70).

We show that this conflict inhibits the ability of the housebank (a term we use interchangeably with 'commercial bank') to certify the true value of the firm to the market, even if the market is regulated and investors have the possibility of redress. The greater the conflict of interest, the less the information the housebank can convey to the market. Even though investors are not fooled in equilibrium, underwriting is inefficient because the housebank is not credible.

Of course, the housebank may have scope economies in acquiring information about the firm, because of its prior lending. This may give it a lower cost of investigating the firm\(^9\) than an independant investment bank, thus enabling it to offset the cost to the firm of inefficient certification. At any rate, if the firm has the ability to choose its underwriter, doing away with the legal separation of functions must be weakly Pareto-improving.

Unfortunately, the firm may not be free to make a choice between underwriters. A housebank

---

\(^8\) Beatty and Ritter(1986), Booth and Smith(1986) and a large subsequent literature emphasize the role of an underwriter as certifying agent.

\(^9\) Once a preliminary agreement has been signed between a firm and an underwriter, it has to make a detailed and costly investigation of the firm and its plans. This investigation is required in the United States under the Securities Act of 1933 and is called 'due diligence'.
which has lent to the firm is not the same as any independent investment bank. The lending process gives the housebank easy access to information, which enables it to choose the timing and the amount of its information acquisition. Underwriting has the characteristics of a natural monopoly, and an incumbent who can make pre-emptive costly investment in information gathering can monopolize the market. We show this holds under a variety of assumptions.

Earlier work (Sharpe(1990) and Rajan(1990)) appeal to asymmetric information between an early inside financier and a later outside potential financier to explain the monopolistic character of financial relationships. Our explanation is complimentary and may indeed better characterize underwriting where substantial costs have to be sunk in the process of investigating the firm.

If the housebank's scope economies are relatively small (to our knowledge, there is no evidence of their size) the welfare implications of allowing commercial banks to underwrite are uniformly negative. As bank loans and public markets are close (though not perfect) substitutes in this paper, the loss in welfare from deregulation depends on the state of competition in the bank loan market. If it is competitive, the main effect of deregulation is that the housebank will inefficiently underwrite some stock issues. If it is monopolistic, the inefficient housebank will be chosen more often to underwrite than in the competitive case. Further, when a stock issue is first best, the firm may continue borrowing from the housebank. Finally, the cost of finance to the firm increases after deregulation. In a sense, the housebank's power to preempt the independant underwriter after deregulation enables it to effectively eliminate the competitive effect of the stock market on loan rates.

A number of implications follow for an economy with universal banks. First, the largest impact would be on small and medium firms for whom loan markets are typically monopolistic. Firms would tend to issue less informationally sensitive securities if underwritten by their housebank. If even these are very risky, they may prefer bank loans to being inefficiently financed in the public markets. Second, investment banks would tend to be confined to underwriting issues for independent firms or those with quality high enough to not require investigation. In order to underwrite middle quality firms, they may be forced to integrate backwards into lending. As more firms are locked in, competition in underwriting will decrease
while the competition to lend - so as to 'capture' firms - will increase.\textsuperscript{10} This will affect the kinds of investments financed.

Nowhere in our model do we assume that housebanks are intentionally malevolent. The housebank is an inefficient certifier because rational public investors know that it has a conflict of interest when both functions are combined. Increasing the size of external legal penalties in case of mis-certification is a blunt, costly tool and may in fact reduce the amount of information conveyed by bank certification. However, if the house bank could credibly alter its incentives while underwriting an issue, it can improve the effectiveness of its certification.

A costless way to alter incentives is for the housebank to commit to buying and holding a small amount of junior securities like firm equity or warrants when making a public offering. We derive plausible conditions under which a costless fully revealing equilibrium exists, which attains the first best.\textsuperscript{11} Unfortunately, commercial banks in many countries are legally prohibited from holding equity in firms (see Table 1). One possibility suggested by this paper, therefore, is that while partial de-regulation - allowing commercial banks to underwrite - may be inefficient, more comprehensive deregulation - allowing them to underwrite and hold junior securities - may restore a measure of efficiency.

We believe our simple model captures the most important elements of lending and underwriting. However, the more general point is that financial institutions are not perfect competitors in complete markets. Ex-post monopolies arising from information are pervasive, especially with respect to small and middle-market firms. In this situation, there are no simple monotonic relationships between welfare and the extent of regulation. The specifics of each situation have to be analyzed. This paper is therefore a call for more investigation, especially empirical.

\textsuperscript{10} Parenthetically, the popular case made for repealing the legal separation of functions suggests exactly the opposite scenario - that competition in underwriting will increase because of the entry of commercial banks.

\textsuperscript{11} Unlike earlier models (Heinkel (1982), Brennan and Kraus(1987), Constanides and Grundy(1989)), the signaller is not the equity owner but holds risky debt. Therefore small equity (or sales) purchases can perfectly signal the value of the firm. The effect of these small equity holdings on the stability of the housebanks would be second-order while the effect on underwriting would be first order.
The paper begins by laying out the structure of the model in section 1. In section 2 we make the basic point, that because of conflicts of interest, a housebank may be an inefficient certifier for a firm, and this inefficiency becomes entrenched because of the housebank's ability to monopolize the firm. In section 3, we show the model is robust to changes. In Section 4, we extend it to allow the investor to seek legal redress. In section 5 the housebank can signal commitment through equity purchases. Section 6 concludes.

**Section 1: The Model**

Consider a risk neutral world where a housebank has extended a line of credit to a firm. The line of credit has been contracted at a prior date. The line of credit allows the firm to borrow up to a large amount at any time. At date 0, an amount D is already outstanding against this line of credit. The terms for any future borrowing (which were set when the line was contracted) are: The firm has to repay R per dollar outstanding at date 1, at a specified future date, say date 2. The risk-free interest rate is 0, and R $1.

We assume the firm is a start-up. The firm has invested in R&D and exhausted all its money and assets in the process. However, it now has a commercially viable idea. This gives the firm an opportunity to invest an additional indivisible amount \( I(\omega) \) at date 1, which will generate at date 2, a random revenue \( Y \) where \( \Omega = \{ y_0, y_1, \ldots, y_k \} \). \( Y \) is discretely distributed with \( P(Y = y) \) such that \( f(y, \omega) \). The quality \( \omega \), \( \Omega = [\$1, \&] \) orders the distribution of \( Y \) in a first order stochastic sense. Every element in the support of \( Y \) occurs with positive probability for all \( \omega \) and the function \( f \) has the monotone likelihood property. At date 0, the distribution of \( \omega \) is \( G(\omega) \) and is common knowledge. At date 1, before investing, the firm and banks get to know the quality \( \omega \) at negligible cost.

Let \( V(\omega) \) be the expected value of the firm, conditional on the investment being made. The technological opportunities are such that

\[
\begin{align*}
V(\omega) &> 0 \quad (i) \\
V(\omega) &- IN(\omega) > 0 \quad (ii) \\
V(\omega, D) &\leq \max_{y \in \Omega} [y \in D, 0] f(y, \omega) \quad (iii)
\end{align*}
\]

i.e. Firms with higher quality have investment opportunities which require greater investment. However, the incremental investment has positive net present value. Finally, the project has value for the owners despite

\[\text{We use the convention that random variables are in bold capitals while their realizations are in small letters.}\]
the debt overhang. Let \( V^D(?, X) \) be the expected value of debt of face value \( X \) to the housebank if firm quality is \( ? \) and the investment is made. Bank debt is risky, \( i.e \) \( X \times V^D(?, X) \)

The firm can finance the new project by drawing further on its line of credit at date 1. However, firm management may not want to take on bank debt for the new project. Too much bank debt can impose deadweight costs as in Diamond (1990) where excessive short term bank debt can result in inefficient liquidation and Rajan (1990) where bank debt distorts investment incentives. These papers make the point that there is an optimal level of bank debt beyond which managerial discretion may be inefficiently constrained. For simplicity, we assume that any additional bank debt contracted for the new project imposes a non-pecuniary cost\(^{13}\) on firm management of \( r_B \) for every dollar borrowed.

The rate \( R \) on the line of credit has been committed to at some prior date by the housebank. Since then some uncertainty has been resolved so that housebank's expected return for funds lent at rate \( R \) may not equal the competitive expected cost of funds. The rate \( R \), while exogenous to our model can be renegotiated as the firm approaches date 0. If \( R^\ast \) is the renegotiated rate on the line of credit, the firm's option of drawing down the line of credit to fund investment has an expected cost, net of the full information cost of funds of

\[
\% \left[ V^D(?, R^\ast I(?) \%RD) \& \text{Min}\left[ V^D(?, RD), D \right] \right].
\]

(1.1)

The first term is the deadweight cost of new debt, the second term is the expected payment on the amount borrowed, the third term is the current value of the housebank's claim, given that the firm has the option of paying it back, the last term is the opportunity cost of new funds, \( I(?) \).

**Sequence of Events If Line of Credit funds investment**

<table>
<thead>
<tr>
<th>Date</th>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td>Line of credit contracted at rate ( R ). Firm draws ( D ). Some uncertainty resolved so that ( R ) no longer the fair rate.</td>
<td>Housebank may renegotiate rate on line of credit.</td>
<td>Firm may choose line of credit to fund investment</td>
<td>Uncertainty about ( ? ) resolved at small cost to insiders. Firm draws a further ( I(?) ) at renegotiated rate and invests.</td>
</tr>
</tbody>
</table>

\(^{13}\) The assumption that these costs are non-pecuniary is merely to simplify the exposition.
The only other source of funds in this economy is the stock market (the analysis applies to the public issue of any risky claim). We now describe the mechanics of a public stock issue in this model. **The Public Stock Issue**

In the real world, investments for a project are spread over time. A bank line of credit is flexible and can be drawn down as the project progresses and information is revealed to insiders. Repeated stock issues, however, are costly. A stock issue which provides enough funds for the entire project will, generally, have to be made before all the parameters of a project are spontaneously revealed to insiders. Therefore, we assume that the stock issue has to be made at date 0, when only the distribution but not the actual quality is common knowledge.

Fortunately, there are two potential underwriters in this economy, the housebank and an independent investment bank, who have the technology to perform a detailed, costly investigation to determine firm quality at date 0. Quality has to be communicated to the market. Firms cannot credibly communicate their own quality because, ex-post, the legal redress mechanism is triggered off when the firm, protected by limited liability, has little ability to pay. The underwriter therefore must communicate the quality to the market. The underwriter then backs its certification with the ability to indemnify those who relied on the certification, if it proves incorrect.

**A. Choosing the Underwriter**

The firm has to choose between the two potential underwriters before issuing stock. The firm asks its housebank and the independent investment bank to submit proposals at date 0. Before submitting a proposal with some ex-ante chance of winning, the intermediary must conduct a preliminary investigation. The preliminary investigation includes analysis of the company's financial statement, its position in industry, the types of products and services it offers...Investment bankers... visit the plants to verify balance sheet values and interview middle management; their attorneys look into a company's patent position and the size of the market. In pursuing this evaluative role, the investment banker will employ outside firms that are specialists in technology, engineering,

---

14 The firms we are concerned with do not have ready access to shelf registration under Article 415.

15 While underwriters perform other important functions like distribution and risk-sharing, we will focus on the certification function for that is crucially affected by the removal of legal separation. While in the days of individual investors, distribution may also have been an important function differentiating commercial bank affiliates and investment banks, it is relatively less important today.

16 A plausible reason is that there is an un-modelled 'bad' firm which is discovered during the preliminary investigation and weeded out. Underwriting this firm would be very costly for the intermediary, because of potential legal penalties (see later).

We assume that the cost of this investigation is $C_p$. Of course, the intermediary may not investigate and then submit a proposal which it knows will not win.

At the time of making the proposal, the investment bank (though not the housebank) has not had an opportunity to perform a detailed 'inside' analysis of the firm. The price at which the offering is made as well as the size of the issue depend on the outcome of this due-diligence analysis and the conditions in the market at the time of the offering.\(^{17}\) We assume, therefore, that the only binding element of the proposal is a fixed underwriter's fee $F$, which is amortized over the actual size of the issue as an underwriting spread.

The firm chooses the proposal, at date 0, with the lowest all-in cost (which includes any cost of mis-certification) only if it is below the cost of the firm's reservation option of borrowing from the housebank. The chosen underwriter then performs a 'due diligence' analysis of the firm which enables it to determine firm quality $\delta$.

"This process entails leaving no question unasked that experienced, sophisticated persons should ask, and leaving no answer intellectually unchallenged. Every answer must be tested to ascertain whether it, in turn raises a pertinent question...At a minimum these [questions] cover all matters bearing on the issuer's organization and standing: its past financial affairs and predictions as to future ones; its operations...contracts,insurance...contingent liabilities, and taxes." (Auerbach and Hayes (1986) p63, p65).

The cost of this analysis is $C_D$.\(^{18}\)

In what follows, a crucial element will be that the housebank has unlimited access to private information about the firm, obtained through its position as principal lender to the firm. It can therefore acquire a substantial portion of the information required for the investigations even before the firm asks for proposals. The outside independent investment bank, however, can acquire the sensitive inside information only after being

\(^{17}\) "Price will be determined by the market at the time of the offering. But whether there is to be an offering depends on the content of the registration statement." - p63 Auerbach and Hayes (1986). Also, in the preliminary agreement before due diligence "the underwriter usually includes a 'market out' clause, which states that the proposal is based on existing market conditions and is therefore subject to change." - p46 Perez (1984).

\(^{18}\) This consists in part of the costs of acquiring information ahead of the time it will be costlessly revealed to insiders and in part, the costs of meeting regulatory requirements.
selected to underwrite.\textsuperscript{19}

After the due diligence investigation is completed, the underwriter has to determine the terms of the stock issue. In practice, once the underwriter is chosen, she has enormous control over the size and price of the offering, based on her 'feel' for the market. We approximate this by assuming the firm has no role to play after selecting the underwriter.

\textbf{B. The Issue Process}

We model the certification function of the underwriter by restricting its actions to announcing the quality of the firm.\textsuperscript{20} It declares firm quality to be \( y \), where \( y \in \mathbb{R} \). This information is transmitted to the investor through the prospectus, road-shows and private communication. In order to determine the quality that is announced, we first have to describe the preferences of the potential underwriters and the market investor.

\textbf{The Housebank's Preferences}

Of the amount I raised in the stock issue, amount I(\( ? \)) is required for the indivisible investment. If I is greater than I(\( ? \)), the excess is used to repay the outstanding line of credit. Repayment is only for notational convenience. Even if the money stayed in the firm, the housebank captures this amount by virtue of its seniority.\textsuperscript{21} Of course, if the amount issued is less than the amount required for investment, the housebank makes up the difference. Thus the line of credit from the housebank is a residual source or use of funds.\textsuperscript{22}

By issuing amount I of stock, the housebank gets

\[
(I \& I(\( ? \))) \% V[D, \hat{I}(I \& I(\( ? \)))]
\]

The first term is the excess amount raised (possibly negative) which goes to repay the housebank while the second term is the resultant value of the housebank's debt claim. The housebank's preferences over the size of

\textsuperscript{19} We have assumed for simplicity that there is only one investment bank which emerges from several contenders. How this investment bank emerges is in itself an interesting problem (but beyond the scope of this paper). Gilbert and Harris (1984) term this the 'nomination' problem.

\textsuperscript{20} The distribution activity is assumed to be performed equally well by the bank and the investment bank and is left unmodelled.

\textsuperscript{21} In general, the short maturity of bank loans and the priority of debt combine to give the bank the most senior claim on the firm's free cash flow.

\textsuperscript{22} An outside competitive market for bank loans will just affect the renegotiated rate without changing the identity of the lender.
the issue and hence the quality it wants to announce depends on the (renegotiated) rate $R$ on the line of credit.

The examples that we discussed in the introduction are for the case where the rate on the line of credit $R$ is less than the minimum breakeven rate for lending.\(^{23}\) In this case, the housebank prefers having as much of its outstanding risky loan paid back as possible. As its claim is senior to the issued equity claim, it has an incentive to issue the largest possible amount, regardless of the price obtained or the quality of the firm.

Another possible case, which is less commonly encountered in the popular literature, is that if $R$ is high enough\(^{24}\), the housebank wants to minimize the amount issued so that it can profit from lending the shortfall at a high rate. Therefore, if $R$ is high or low enough, the housebank's preferences over the amount to be issued become monotonic. As we see later, $R$ is determined by the rate before renegotiation, $\hat{R}$, and the state of competition in the loan market.

**Assumption 1**: $R$ is such that the housebank's preferences are monotonic in the size of the issue.

It turns out that this assumption is satisfied if the bank loan market is competitive or if $R$ is high enough.

**Investment Bank's Preferences**

The investment bank suffers no conflict of interest. If we preclude side-payments\(^{25}\), it will be indifferent to the quality it announces. Infinitesimal reputational costs of miscertifying will break this indifference.

**The Market Investor's Response**

The market consists of a number of symmetric institutional equity investors who are competitive. Apart from the assumption that the market is competitive, we do not distinguish between the individual components of the market and hence refer to it in the aggregate as the representative market investor.

We assume that the market investor determines the size of the issue $I$ after she updates her prior about the quality of the firm, with the communicated signal $\hat{y}$. If her posterior belief about quality is given by $G(\hat{y}|\hat{y})$, then

\[^{23}\text{i.e where } R \text{ is such that } V^D(\hat{y}, \hat{R}X) \neq X\]

\[^{24}\hat{R} > \frac{1}{V^D_2} \text{ for all } X, \hat{y}\]

\[^{25}\text{Nothing in this model requires criminal intent. We therefore assume that agents in this model, though rational, are not criminal.}\]
**Assumption 2: Market Investor's Response:** The market invests
\[ I(\hat{\theta}^\text{AVG}) \quad \text{where} \quad \hat{\theta}^\text{AVG} \equiv \int m g(\hat{\theta}^\text{AVG} d\theta) \]

As the market investor is competitive, the price is determined given the size of the issue and her beliefs about firm quality. Assumption 2, that the size of the issue is endogenously determined by the market, is consistent with the stylized facts that the underwriter consults the main clients and institutional investors in its distribution network about the amount they are willing to invest.\(^{26}\)

The specific form of the investor's market response function is not important for the results that follow. All that we require is that it be increasing in the beliefs about quality. Such a response function could be derived in a number of ways. At the most general level, the market has a portfolio demand for the idiosyncratic stream of returns promised by the new security. It is natural to think that the size of this demand would be positively correlated with the quality of the firm.\(^{27}\)

**Assumption 3:** Intermediaries make all offers and competition is Bertrand.

With that, we complete our description of the issue process. In section 2, we analyze this simple model. In Section 3, we extend it to show the model is robust to changes.

**Sequence of Events for a Stock Issue**

<table>
<thead>
<tr>
<th>Date -2</th>
<th>Date -1</th>
<th>Date 0</th>
<th>Date 1</th>
<th>Date 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------</td>
<td>---------</td>
<td>--------</td>
<td>--------</td>
<td>--------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

\(^{26}\) Benveniste and Spindt (1989) model this interaction.

\(^{27}\) In the absence of portfolio demand, it might appear that the size of the issue is indeterminate - till such time as old equity is completely diluted, there is always a price that clears the market. However, recent work suggests another possible interpretation of the market response function. The value that can be transferred to outside claim-holders is limited by managerial perk consumption (Jensen and Meckling(1976)), negative NPV investments (Jensen (1986)), managerial surplus extraction (Myers (1990)), managerial reputation and credibility (Diamond (1990)) and the inability of management to commit to pay outsiders (Hart and Moore(1989)). Thus firm value is composed of non-transferable control rents or managerial surplus and a transferable component. It is natural to assume that the transferable value of the firm increases in firm quality.
We can break ties by assuming that if two signals generate the same funding response, the housebank weakly prefers a higher nominal signal.

### Section 2: The Basic Problem

We proceed with backward induction by first analyzing the public stock issue, which has two sequential subgames; the choice subgame where the firm chooses its underwriter and the issue subgame where the chosen underwriter communicates quality and the market responds with an amount $I$. During this analysis, we take as given the reservation option of drawing the line of credit, at cost $F_{LC}$. After this, we analyze the firm's financing decision, given that the housebank may have some leeway to alter the terms of the line of credit.

#### The Stock Issue

##### The Issue Subgame

The investment bank, which has no incentive to lie, is completely credible. Therefore it can communicate the true quality $q$ to the market. On the other hand, as the housebank's claim $D$ is risky, it cannot communicate any information that changes the investor's average prior beliefs. When the housebank's preferences are monotonically increasing in issue size, the intuition is as follows. Suppose an equilibrium exists where the investor's average beliefs are changed by at least one signal sent in equilibrium. Call the communicated quality signal which generates the highest average equilibrium belief, signal $A$. From monotonicity, we see that the housebank always wants to attract a higher amount from the investor, and by assumption 2, signal $A$ generates the highest amount. The housebank then sends signal $A$ regardless of the quality of the firm. By Bayes rule, the investor's prior beliefs cannot change: a contradiction. Note that this result holds because all signals are costless and the housebank has an incentive to lie. A similar result can be proved when the housebank's preferences decrease in issue size.

Let $I(q, N) = I(q) - I(N)$. If the housebank rather than the investment bank underwrites a firm of quality $q$...

\[28\] We can break ties by assuming that if two signals generate the same funding response, the housebank weakly prefers a higher nominal signal.
?, its gain or loss from its lending operations is
\[ ? I ( ?^{AVG}, ?) \% V^{D} \left[ ?, \hat{R} D \& \hat{R} ? I ( ?^{AVG}, ?) \right] \Delta V^{D} ((?, \hat{R} D) \text{ where } ?^{AVG} = \frac{7}{4} ? g (? ) d ?. \]

Therefore, before the due diligence investigation, the housebank expects a gain from lending operations of
\[ ? B \{ ? I ( ?^{AVG}, ?) \% V^{D} \left[ ?, \hat{R} D & \hat{R} ? I ( ?^{AVG}, ?) \right] \Delta V^{D} ((?, \hat{R} D) \} g (? ) d ?. \text{ The firm expects a dead-weight loss from excessive bank debt of } \frac{1}{w} \{ ?^{AVG} \%
\]
\[ \{ ? B \hat{R} ? I ( ?^{AVG}, ?) \} g (? ) d ? \text{.$0.} \]

Note that \( w \) is the net welfare loss from housebank underwriting, all else being merely transfers. As the rational competitive market investor makes zero profits in any equilibrium, ex-ante, the firm bears the cost \( ? B + w \) if it chooses the housebank. The firm bears no cost if it chooses the independent investment bank. We now step back to analyze the firm's choice of underwriter.

The Choice Subgame

Remember that as a result of its prior relationship with the firm, the housebank can make a pre-emptive investment in information acquisition. Therefore, at date -2 the housebank invests the pre-emptive amount \( C^{PRE} \) in information gathering before the firm asks for proposals. At present, we assume that the housebank can invest almost (but not quite) \( C_{p} + C_{D} \) so that it cannot know firm quality at the time of bidding. Once the firm asks for proposals, the investment bank must investigate at cost \( C_{p} \) at date -1 in order to make a meaningful proposal. All investigations are common knowledge.

Three situations could arise when the proposals are evaluated at date 0, (i) both the housebank and investment bank have conducted the preliminary investigation (ii) only the housebank has investigated (iii) only the investment bank has investigated.

Consider, first, a hypothetical equilibrium where both the housebank and the investment bank have conducted the preliminary investigation before bidding. Let the investment bank propose a fee of \( F^{IB} \). It must be that \( C_{D} \# F^{IB} \# F^{LC} \) where \( F^{LC} \) is the reservation option for the firm of rejecting the bids and drawing down the line of credit. The first inequality is individual rationality (IR) for the investment bank while the second inequality represents rationality for the firm. The housebank can win only if it compensates the firm for its losses in addition to matching the investment bank’s bid i.e only if it bids \( F^{IB} - B - w \). At this point, the housebank has already sunk \( C^{PRE} \) and only has to invest \( C_{p} + C_{D} - C^{PRE} \) if it wins the bidding game. Also, it
expects a gain of \( ? B \) from changes in the outstanding line of credit. Therefore the housebank will bear a net cost of \( C_p + C_D - C^{\text{PRE}} \). B conditional on winning. The housebank will always win the bidding game if its lowest rational bid is lower than the lowest bid the investment bank can make, \( C_D \). It follows that this condition is \( C_D - B - w \) \( C_p + C_D - C^{\text{PRE}} \). B, or

\[
C^{\text{PRE}} < C_p + w \quad (2.1)
\]

or \( C_D > w \)

i.e by making a pre-emptive investment in information of at least \( C_p + w \) at date -2, the housebank can commit to bidding so aggressively at date 0, so as to always win. Stepping back to date -1, the investment bank faced with the prospect of never winning at date 0, will not conduct the costly preliminary investigation. Our conjectured equilibrium breaks down if (2.1) holds.

An alternative equilibrium is one where only the housebank investigates. But stepping back to date -2, it must be profitable for the housebank to monopolize the firm. The housebank will invest \( C^{\text{PRE}} \) to satisfy (2.1) if the fee it extracts by monopolizing the firm, \( F^{LC} - B - w \), is enough to compensate it for its costs \( C_p + C_D - B \)

i.e if \( F^{LC} - C_p - C_D > w \). We state

**Proposition 2.1:** the housebank underwrites the firm at a fee of \( F^{LC} - B - w \) if (i) \( C_D < w \) and (ii) \( F^{LC} - C_p - C_D < w \). If (ii) does not hold, but (iii) \( F^{LC} - C_p - C_D > 0 \), the investment bank underwrites the firm. If (ii) holds but (i) does not, there is no equilibrium in pure strategies. If (iii) does not hold, the firm finances the project through the line of credit.

Keeping the welfare costs of housebank underwriting and housebank's profits constant, the more that has to be invested in learning about the firm, the greater the housebank's advantage of prior access and greater the housebank's ability to deter the entry of the investment bank. Naturally, the lower the housebank's inefficiency in underwriting the higher the housebank's ability to deter entry.

**Firm's Financing Decision**

Having determined the cost of a stock issue, we now consider whether the firm would draw down the line of credit or issue stock. Proposition 2.1 shows that \( F^{LC}(R) \) determines the housebank's gain from shutting out the investment bank and hence its incentive to do so. It also determines the incentive of the investment bank to take the call for proposals seriously. From (1.1), \( F^{LC} \) increase in \( R \), which in turn results from the housebank
renegotiating the original rate $R$. The housebank's offers to renegotiate $R$ are constrained by the state of competition in the market for bank lines of credit i.e the 'loan' market. Once $R$ is determined, everything else is determined. Therefore, as we show, the state of competition in the loan market and the initial rate $R$ determine the mode of financing, the costs and the underwriter.

If the loan market is competitive, the maximum rate the housebank can charge on the line of credit is the value $R^C$ that solves $V^D \left[ ?, R^C (I(?) \% D) \right] = I(?) \% \text{Min} \left[ V^D (?, RD), D \right]$. The term on the right hand side is the sum of the new amount loaned and the value of old claims held by the housebank, that on the left hand side is the expected repayment. $R^C$ caps the value of the renegotiated rate $R$ when the loan market is competitive.

If the loan market is monopolistic, the minimum the housebank will charge is $\text{Min} [ R, R^M]$ where $R^M$ solves $V^D \left[ ?, R^M (I(?) \% D) \right] = I(?) \% V^D (?, RD)$. The right hand side is the least the housebank can get by allowing the investment bank to make the issue.

**Housebank Not Allowed to Underwrite**

To establish a standard of comparison, we first analyze the case when housebanks are prohibited from underwriting. The first best solution is for the firm to draw down the line of credit from the housebank only if the expected non-pecuniary cost of bank debt, which equals $F_{\text{LC}}(R^C)$, is greater than the cost of investigation, $C_P + C_D$.

In a competitive loan market, the firm's choice of mode of finance is first best (see Table 2A). The reason is straightforward. If $R < R^C$, the housebank will be forced to offer the competitive rate $R = R^C$. If $R < R^C$, the housebank will offer to pay the firm $F_{\text{LC}}(R^C) - F_{\text{LC}}(R)$ in return for substituting the old line of credit contract with a new one at the competitive rate. This will be done before the call for proposals and the offer will be accepted. Therefore, the firm will always face the first best choice. In turn, the investment bank knows that it cannot be undercut if $C_P + C_D < F_{\text{LC}}(R^C)$ and will investigate only if this condition holds.

In a monopolistic loan market, if $R < R^M$ and $C_P + C_D < F_{\text{LC}}(R^M)$, the housebank will match any rational proposal offered by the investment bank. The investment bank then has no incentive to do the preliminary

---

29 This is necessary so that the investment bank has the right incentives to enter. But the housebank wants to avoid lending as far as possible when $R \neq R^C$ and hence will renegotiate the rate early on.
The reason why $R^C$ and $R^M$ are different is an artifact of the model - that the public stock market investor responds with $I(?)$ rather than the sum of $I(?)$ and the value of the costly outstanding bank debt. As the specific response was arbitrary, we will not emphasize this difference in the discussion that follows.

We now examine how welfare changes when housebanks are allowed to underwrite.

**Housebank allowed to Underwrite Firm**

By proposition 2.1, if the housebank is allowed to underwrite and $C_D > W$ the housebank has an ability to pre-empt the investment bank. The higher is $F^{LC}(R)$, the greater the ability to preempt and the greater the inefficiency. We list the separate cases in Table 2B. Comparing tables 2A and 2B, we state

**Proposition 2.2:** If the bank loan market is competitive, the first best mode of financing is always used. However, if housebanks are allowed to underwrite, the firm may choose the inefficient housebank rather than the efficient investment bank to underwrite a stock issue. The cost of finance to the firm is the same in both regulatory environments.

**Proof:** Omitted

**Proposition 2.3:** If the bank loan market is monopolistic: (i) If $R^C > R^C$, the firm will choose the first best mode of finance. (ii) If $R > R^C$ and $R^M = R^C$, the firm will choose the first best only when housebanks are prohibited from underwriting. When the housebank is allowed to underwrite, the firm may choose the inefficient housebank to underwrite. The investment bank is chosen less often than in the competitive case. In addition, the firm may rely on the bank line of credit when the first best mode of finance is to issue stock. Finally, the cost of finance to the firm is (weakly) higher than when housebanks are prohibited from underwriting. (iii) If $R > R^C$ and $R^M > R^C$, the mode of finance may not be first best under either regulatory environment. All the other results continue to hold.

**Proof:** Omitted.

---

30 The reason why $R^C$ and $R^M$ are different is an artifact of the model - that the public stock market investor responds with $I(?)$ rather than the sum of $I(?)$ and the value of the costly outstanding bank debt. As the specific response was arbitrary, we will not emphasize this difference in the discussion that follows.
These propositions are the core of the paper. Proposition 2.2 is the more obvious one. In the competitive case, changes in regulation reflect only in the identity of the underwriter. The competitive loan market limits the fee that can be charged by any underwriter. Even though the housebank can deter entry by the investment bank and secure the underwriting contract, it has an incentive to do so only when a stock issue is the first best mode of finance and issuing through the housebank is still better than borrowing from it. A reduction in welfare results from the fact that the inefficient housebank underwrites the firm.

When deregulation takes place in a monopolistic bank loan market, in addition to the effect above, the mode of finance may change and the cost to the firm may increase. The housebank is no longer required to reduce the rate on its line of credit to match the competition. As proposition 2.1 showed, the expected rate on the line of credit determines the firm's reservation option and hence the incentive of the housebank to secure the underwriting contract. The housebank has a greater incentive to deter entry by the investment bank than in the competitive case. Further, the inefficiency introduced by housebank underwriting may raise the cost of a stock issue above that of borrowing from the housebank, even when a stock issue is first best. The firm will then borrow from the housebank and forego a stock issue.

The important new points emerging from proposition 2.3 are; First, allowing housebanks to underwrite will reduce the competitive effect of public markets on the costs of monopolistic private finance. Second, the firm will use private finance excessively rather than the more efficient public finance. Third, firms may issue informationally less sensitive securities where housebank inefficiency is minimal. Fourth, while independant investment banks will lose business after deregulation, they lose more business if the bank loan market is monopolistic rather than competitive.

Section 3: Extensions to the basic model

Extensions to the Selection Process

The reader may worry that the housebank's ability to preempt as modelled above may be too simplistic. There are, of course, other ways the housebank can 'capture' the firm's underwriting business. For example, a housebank with private information about the costs of underwriting the firm can lock the firm in because the
investment bank is faced with an adverse selection problem while making the proposal.\textsuperscript{31} But the process we have modelled is itself robust to changes in description, which we now examine.

**Allowing for Renegotiation**

Allowing the housebank and the investment bank to renegotiate after the bidding at date 0 has no effect here. The reason is simple. In order for the housebank to have any bargaining power at date 0, it has to have invested at least $C_p + w$, else the investment bank will undercut its bid. But because investment in information is non-transferable, the housebank is now more efficient than the investment bank. Excessive irreversible investment overcomes any prior inefficiency and ex-post renegotiation has no bite.

One way around the problem we have discussed so far is for the firm to commit to not use the housebank to underwrite prior to the proposal stage. Such a commitment will not be credible. If there is uncertainty about the relative costs of the underwriters, it may not be efficient. Finally, in the presence of asymmetric information about firm type, it will send the wrong signal. In fact, as we argue later, rather than committing to exclude the housebank, the firm may contract with the inside housebank to give it first rights of refusal on all underwriting contracts.

**Inducing Information Acquisition**

The firm has an incentive to induce competition. Could the firm encourage the investment bank to invest the costs of the preliminary investigation by paying for proposals? This is common practice for little known firms.\textsuperscript{32} In our model, this has no effect. If (2.1) and (ii) hold, the investment bank knows it has no chance of winning at date 0. As the fact of investigation is not contractible, it merely submits a meaningless bid greater than $F^L_c$, without investigating, and collects a fee from the firm. The only contractible method of giving the investment bank an incentive to investigate is to pay it a fee contingent on it being selected to underwrite. In the situation discussed above, however, either the housebank will not make a proposal in which case there is no need to give the investment bank incentives, or the investment bank has no chance of winning so that contingent fees are meaningless.

\textsuperscript{31} See Sharpe(1990), Rajan(1991)

\textsuperscript{32} “These proposals are frequently done for a fee of $25,000 to $50,000 and constitute a blue-print of suggested financing for the firm.” (Perez 1984)
Uncertainty about relative efficiency

So far we have assumed that the housebank and investment bank are equally efficient in collecting information. The investment bank may actually have higher costs or get a noisier signal about firm quality during its investigation. Alternatively, the investment bank may be more efficient because of specialization. If there is a high probability that the investment bank is more efficient - for example, if it has a lower cost of investigation - than the housebank, then the housebank will not be successful in shutting out the investment bank.

The reason is simple: Pre-emptive investment is limited above by $C_p+C_D$. Also, the housebank is at a competitive disadvantage because of its inefficiency. If the investment bank's costs are very low, it can undercut the housebank, whatever the level of the housebank's pre-emptive investment (see Appendix). The investment bank then has some chance of winning at date 0. This provides it enough incentive to investigate at date -1 either because the expected value of the profits it makes from underwriting are enough to compensate it for the cost of investigation or because the firm can contract to pay it a fee contingent on it securing the underwriting contract.  

Once the housebank knows it cannot prevent the investment bank from conducting the preliminary investigation, it is optimal for the housebank to not incur excessive pre-emptive investigation costs i.e $C^{\text{pre}}=C_p$. This is because pre-emptive investment is useful only in deterring the investment bank from conducting the preliminary investigation. If the investment bank is not deterred and wins, any pre-emptive investment is a dead-weight loss, in case the housebank is not selected.

While it is clear that sufficient uncertainty about relative costs destroys the power of the housebank to shut out the investment bank, this requires that there be a high probability that the investment bank is substantially more efficient than the housebank. This conflicts with the popular argument that housebanks have economies of scope in acquiring information. Moreover, if the housebank and firm can contract either explicitly or implicitly prior to the proposal, the firm will accept a contract which locks it in to the housebank even when

---

33 The size of the contingent fee is limited by the firm's assets, while the expected value of the fee is limited by the reservation price.
the housebank is inefficient (see Appendix). The intuition behind this is that the contract extracts some of the investment bank's rents and gives it to the housebank firm coalition (see also Diamond and Maskin (1979), Aghion and Bolton (1987)). All our results then continue to hold.

One shortcoming of our analysis so far is that it leaves out the legal system. We now introduce a third stage where investors can seek redress from the courts. The housebank can now communicate some information to the market, though it has to add noise to its signal to make it credible. We show that the information the housebank can communicate is decreasing in the size of the risky debt i.e in the magnitude of the conflict of interest. Also raising the size of penalties beyond a point may reduce information transmission. All our results continue to hold, albeit with a (weakly) lower $w$.

**Section 4: Information Transmission when Investors can seek Legal Redress**

**Post-Issue Litigation**

Nothing thus far constrains the announcements the housebank can make about firm quality. In recent empirical work, Tinic (1988) and Ritter (1991) have suggested that the underwriter's announcements are constrained by the fear of litigation.

We now allow the investor to seek legal redress. At date 2, the value $y$ of the firm is realized and becomes common knowledge. The public investor decides whether to sue the housebank for misreporting based on $y$ and the reported $\hat{w}$. She bears cost $c_l$ in moving the courts, regardless of the outcome of the suit. If the law suit is successful, the housebank pays the investor damages.

The court cannot trace back all the private and public information provided by the housebank to the investor. However it knows the amount raised which depends on the investor's beliefs which in turn depends on $y$.

---

34 "The contract on an initial financing " includes a clause requiring the corporation to offer all additional securities through the originating underwriter for a specified period. These are called "first right of refusal" or "preferential right" clauses." (Perez (1984)). Also, venture capital contracts have a clause prohibiting de-novo financing from elsewhere.

35 We can also allow the investor to sue only if she suffers losses, which is consistent with the U.S legal system.

36 For example the non-pecuniary costs of time and effort spent in litigation.
on the information communicated by the housebank. The court then backs out the average beliefs $q^C$ of the investor at the time of the issue, from the issued amount $I$. The monotonicity of the investor's response in her average beliefs ensures that this is possible.

Intuitively, the act of portraying a fly-by-night operator as the next Microsoft attracts heavier legal penalties than portraying Lotus thus. Also the probability of the courts discovering misrepresentation increases in the size of the misrepresentation. The expected value of the awarded damages is thus assumed to be an increasing, convex, non-negative function of the difference between the deduced beliefs about quality and the actual quality. i.e Expected Damages = $L(q^C-q)$ where (i) $L > 0$ (ii) $LNN > 0$

A natural requirement of our exogenously imposed judicial system is that if the housebank announces the truth and is known to do so, there should be no incentive for the investor to sue and make profits in expectation. So, in order that an investor not litigate frivolously

Assumption 3: $L(0) \# c_i$

The Issue Game

The issue game now differs from the one described earlier in that there is a cost to the housebank of sending the wrong signal. In what follows, we will consider the interesting case when $R \# R^C$, and for notational convenience set $R=R=1$. The equilibrium concept is that of sequential equilibrium.

Call $\theta$ the 'type' of the housebank. It sends signal $\theta[\{\theta, \&\}]$ to the market investor. In choosing the signal

37 The price would be an equally good source.

38 Basing legal penalties on the information actually announced by the bank has a serious flaw, even if it were possible. In an economy or equilibrium where everyone is optimistic, the bank has to make optimistic announcements even though everyone discounts them. In this rat-race equilibrium, a legal system which levied penalties based on announcements would impose unnecessary costs. It is not what is said that is important but what is understood.

39 The virtue of such backward deduction according to the legal literature is that it captures all communicated information and it demonstrates that the investor relied on it.

40 For the case $V^D > 1/R$, the housebank will attempt to induce beliefs that the firm is of the lowest quality $\$, as this maximizes its profits and minimizes the legal penalties. As earlier discussed, no information can be conveyed by the housebank.
to send the housebank maximizes

$$\hat{y}^{AVG} \max_{? \in T} \left[ I(\hat{y}^{AVG}, ?) \% V^{\hat{y}}_{?, D & I(\hat{y}^{AVG}, ?)} \right] \& E \left[ I(\hat{y}, ?) \right].$$

(4.1)

where $\hat{y}^{AVG}$ is the investor's posterior beliefs and $s \in \{0, 1\}$ is the investor's decision to sue. The term in large square brackets is the benefit from premature debt repayment while the last term in (4.1) is the expected cost of litigation with the expectation taken over Y. We denote the housebank's strategy by $q(\hat{y}^{AVG})$ where $q$ is a probability distribution with a single point support and $\hat{y}$ solves (4.1).41

An announcement $\hat{y}$ that raises more funds than $I(\hat{y})$ affects the housebank in two ways. First, the risky loan is repaid at face value, a benefit which decreases in marginal value as the outstanding debt amount falls. Second, the expected penalties conditional on litigation, increase in a convex fashion with the funds raised. For a fixed suing strategy, $U^{B}$ is strictly concave in $I(\hat{y}^{AVG})$.

If the outstanding debt is sufficiently risky, the housebank has an incentive to induce overly optimistic beliefs about quality.42 We assume that all types have this conflict of interest.

**Assumption 4:** Conflict of Interest; $U^{B*}_{\hat{y}(I(\hat{y}))} > 0 \mbox{ for all } \hat{y}.$

Finally, in order that some information be conveyed in equilibrium, there has to be some ordering of the types, in other words, an ordering of the conflict of interest similar to the Spence-Mirlees condition for costly signalling games.

**Assumption 5:** $U^{B}_{\hat{y}_{1}(I(\hat{y}_{1}))} < U^{B}_{\hat{y}_{2}(I(\hat{y}_{2}))} \mbox{ for all } \hat{y}_{2} > \hat{y}_{1} \mbox{ and all } I.$ A sufficient condition43 for this is $V^{D}_{\hat{y}_{1}(D \% \hat{y}(\hat{y}_{1}) \& I)} > V^{D}_{\hat{y}_{2}(D \% \hat{y}(\hat{y}_{2}) \& I)} \mbox{ for all } \hat{y}_{2} > \hat{y}_{1} \mbox{ and all } I.$

---

41 If the solution is not unique, then we define $\hat{y}$ to be the minimum of such $\hat{y}$.

42 This would also hold if the market’s optimal response is much less than the required investment.

43 Unfortunately assumption 5 is predicated on the equilibrium behavior of the investor and hence is not very satisfactory. However, the sufficient condition depends only on the technology and hence is more appealing.
The present value of an extra dollar of debt is always lower for the low type \( \hat{\theta} \) given the same face value of outstanding debt claim as the high type. However, when the low type has raised funds \( I \) and paid down some of the debt, the marginal value of an extra dollar of debt increases because the outstanding debt has decreased and become less risky. Now, if the amount raised, \( I \), is below the required level \( \hat{I}(\hat{\theta}) \) for the high type housebank, it has to lend to make up the shortfall. Outstanding debt now is more than the initial face value. The marginal value of more debt for this type decreases because the debt is now more risky.

\[
I(\hat{\theta}^{AVG}) \quad \text{where} \quad \hat{\theta}^{AVG} \quad \frac{\tau}{\mathcal{M}} \left( \frac{\mathcal{D}(\hat{\theta}^{*}\theta) g(\hat{\theta}^{*}\theta) d\hat{\theta}^{*}\theta}{\mathcal{M}(\hat{\theta}^{*}\theta) g(\hat{\theta}(s) d\hat{\theta} s)} \right)
\]

After value \( y \) is realized, the investor's has the choice to sue \( (s=1) \) or not to sue \( (s=0) \). She chooses

\[
\begin{align*}
\frac{\tau}{\mathcal{M}} \left( \frac{\mathcal{G}(\hat{\theta}^{*}\theta) g(\hat{\theta}^{*}\theta, y) d\hat{\theta}^{*}\theta}{\mathcal{G}(\hat{\theta}^{*}\theta) g(\hat{\theta}(s) d\hat{\theta} s)} \right)
\end{align*}
\]

Characterising the Equilibria

We specify a sequential equilibrium by strategies \((q^{*}, I^{*}, s^{*})\) and beliefs \( G \) which are derived from Bayes rule whenever possible. For signals that are sent with zero probability in equilibrium, there must be some consistent beliefs which sustain the equilibrium. We look for:

Fully Revealing Signalling Equilibria where the equilibrium signal \( \hat{\theta}^{*}(\theta) \) is invertible in \( \theta \).

Partition or Coarse Signalling Equilibria where there exists a finite partition of \( T \), \( A(N) = (\theta = a_{0}, a_{1}, a_{2}, ..., a_{N-1}, a_{N} = \$) \), with \( \theta = a_{0} < a_{1} < a_{2} < ... < a_{N-1} < a_{N} = \& \) such that \( \hat{\theta}^{*}(\theta) = \theta^{i} \) for each \( ? \) \((a_{0}, a_{1}, a_{2}, ..., a_{N-1}, a_{N} = \&), i = 0, 1, ..., N-2 \), and \( \hat{\theta}^{*}(\theta) = \theta_{N-1}^{*} \) for each \( ? \) \((a_{0}, a_{1}, a_{2}, ..., a_{N-1}, a_{N} = \&). \) We call each interval of the partition a step. Proposition 4.1 There does not exist a sequential fully revealing signalling equilibrium.

Proof: See Appendix

By assumption 3, the market investor will not sue if the housebank tells the truth and is believed. But

\[4\]
then the signal becomes costless and no information can be conveyed - a contradiction.\textsuperscript{45} In equilibrium, the housebank must introduce noise in its signal, both to build in a sufficient cost to lying as well as to give the market investor an incentive to impose costs through litigation.

\textbf{Proposition 4.2:} There exists a finite positive integer $N$ and a sequence of signals $\mathbf{y}=(y_0,y_1,y_2,...,y_N),y_0 \in T$ such that a coarse signaling equilibrium $A(N)=(a_0(a_0,N),a_1(a_1,N),...,a_N(N)=0)$ exists where

\begin{align*}
q_i(\hat{y}_i^{\text{star}}) &= 1 \text{ if } y \in [a_i(N),a_i(N)], i=0,1,...,N \\
q_{N+1}(\hat{y}_{N+1}^{\text{star}}) &= 1 \text{ if } y \in [a_{N+1}(N),a_N(N)] \\
&\text{and zero otherwise}
\end{align*}

\begin{align*}
I_i(\hat{y}_i) &= I\left(\hat{y}_i^{\text{avg}}(a_i(N),a_i(N))\right) \text{ where } \hat{y}_i^{\text{avg}}(a_i(N),a_i(N)) &= \frac{1}{N}\sum_{i=0}^{N}a_i(N) \\
I_i(\hat{y}_{N+1}) &= I\left(\hat{y}_{N+1}^{\text{avg}}(a_0(N),a_1(N))\right) \text{ if } y \in \hat{y}_{N+1}^{\text{avg}}(a_0(N),a_1(N))
\end{align*}

3. If $y_i \not\in \hat{y}_i$ then

\begin{align*}
s_i(\hat{y}_i,y) &= 1 \text{ if } a_i(N) \frac{\hat{y}_i^{\text{star}}}{a_i(N)} \int L(\hat{y}_i^{\text{avg}}(t),y) dt &\in \mathcal{C}_i \text{ if } h(t^{*}\hat{y}_i^{\text{star}}) \\
&0 \text{ if } y < 0
\end{align*}

\textsuperscript{45}This is not a result of our restriction to pure strategy equilibria, but a requirement of sequential rationality.
4. If \( ? \hat{U} ? \) then
\[
\begin{align*}
  s(?, y) &= 1 \text{ if } \min_{a_1(N)} \int_{a_2(N)} L(?_1^{AVG} & s) h(s^*, y) ds & c_1 \geq 0 \text{ where } h(t^*, y) = 0 \text{ if } < 0
\end{align*}
\]

Proof: See Appendix.

Condition 1 in the proposition above states that the housebank sends a signal depending on which step of the partition its type lies in. Note that the level of the signal it sends is indeterminate, except for the fact that it is the same for every type in the step.\(^{46}\) This is a direct result of signals per se being costless, for it is the interpretation of those signals, by the investor, as emanating from a certain average type which endogenously creates costs for the housebank. Condition 2 describes the investor's response to signals from the housebank. Its response to off-equilibrium path signals is to assume that they were sent by types in the lowest step. Condition 3 describes the investor's litigation response after seeing the realization \( y \). Condition 4 describes its response to an earlier deviation.

The intuition behind the 'coarse' nature of the equilibrium is that small lies are not costly so the housebank must be forced to announce large lies in order to change the investor's funding response. The change in response is not worth the cost of these large lies. The housebank then has the incentive to announce truthfully the step it is in. Also note that the noise introduced by these steps make it sequentially rational for the investor to sue.

What we have demonstrated is that the introduction of a legal system will not eliminate the problem of inefficient certification by the housebank, but may reduce the inefficiency by increasing the amount of

\(^{46}\) This leads to the possibility that we could have optimistic equilibria where housebanks always overstate quality in their signals but these are appropriately discounted by investors, or pessimistic equilibria where the housebanks are very conservative and investors push up signals. Of course, small costs of making arbitrary announcements would lead to a close correspondence between the level of the signals and types.
information conveyed. As the equilibrium is never fully revealing, all our previous results go through.

A number of partition equilibria may exist. For example, the trivial equilibrium in which no information is conveyed always exists. The partition with the highest number of steps is important for it describes, in a sense, the maximum amount of information that can be conveyed in any equilibrium. Under a monotonicity assumption, this partition - the maximal sized partition - is unique and is the only equilibrium to survive the universal divinity refinement (see Kumar(1989)).

We now present an example, by which we illustrate two intuitive results.

**Example 1:** Let there be 4 equally likely types for the firms and 4 possible states. The associated probability matrix as well as the required investment and the market response\(^{47}\) \(I^M\) is

<table>
<thead>
<tr>
<th>(\omega)</th>
<th>(y^1)</th>
<th>(y^2)</th>
<th>(y^3)</th>
<th>(y^4)</th>
<th>(I(\omega))</th>
<th>(I^M(\omega))</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\omega_1)</td>
<td>0.3</td>
<td>0.28</td>
<td>0.22</td>
<td>0.2</td>
<td>0.5</td>
<td>0.4</td>
</tr>
<tr>
<td>(\omega_2)</td>
<td>0.25</td>
<td>0.25</td>
<td>0.25</td>
<td>0.25</td>
<td>0.75</td>
<td>0.46</td>
</tr>
<tr>
<td>(\omega_3)</td>
<td>0.18</td>
<td>0.26</td>
<td>0.29</td>
<td>0.27</td>
<td>1</td>
<td>0.52</td>
</tr>
<tr>
<td>(\omega_4)</td>
<td>0.15</td>
<td>0.22</td>
<td>0.31</td>
<td>0.32</td>
<td>1.25</td>
<td>0.58</td>
</tr>
</tbody>
</table>

Let \(L(\omega^C,\omega) = a (\omega^C C^- + (\omega^C ?_1))\) where \(a\) is initially 0.005 and \(c_0=0.02\). Assume initially that debt is 0.5. There are only three possible equilibria. This is easily seen. As \(L(0) < c\), no fully revealing equilibrium exists. Also, this ensures that no equilibrium in which any of \(\omega_2, \omega_3, \) or \(\omega_4\) are perfectly revealed can exist. This is because the investor has no incentive to sue on receiving the equilibrium signal from any of these types, in which case type \(\omega_1\) has an incentive to imitate their equilibrium signal. The possible equilibria are then the partitions \(A=\{\omega_1, \omega_2, \omega_3, \omega_4\}\), \(B=\{\omega_1, (\omega_2, \omega_3, \omega_4)\}\) and \(C=\{(\omega_1, \omega_2), (\omega_3, \omega_4)\}\). Equilibrium \(A\) is the pooling or babbling equilibrium, which always exists, in which signals have no meaning, equilibrium \(B\) is a more informative one where the lowest type separates out, and in equilibrium \(C\), the top two and bottom two types form the steps.

---

\(^{47}\) We take the market response \(I^M(\omega)\) to be different from \(I(\omega)\) to show that there is no loss of generality in our earlier assumption.
As the debt level increases, first C is no longer an equilibrium, then B also ceases to be one, leaving only the un-informative equilibrium at high levels of debt (see Fig. 1). Next we change the size of the legal penalties by changing the coefficient $a$, keeping $D$ constant. Figure 1 shows that as the legal penalties increase, more information is revealed. This however is not monotonic. If penalties are high enough, Assumption 4 no longer holds and housebanks have an incentive to pool in understating in order to avoid legal penalties. The equilibrium again becomes un-informative when $a > 0.008$. Therefore higher penalties can reduce the amount of information revelation.

This example demonstrates two results. First, as the conflict of interest - as measured by the size of the outstanding risky debt - increases, the size of the maximal partition falls. Intuitively, as the incentive to lie increases, the housebank must be forced to tell greater lies in order to secure more funds in equilibrium. Hence the step size increases. Less information is then conveyed.

Second, increasing the size of the legal penalties can, up to a point, increase the information conveyed by the housebank. However, after that point, legal penalties become counter-productive because the housebank now prefers to understate value. Again, after a certain size of legal penalties, the housebank can convey no information because all types will send the signal which generates the lowest investor response.

The problem so far has been that the housebank has had no obvious way of making a costly commitment to its certification. While the legal system we introduced may seem ad-hoc, it approximates the real world where laws are enacted to deal with a broad spectrum of situations. As the optimal legal penalty depends on the distribution of firm types, the outstanding debt levels and the preferences of investors, it is by no means clear that the legal system can be fine-tuned to induce optimal information transmission.\textsuperscript{48} Thus legal

\textsuperscript{48} Parenthetically, what is optimal for housebanks may not be optimal for the independent investment banks. For example, if outsiders are uncertain about the costs (including expected damages) of underwriting a firm, increasing the size of legal penalties will increase the monopoly power of the informed inside housebank.
(or reputational) penalties are blunt instruments and will, as we have shown, generally not solve the problem.\textsuperscript{49} Further, such penalties are ineffective when the outstanding loan is large enough to impair the capital of the housebank and create an end-game situation.\textsuperscript{50}

A more effective way of improving information transmission is to allow the housebank to endogenously set up a commitment mechanism. The housebank can then tailor the mechanism to the kinds of firms it brings to market. Even in such market based mechanisms, there may still be a role for regulation.

**Section 5: Endogenous Commitment**

An effective way for the housebank to commit to credible certification is for it to obtain rights to the value of the firm based on the quality certified. One simple way for it to do so, is for the housebank to commit to buying risky securities in the firm at the time of underwriting. The advantage here is that signaling is costless or non-dissipative.\textsuperscript{51}

The intuition is that, in equilibrium, the housebank purchases equity at the market price, which is based on investor's beliefs. If the housebank overstates quality, it loses on its equity purchase while it gains on its debt stake. The equity purchase schedule ensures that the value of the housebank's claims - the sum of its prior outstanding debt claim and the risky security that it commits to buying - is locally convex in the induced market beliefs about quality. This gives the housebank a credible incentive to signal the true quality. Note that as the housebank's prior claim, debt, is safer than the claim it is buying, it can signal by purchasing only small amounts of equity (or warrants). Also, in a fully revealing equilibrium, by Proposition 4.1, investors have no incentive to sue. The non-dissipative equity purchase takes the place of legal penalties in providing incentives to not overstate value.

\textsuperscript{49} Such penalties also impose dead-weight costs, for example, that of litigation.

\textsuperscript{50} Alternatively, reputation has little effect in a herd situation where type specifications themselves change. For example, J.P Morgan stayed out of issuing stock till 1929, when the volume of stock issues increased so much that J.P Morgan was forced to join the crowd.

\textsuperscript{51} A number of models have explored costless signaling where the signaler is the owner or management acting in the interest of old equity (Heinkel (1982), Brennan and Kraus (1987), Constantinides and Grundy (1989)).
Non-Dissipative Signaling Equilibria

Let the housebank announce that it will underwrite the firm's stock issue and it will buy and hold \( n(\hat{?}) \) shares for its own account. Investors form average beliefs \( \hat{?}(n(?)) \) and respond with \( \frac{I(\hat{?}, n(?))}{n_{old}} \) of funds. Suppressing the argument of \( ? \), the share price, given their beliefs is \( P_E(\hat{?}, D) \frac{V_E(\hat{?}, D)}{n_{old}} \) and they get new shares numbering \( n_{new}(\hat{?}) \frac{I(\hat{?})}{n_{old}} \) in return. As the true state is \( ? \), the full information expected value of the shares is \( P_E(?, D^i) \frac{V_E(?, D)}{n_{old}} \) where \( D^i \) is the gain (or loss) on the equity it buys at market price. Therefore the value of the housebank's position if it announces \( n(?) \) when the true firm quality is \( ? \) is

\[
\hat{?}(?) \frac{I(?)}{n(?) \frac{P_E(?, D)}{n_{old}}} \frac{V_E(?, D)}{I(?) \frac{1}{n_{old}}} \frac{1}{n_{new}(?) \frac{I(?)}{n_{old}}} \frac{V_E(?, D)}{I(?) \frac{1}{n_{old}}} (5.1)
\]

The first bracketed term is the change in the housebank's debt and cash position while the second term is the gain (or loss) on the equity it buys at market price.

In a fully revealing equilibrium, outsiders must not be fooled. Therefore \( \hat{?}(n(?) \frac{1}{n_{old}}) \frac{I(?)}{n(?) \frac{P_E(?, D)}{n_{old}}} \frac{V_E(?, D)}{I(?) \frac{1}{n_{old}}} \frac{1}{n_{new}(?) \frac{I(?)}{n_{old}}} \frac{V_E(?, D)}{I(?) \frac{1}{n_{old}}} (5.2) \]

where the last term on the left is the full information value of the housebank's claim. The housebank chooses \( n(?) \) to maximize (5.1), the F.O.C is

\[
\frac{\partial(?, D^i)}{\partial(?, D)} \frac{I(?) \frac{1}{n(?) \frac{P_E(?, D)}{n_{old}}} \frac{V_E(?, D)}{I(?) \frac{1}{n_{old}}} \frac{1}{n_{new}(?) \frac{I(?)}{n_{old}}} \frac{V_E(?, D)}{I(?) \frac{1}{n_{old}}}}{\partial(?, D)} \frac{1}{n(?) \frac{P_E(?, D)}{n_{old}}} \frac{V_E(?, D)}{I(?) \frac{1}{n_{old}}} \frac{1}{n_{new}(?) \frac{I(?)}{n_{old}}} \frac{V_E(?, D)}{I(?) \frac{1}{n_{old}}} (5.3)
\]

where the last term on the left is the full information value of the housebank's claim. The housebank chooses \( n(?) \) to maximize (5.1), the F.O.C is

\[
\frac{\partial(?, D^i)}{\partial(?, D)} \frac{I(?) \frac{1}{n(?) \frac{P_E(?, D)}{n_{old}}} \frac{V_E(?, D)}{I(?) \frac{1}{n_{old}}} \frac{1}{n_{new}(?) \frac{I(?)}{n_{old}}} \frac{V_E(?, D)}{I(?) \frac{1}{n_{old}}}}{\partial(?, D)} \frac{1}{n(?) \frac{P_E(?, D)}{n_{old}}} \frac{V_E(?, D)}{I(?) \frac{1}{n_{old}}} \frac{1}{n_{new}(?) \frac{I(?)}{n_{old}}} \frac{V_E(?, D)}{I(?) \frac{1}{n_{old}}} (5.4)
\]

The denominator is the rate of change of the share price with \( ? \), keeping the announcement \( n(?) \) constant. As incremental investment has positive NPV, the denominator must be positive if the debt overhang is not too high. The numerator is a measure of the conflict of interest, the benefit of getting risky debt paid back by incrementally overstating \( ? \). In order for this to be fully revealing, it must be that \( n(?) \) is monotonic in \( ? \). This
holds under plausible conditions (see example 2). In the appendix, we obtain sufficient conditions for this to be an equilibrium.

Note that the more sensitive the share price to $\gamma$, the lower the equilibrium equity purchase required, while the more sensitive the required investment to $\gamma$ or the higher the outstanding debt level, the greater the required stake. Also, it is easily shown that the higher the prior equity stake of the housebank in the firm, the greater the amount it has to buy in the new issue to overcome the lack of credibility.

**Example 2** Let $Y = U[X-b\gamma,X+a\gamma]$ and $I(\gamma) = c\gamma$. Then

$$V(\gamma) = \frac{X\%}{2} + \frac{D(\delta)}{(a \%)} \gamma; \quad V^D = \frac{D(\delta)}{(a \%)} \gamma^2; \quad V^{12} = \frac{D(\delta)}{(a \%)} \gamma^2; \quad V^{22} = \frac{D(\delta)}{(a \%)} \gamma^3.$$

Substitute $D=2.1$, $a=2$, $b=0.8$, $c=0.5$, $X=2$, $T=[0.55,0.75]$, $n_{old}=1$.

The share purchase schedule is in Fig 2. and is decreasing in quality. The relative gains for each quality type at an announcement of $n=2.50$ is seen in Fig 3. Note that the maximum gain is zero and occurs for type $\gamma=0.65$.

This is the type that will announce a purchase of 2.5 shares.

The difference between this case and the earlier case of legal (or reputational) penalties is that the housebank now can endogenously set up commitment. Further, such commitment does not break down in endgame situations. Of course there may be other ways than equity purchases/sales to build commitment. The point here is that if banking is deregulated, such activities which enhance the effectiveness of underwriting should also be deregulated.

---

52 As $\gamma$ increases, $(1-V^D)$ decreases because the incremental value of a unit of debt increases as the quality of the firm goes up. If $|N|$ changes little or is non-increasing, the numerator as a whole decreases in $\gamma$. The denominator, must increase with $\gamma$, because the debt overhang $D-I(\gamma)$ remains constant, while the incremental investment is positive NPV.

53 The key to the equilibrium is that the market investor somehow know the equilibrium schedule of quality contingent equity purchases i.e $n(\gamma)$. In the real world, investors would learn the shape of the schedule over repeated issues.

54 The housebank will have to sell stock to establish credibility in the case where it has an incentive to understate quality.
There may still be need for regulation. First, in order to make the signal credible, housebanks should be required to hold on to their inside stakes until the revelation of much of the uncertainty. This mandatory period of holding is already required of insiders in the United States. Second, as firms do repeated issues, the ability of the housebank to signal falls because its prior holding (from previous issues), and hence its conflict of interest, increases. In the interest of stability, it may make sense to limit the size of equity stakes banks can hold. Also when near the limit, the housebank can reduce its stake without conveying adverse information.

Section 6: Conclusion

Banks have the ability to leverage power from one market to another by virtue of their access to private information. Also they may combine activities very inefficiently because of conflicts of interest. Monopoly by itself may be good because investments in information have increasing returns to scale. Inefficiency by itself may not be bad as long as buyers have freedom of choice and inefficient producers are closed down. However, the two together may have important welfare effects. Note that the object of this paper is not to claim that the Glass-Steagall act or Article 65 increase welfare. Rather, it is to point out that there are sound theoretical reasons why deregulation may decrease welfare. There is a paucity of empirical evidence on the economies of scope that commercial banks purportedly enjoy when activities are combined. If these are small, other effects may then become first order.

The reader may feel that the effects of conflicts of interest must be second order. After all these conflicts are pervasive and reputational concerns are usually enough to keep abuses in check. But when the bank faces a large potential capital loss in the outstanding loan, the bank manager (if not the bank) face an end-game situation. In this situation, conflict of interest would have first order effects on certification. There is casual evidence that such problems arise in merchant banking - where investment banks make bridge loans to the firms they advise. First Boston was forced to withdraw a number of junk bond issues because of poor demand, long before the collapse of the junk bond market. Finally, First Boston sold its parent $1.1 billion of bridge loans that firms could not re-finance. There is some suggestion that firms had trouble refinancing bridge loans because of problems of the credibility of the underwriter.

Of course in the banking industry as it is today, the problem does not seem to be one of monopoly but
of excessive competition and disintermediation. Too much has possibly been made of this. Undoubtedly, with the growth of public markets, the banking sector has had to downsize. Ultimately, it will concentrate on its natural lending franchise, small and medium firms. For these firms, the asymmetric information between insiders and outsiders gives bank lending the qualities of a natural monopoly. The effects we point to will be significant. Finally, disintermediation is not necessarily a permanent phenomenon.  

To conclude, banking regulation in much of the world has had strong political roots. While rejecting purely political arguments behind such regulation, we must recognize that regulation may have potential (and unforeseen) economic benefits. As the future of banking all over the world is being debated, more research, especially empirical, is needed on the subject.

References


---

55 Peach (1941) documents the dramatic drop in bank loans over the 1920's as firms issued stock to repay loans. This precipitated the entrance of banks into the securities business. It was felt that the decline in commercial lending was permanent and the predominant part of their future business would be concerned with making loans on securities.


Peach, N. (1941), *The Security Affiliates of National Banks* (Johns Hopkins, Baltimore)


<table>
<thead>
<tr>
<th>Country</th>
<th>Market Capitalization (% of GNP) Dec 1987&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Permissible activities for deposit taking banks&lt;sup&gt;c&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>30</td>
<td>Banks may hold equity in connection with their underwriting activity.</td>
</tr>
<tr>
<td>France</td>
<td>20</td>
<td>Underwriting allowed. banks may hold 20% of shares in a non-bank company (and 100% if financed by long-term deposits.</td>
</tr>
<tr>
<td>Federal Republic of Germany</td>
<td>20</td>
<td>Universal banking</td>
</tr>
<tr>
<td>Italy</td>
<td>16</td>
<td>Underwriting allowed. banks cannot hold more than 2% in non-bank company shares.</td>
</tr>
<tr>
<td>Japan</td>
<td>105</td>
<td>Banks not allowed to underwrite corporate securities. 5% limit on holdings in any firm</td>
</tr>
<tr>
<td>Netherlands</td>
<td>48</td>
<td>Underwriting allowed. Equity participation greater than 5% subject to approval.</td>
</tr>
<tr>
<td>U.K</td>
<td>92</td>
<td>No specific controls. By tradition, a separation between deposit-taking banks (accepting houses) and merchant banks (issuing houses).</td>
</tr>
<tr>
<td>U.S</td>
<td>60</td>
<td>Banks not allowed to underwrite corporate securities. Some equity participation now allowed to holding companies.</td>
</tr>
</tbody>
</table>

Table 2 A

Intermediary, Mode of Finance and Rates when housebanks prohibited from underwriting

<table>
<thead>
<tr>
<th>Intermediary, Mode of Finance and Rates when housebanks prohibited from underwriting</th>
<th>Intermediary, Mode, Cost to Firm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loan market competitive, R$R^C</td>
<td>Investment bank, Stock, F^LC(R^C)</td>
</tr>
<tr>
<td>C_p+C_d &lt; F^LC(R^C)</td>
<td>Housebank, F^LC(R^C)</td>
</tr>
<tr>
<td>C_p+C_d, $ F^LC(R^C)</td>
<td></td>
</tr>
<tr>
<td>Loan market monopolistic, R$R^M</td>
<td>Investment bank, F^LC(R^M)</td>
</tr>
<tr>
<td>C_p+C_d &lt; F^LC(R^M)</td>
<td>Housebank, F^LC(R)</td>
</tr>
<tr>
<td>C_p+C_d, $ F^LC(R^M)</td>
<td></td>
</tr>
</tbody>
</table>

Table 2 B

Intermediary, Mode of Finance and Rates when housebank allowed to underwrite

<table>
<thead>
<tr>
<th>Intermediary, Mode, Cost to Firm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housebank, Stock, F^LC(R^C)</td>
</tr>
<tr>
<td>Investment bank, Stock, F^LC(R^C)</td>
</tr>
<tr>
<td>Housebank, Loan, F^LC(R^C)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Intermediary, Mode of Finance and Rates when housebank allowed to underwrite</th>
<th>Intermediary, Mode, Cost to Firm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loan market competitive, R$R^C</td>
<td>Housebank, Stock, F^LC(R^C)</td>
</tr>
<tr>
<td>C_p+C_d +? W #F^LC(R^C)</td>
<td></td>
</tr>
<tr>
<td>C_p+C_d &lt; F^LC(R^C) &lt; C_p+C_d +? W</td>
<td></td>
</tr>
<tr>
<td>C_p+C_d, $ F^LC(R^C)</td>
<td></td>
</tr>
<tr>
<td>Loan market monopolistic, R$R^M</td>
<td>Housebank, Stock, F^LC(R)</td>
</tr>
<tr>
<td>C_p+C_d #F^LC(R^M) #C_p+C_d +? W #F^LC(R)</td>
<td></td>
</tr>
<tr>
<td>C_p+C_d #F^LC(R^M) #C_p+C_d +? W</td>
<td></td>
</tr>
<tr>
<td>C_p+C_d, $ F^LC(R^M)</td>
<td></td>
</tr>
</tbody>
</table>

APPENDIX
The Effect of Uncertainty about Investigation Costs

Let the investment bank's costs of due diligence be \( c_D \), distributed uniformly between 0 and \( 2(C_D + \sigma) \).\(^{56}\) The investment bank is, on average, as efficient as the housebank. Further, we assume that it learns this cost (which becomes common knowledge) only after it performs the preliminary investigation.

The crucial difference in this case is as follows: Pre-emptive investment is limited above by \( C_p + C_D \). When \( c_D > \sigma \), the investment bank can commit to undercut the housebank, whatever the level of pre-emptive investment. The investment bank then has some chance of winning at date 0. This provides it enough incentive to investigate at date -1 either because the expected value of the profits it makes from underwriting are enough to compensate it for the cost of investigation or because the firm can contract to pay it a fee contingent on it securing the underwriting contract.\(^{57}\)

Once the housebank knows it cannot prevent the investment bank from conducting the preliminary investigation, it is optimal for the housebank to not incur excessive pre-emptive investigation costs i.e \( C^{\text{PRE}} = C_p \). The reason is simple. Pre-emptive investment is useful only in deterring the investment bank from conducting the preliminary investigation. If the investment bank is not deterred and wins, any pre-emptive investment is a dead-weight loss.

Under Bertrand competition, the housebank asks a fee of \( c_D - \sigma - B - \sigma \) when it wins and the investment bank charges \( C_D + \sigma \) when it underwrites. The investment bank underwrites whenever \( c_D > C_D + \sigma \), implying that the firm stays with the housebank with probability 1/2. Measuring firm surplus with respect to its reservation value, it is easily

\(^{56}\) We choose this distribution only for notational convenience.

\(^{57}\) The size of the contingent fee is limited by the firm's assets, while the expected value of the fee is limited by the reservation price.
Firm Surplus \( \frac{F_{LC}^2}{4C} \) & \( \frac{C}{4} \)

Bank Surplus \( \left( \frac{F_{LC} \& C}{4C} \right)^2 \)% \( \left( \frac{F_{LC} \& C}{2C} \right) \) & \( C_p \)

Investment Bank Surplus \( \frac{C}{4} \) & \( C_p \), where \( C' \) \( C_p \) & \( w \)

verified that

While it is clear that sufficient uncertainty about relative costs destroys the power of the housebank to preempt the investment bank, this requires that there be a high probability that the investment bank is substantially more efficient than the housebank. This conflicts with the efficiency arguments for allowing housebanks to underwrite. Moreover, if the housebank and firm can contract either explicitly or implicitly prior to the bidding, the firm will accept a contract which locks it in to the housebank even when the housebank is inefficient. All our previous results then continue to hold.

**Lock In Contracts**

Let the housebank offer a contract to underwrite at a fixed fee of \( F - B \) at date -2. If the firm goes to the investment bank instead, it has to pay the housebank liquidated damages of \( F D \). This contract may be explicit or implicit, via a prior relationship and specific investment.

At date 0, the firm gets a surplus of \( (F_{LC} - F) \) if it stays with the housebank. The investment bank has to offer the housebank the same surplus to get it to switch, which means it has to bid lower than \( F - F^D \). This is rational for the investment bank only if \( F - F^D \) \( c_p \). The probability that the investment bank is selected is \( p = \max \left[ 0, \frac{F \& F^D}{2C} \right] \). The housebank then faces the problem

\[
\max_{F', F^D} \quad p F^D \% (1 \& p) \quad (F \& C)
\]
Constraint (i) makes it rational for the firm to accept while constraint (ii) requires that the investment bank win with positive probability and constraint (iii) that it be incentive compatible for the investment bank to investigate.\(^{58}\) Let us set \(F_{LC}=2C\) for simplicity. The solution can be verified to be \(F=5C/4, F_{FD}=3C/4\) if \(C_p \neq C/8\). Housebank surplus goes up. Firm surplus remains the same while investment bank surplus goes down. The probability that the firm stays with the housebank goes up from 1/2 to 3/4. Note that as in the earlier case of preemption, the housebank underwrites even when inefficient. This contract is not renegotiation proof because it is ex-post inefficient. However, such contracts are seen in the real world and are sustainable in a supergame.●●

**Proof of Proposition 4.1**

Proof by contradiction; assume a fully revealing equilibrium exists. Consider type \(?_1\) and type \(?_2, ?_1<?_2\), who send different signals \(?_1^\hat{\ }\) and \(?_2^\hat{\ }\). In the fully revealing equilibrium, the response of the investor is to provide \(I(?_1)\) and \(I(?_2)\) respectively. By strict monotonicity of the investor's preferences, \(I(?_1) < I(?_2)\). Also, the courts deduce the true quality from the market response. Under these circumstances, by Assumption 3, suing is not profitable. In any sequentially rational equilibrium, the investor will not sue on the equilibrium path. There is a conflict of interest and the housebank wants to raise \(\text{REWRITE ENDFIELD}\) e funds than the market is willing to offer for a given type. As expected damages are zero, the housebank of type \(?_1\) will announce \(?_2^\hat{\ }\) and the equilibrium breaks down.●●

**Proof of Proposition 4.2**

First we need to prove some useful lemmas which will help us in constructing an equilibrium.

**Lemma 4.1:** If in response to some announced \(y\) and some realization \(y_N\) the investor sues, she will also sue when the realization is \(y_O\) where \(y_O \neq y_N\).

**Proof:** This follows from the Monotone Likelihood Ratio Property and the fact that damages increase monotonically in the difference between \(y^{AVG}\) and \(?\).

---

\(^{58}\) If we allow the firm to subsidize entry for the investment bank, constraint (i) and (iii) collapse to

\[
\left(F^{LC}\& F\right) \frac{F^{LC}^2}{4C} \& \frac{C}{4} \& \max \{ F^{DI}, (F^{DI})^2 \} \& \frac{C}{4} \& \max \{ C, C, 0 \}
\]
**Lemma 4.2:** Consider an equilibrium where the investor receives a signal $y_2$ sent with positive probability and forms posterior average beliefs $\tilde{\beta}_2$. If it is an equilibrium response for the investor to not sue for any realization of $Y$ after receiving this signal, then it cannot be an equilibrium response for her to sue, for any realization of $Y$, if she receives a signal $y_1$ which she believes is sent by average types $\tilde{\alpha}_1 \# \tilde{\alpha}_2$.

**Proof:** The investor offers $I(\tilde{\alpha}_2)$ when she encounters the signal $y_2$. If her beliefs on encountering a signal $y_1$ are (weakly) lower, she will offer $I(\tilde{\alpha}_1) \# I(\tilde{\alpha}_2)$. As it is an equilibrium response for her not to sue when she encounters $\tilde{\alpha}_2$ for any realization of $Y$, type $\tilde{\alpha}_1$ strictly prefers to send signal $y_2$ unless it is an equilibrium response for the investor to not sue when she receives signal $y_1$.

**Corollary 4.1:** If there is some step in a partition equilibrium where the investor, in equilibrium, does not sue for any realization of $Y$ when she encounters signals from the step, the step can only be the lowest step.

**Proof:** Direct from Lemma 4.2.

The content of lemma 4.2 is that in order to specify an equilibrium litigation response for the investor, for every signal $\tilde{\alpha}_i$, sent in equilibrium one need only specify the highest realization $y_i$ for which the investor can and will sue. Corollary 4.1 suggests that it is not possible for high types to be perfectly revealed when low types are not.

We now can prove proposition 4.2. The proof is by construction, step by step, using the above lemmas. We develop an iterative algorithm which determines the equilibrium suing response, and then follow work by Crawford and Sobel (1982) to establish the existence of the equilibrium.

(A) We first define an arbitrary initial step by picking $a_i$. Now we have to find $y_0$ such that it is incentive compatible for the investor to sue if he knows that $\tilde{\alpha}_0 [\tilde{\theta},a_i]$ and only if he observes a realization $y \# y_0$ i.e substituting parameters in (3) of Proposition (3.3), it must be that $s (\gamma^{\tilde{\alpha}_0}(\tilde{\theta},a_i),y) = 1$ iff $y \# y_0$. We start by conjecturing $y_0 = y^k$ and check the condition. If it holds, by Lemma 4.1, $y_0 = y^k$. If it does not hold we check for $y^{k-1}$ and so on. If no such $y_0$ exists, the investor does not sue when he encounters a signal from this step. Now $U^B_{\tilde{\alpha}_0} \tilde{\theta}, I(\gamma^{\tilde{\alpha}_0}(\tilde{\theta},a_i)) \tilde{\beta}$ is well defined in step 0.

---

59 We can easily incorporate constraints on litigation - for example that the investor can sue only if he has incurred a loss. We do this in example 1.
A suing strategy is completely determined by a tuple consisting of a signal and a corresponding level of \( y \) at and below which the investor sues. Now, suppose we have determined up to step \( i-1 \) the step end-points \((a_1,a_2,\ldots,a_i)\) as well as \( y_0,\ldots,y_{i-1} \) such that on seeing signal \( ?_i \) at date 0, the investor sues at date 2 for all \( y \neq y_i \). Now consider the housebank of type \( a_i \). Assume the investor sues after seeing signal \( ?_i \) and realizations \( y \neq y_i^* \). \( y_i^* \) defines a \( U_i^{B} \). Let \( a_{i+1}^* \) solve

\[
U_{i+1}^{B}(\hat{a}_i, I(\text{AVG}(a_i, a_{i+1}))) - \xi = U_i^{B}(\hat{a}_i, I(\text{AVG}(a_i, a_{i+1}))) - \xi \tag{AC}
\]

By strict concavity of \( U_i^{B} \) for a given \( y_i^* \), and as \( I(\text{AVG}(a_i, a_{i+1})) \) is increasing in both arguments, \( a_{i+1}^* \) is unique. We can easily show

**Lemma 4.3:** If \( a_{i+1}^* = a_N \) solves (AC) when \( y_i^* = y_N \) then \( a_{i+1}^* = a_O \) solves (AC) when \( y_i^* = y_O < y_N \)

**Proof:** Omitted.

**Lemma 4.4:** If it is incentive compatible for the investor to sue for all \( y \neq y_i^* \), in a step \([a_i,a_N]\) then it is incentive compatible for him to sue for all \( y \neq y_i^* \), in a step \([a_O,a_N]\) where \( a_O > a_N \).

**Proof:** Omitted.

The rest of the construction is simple using these Lemmas. Assume we have solved till step \( i-1 \). Then follow the simple one pass algorithm described below. Lemmas 4.3 and 4.4 enable us to do this.

1. **(B)** Let \( y_i = y_i^* \).
2. **(C)** Find \( a_{i+1}^* \) which solves (AC).
3. **B.1)** If \( a_{i+1}^* > \xi \), then start again at \( (A) \) with a higher value of \( a_i \). Lemma 4.3 permits us to conclude that no solution exists as the solution with any other suing strategy would also exceed \( \xi \).
4. **B.2)** If \( a_{i+1}^* \neq \xi \),
   - then check if it is incentive compatible to sue for all \( y = y_i^* \). (If this holds, by Lemma 4.1 the investor will sue for all \( y < y_i \)).
   - **B.2.1)** If yes then check if incentive compatible to sue for the next higher \( y \) to \( y_i \). \( y_i^* \). 60

---

60 The investor did not have a reason to sue at the higher \( y \) earlier because the step size was smaller. We have to make sure that the increase in the trial step size as we lower the trial \( y_i \) (lemma 4.3) is enough to give the investor an incentive to sue (lemma 4.4).
B.2.1.1) If yes, then no solution exists for this value of \( a_i \). Start with a different value at step (A). B.2.1.2) If no, then (B.2.1.2.1) if \( a_{i+1}^* = \& \), we have a partition equilibrium with \( i \) steps.

(B.2.1.2.2) if \( a_{i+1}^* < ? \), we have solved for the \( i^{th} \) step. Go to (B) with \( i = i+1 \).

B.2.2) If no, set \( y \) to the next lower \( y \) and go to (C). If we are already at \( y^0 \), start again at (A).

Note that by this algorithm, varying \( a_i \) up from \( \$ \), we can trace out all the partition equilibria in one pass. By applying Lemma 4.3 and Lemma 4.4 after step B.2.1.2, we can assure ourselves that for every initial point \( a_i \), the equilibrium using response determined by this algorithm is unique (if a solution exists) and hence the equilibrium is unique. The pooling or babbling equilibrium trivially shows that an equilibrium exists.

Having generated the partition, we know the conjectured strategies are best responses for the investor. It remains to be shown that a signal \( y_i \) is a best response for a housebank of type  \( ?0[a_i, a_{i+1}] \) to \( I(\text{AVG}(a_i, a_{i+1})) \).

i.e that \( U^B, I(\text{AVG}(a_i, a_{i+1})) \) \( \max_j U^B \left( y, I(\text{AVG}(a_j, a_{j+1})) \right) \) --(AB).

But because \( U^B_{i+2} > 0 \) (Assumption 5), and \( ?0[a_i, a_{i+1}] \) it follows that

\[
U^B \left( y, I(\text{AVG}(a_i, a_{i+1})) \right) \& U^B \left( y, I(\text{AVG}(a_j, a_{j+1})) \right) \leq 0 \quad \text{(i) and (ii) hold for any} \quad 0 \leq j \leq k \leq N \quad \text{and the second inequality in each expression is by concavity. Hence} \quad (AB) \text{is proved. Q.E.D}
\]

Second Order Condition for Costless Fully Revealing Equilibrium

Now, totally differentiate the F.O.C. Then totally differentiate (5.4) and substitute it in the differentiated F.O.C. In order for the S.O.C of the housebank's maximization problem to be satisfied,

\[
I^1(?) \left( P^D_{22}(?) \right) I^1(?) \left( P^D_{12}(?) \right) \leq 0 \quad (5.8)
\]

The conditions (5.4) and (5.8) are easily interpreted. They are merely the First and Second order conditions obtained
by maximizing the equilibrium condition with respect to \( \psi \). The intuition is that outsiders will attribute any announced quality \( \psi \) to the firm that has the maximum incentive to make that announcement. In a fully revealing equilibrium, the announced quality and the attributed quality must be the same, i.e. the equilibrium condition must attain its unique maximum with respect to \( \psi \) at \( \psi = \psi \).

We can simplify (5.8) by recognizing that the sum of equity and debt claims identically equal the value of the firm. Therefore, \( V_D(\psi, D) + N \, P^E(\psi, D) / V(\psi) \) where \( N = (n_{old} + n_{new}) \). Hence \( V_1^D = -NP_1^E \), \( V_2^D = -NP_2^E \) and \( V_{12}^D = -NP_{12}^E \). Substituting in (5.8), we require that

\[
\delta n / N [ I^{1}(\psi) V_{22}^{D} [ 1 \delta n / N ] I^{2}(\psi) V_{12}^{D} [ 1 \delta n ] \tag{5.9}
\]