TRANSACTION CONTRACTS

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Gary Gorton and George Pennacchi

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Abstract

We model the demand for transactions services and liquidity in an economy with asymmetrically informed agents. It is shown that informed agents can systematically take advantage of agents who are relatively uninformed but who have unexpected needs to trade. This causes certain financial contracts to endogenously arise because they provide a type of "protection" to the uninformed agents. These contracts have the characteristic of creating a security with a safe return from underlying assets with uncertain returns. Intermediaries that resemble banks are examples of such a contract, and we provide a rationale for deposit insurance in this context. However, a commercial paper market in conjunction with intermediaries resembling money market mutual funds is another financial contract which provides this same transaction service, and may well be preferred to the bank financial contract. Deposit insurance would not be needed in this latter case, though the need for a government debt market may arise.

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I. Introduction

A widely held view is that the investor of modest means is at a disadvantage relative to large investors. This popular perception, dating from at least the early 19th century, has it that the small, unsophisticated, investor--"the farmer, mechanic, and the laborer"--is least equipped to acquire information and is most often victimized by having to trade with better informed agents. U.S. history is repeatedly marked by incidents of real or imagined insider shenanigans, and resulting popular initiatives against the "money trusts" and the "robber barons." This view is responsible for many institutions, e.g., the SEC, anti-trust legislation, and various forms of taxation. This argument has also influenced bank regulation where it has been used to justify government provision of deposit insurance as a matter of public policy.

How could some agents systematically bilk other agents, even if some are informed and others are not informed? In a voluntary trading process, small, uninformed agents with rational expectations would know that (changes in) market prices reveal information. If prices are fully revealing, insiders could not benefit. In Kyle (1985) and Grinblatt and Ross (1983), insiders can systematically benefit at the expense of uninformed traders. This occurs because the uninformed traders, called noise traders, are non-optimizing agents; they simply trade and lose money. If informed agents can, somehow, systematically take advantage of uninformed agents, then it seems clear that the uninformed agents would be motivated to respond, possibly creating alternative trading mechanisms. In this essay we investigate whether financial institutions or transactions contracts will endogenously arise as a response to problems faced by small, uninformed, investors with a need to transact. In particular, we ask whether there are a variety of solutions, and whether government intervention might be a necessary feature of any of them.

We first consider an environment that is similar in spirit to the above traditional notion that small, unsophisticated, investors might need to trade in markets where better informed agents are present. Our model assumes there is a large number of agents who face unexpected consumption needs and who are uninformed about the relevant information. There is also a small number of informed agents. We show that the informed traders can collude in a self-enforcing way to execute trades at the expense of the uninformed agents.

In this imperfectly competitive market, the uninformed systematically lose to the informed agents who have an incentive to act collusively. Might the uninformed agents be able to prevent this? We show that by offering a certain type of transactions contract, the uninformed can negate the power of the informed agents' coalition, thereby protecting themselves against trading losses. This transactions contract is characterized by the creation of a security that can be used in trade without loss to better informed agents. We focus on what types of private contracts and public institutions can satisfy this demand for transactions services or "liquidity."

One type of transactions contract takes the form of an intermediary that offers equity and riskless debt as liabilities. The existence of this intermediary can lead to defections by informed agents from their collusive coalition if they can be offered a superior expected rate of return as an intermediary equity holder. The uninformed agents will then hold the intermediary's riskless debt that can be used for trading. Thus, this intermediary closely resembles a deposit and equity issuing bank.

This example of a transactions contract provides a rationale for the existence of banks which differs from other models. In the analysis here, banks neither provide risk sharing nor solve agency cost problems. Their function is also unrelated to resolving inefficient interruptions of production (avoiding costs of liquidating physical assets).[1] All of the agents in our setting are risk neutral and the aggregate supply of output in the economy is fixed. Equilibrium involves determining the distribution of wealth between agents. "Small" agents, however, demand transactions services in the form of a security which prevents the loss of wealth in the transactions process. Banks can provide this required medium of exchange.

Importantly, however, bank intermediation is not the unique solution for protecting uninformed agents. We show that if there is a market for corporate liabilities, then firms can issue equity and riskless debt that also act to protect uninformed agents. Transactions can be carried out by money market mutual funds holding exclusively firm debt. Uninformed agents would buy shares in these funds and some informed agents could be induced to buy equity shares in the levered corporations. This arrangement can duplicate the allocation achieved by the bank contract, given a sufficient quantity of riskless corporate debt, such as commercial paper.

It may be that a private transactions contract is not feasible. This might be viewed as a "market failure" from the perspective of the small, uninformed agents, and would justify a role for government intervention. The government can intervene on their behalf in several ways. One way of protecting the uninformed agents is by insuring the deposits of the banking system through a tax-subsidy scheme. A system of government deposit insurance can achieve the same allocation as when private bank transactions contracts are feasible. Alternatively, the government can make the mutual fund solution viable if it is infeasible for corporations to issue sufficient amounts of riskless debt. In this case, government intervention in the form of a Treasury bill market can improve uninformed agents' welfare by providing additional riskless securities for mutual funds to hold. This form of intervention is shown to parallel that of the provision of deposit insurance since in both cases, the government's role is to create a risk-free asset.

The paper proceeds as follows. In Section II the model economy is detailed. In Section III a stock market allocation when all agents are fully informed is set out as a reference point. Section IV considers the case of asymmetric information and shows how the informed agents can take advantage of uninformed agents by forming a coalition that trades in the stock market. Then, in Section V the private intermediary contact, when feasible, is shown to break the informed agents' coalition. When private contracts are infeasible, we show in Section VI that government intervention by insuring bank deposits or creating a government debt market can be beneficial in protecting uninformed agents. Section VII concludes.

II. The Model Economy

There are three dates in the model economy, $t = 0, 1, 2$, and a single consumption good. The following assumptions detail the model.

A1. Preferences

There are three types of agents:

(i) Agents with known preferences at $t = 0$, who derive utility from consumption at date $t = 2$ given by $U = C_2$.

(ii) Agents with preferences that are unknown at date $t = 0$, but which are realized at date $t = 1$ to have utility from consumption at date $t = 1$ given by $U = C_1$, but no utility from consumption at $t = 2$. These agents are called "early" consumers.

(iii) Agents with preferences that are unknown at date $t = 0$, but which are realized at date $t = 1$ to have utility from consumption at date $t = 2$ given by $U = C_2$, but no utility from consumption at date 1. These agents are called "late" consumers.

Agents of types (ii) and (iii) will collectively be called "liquidity traders." Let N equal the number of liquidity traders, which is assumed to be large relative to the number of agents with known preferences. At $t = 1$ the proportion of liquidity traders with preferences for early consumption is realized. (The remaining fraction consists of late consumers.) The realized proportion of early consumers may be low, proportion w_l, which is expected to occur with prior probability q_l, or high, proportion w_h, expected to occur with prior probability q_h. It is assumed that $w_h > w_l$.

A2. Endowments and Technology

At $t = 0$, all agents receive endowments of a capital good which when invested earn a return in the form of the consumption good at $t = 2$. Each liquidity trader is assumed to receive an endowment of one unit of the capital good, while type (i) agents with known preferences receive equal endowment shares of the capital good that total M units in aggregate. Capital is homogeneous and each unity produces the same random return. Each capital unit produces either R_H units of the consumption good or R_L units of the consumption good at date $t = 2$, where $R_L < R_H$. It is assumed that the probabilities at date $t = 0$ of each state occurring equal one-half.

In addition to the capital good, all liquidity traders receive an endowment of e_1 units of the consumption good at $t = 1$, while type (i) consumers receive equal endowment shares of the consumption good at time $t = 2$ that total Me_2 units in aggregate. Each unit of the consumption good received by the liquidity traders at $t = 1$ can either be consumed at $t = 1$ or stored to yield a certain return of 1 unit of the consumption good at date $t = 2$.

A3. Information Sets

At date $t = 1$, uncertainty about capital returns and liquidity traders' preferences is realized. It is assumed that type (i) consumers have access to this information at date $t = 1$, i. e., they know whether the return on capital will be high or low and whether the proportion of early consumers in the economy is high or low. Thus, we will hereafter refer to the type (i) consumers as the "informed" traders.

While liquidity traders find out at $t = 1$ whether they are an early or late consuming individual, we will consider the case where they are not directly informed about the aggregate proportion of early consumers and the realized return on capital. In this case, information may or may not be revealed by the result of traders' actions at time $t = 1$. However, for purposes of comparison, we will first consider the "full information" benchmark case where liquidity traders are assumed to directly receive information regarding the realized aggregate proportion of early consumers and the realized return on capital.

III. A Stock Market with Full Information

It is apparent that certain agents will desire to trade at $t = 1$. In particular, when some liquidity traders find that they are early consumers at $t = 1$, they will want to sell their entire endowment of the capital good for the consumption good at this time. In addition, other liquidity traders who discover that they are late consumers may want to sell their $t = 1$ endowment of the consumption good for the capital good if their expected return to holding capital is at least as good as their return to storing their consumption endowment.

In general, the type (i) informed traders may desire to sell some of their capital good for the consumption good at time $t = 1$ in order to store it from $t = 1$ to $t = 2$. Whether informed traders want to sell capital or not will be an important issue when we consider the case of uninformed liquidity traders. However, it will become clear that ignoring the type (i) traders will not change the equilibrium for the full information case.

Since each unit of capital invested at $t = 0$ is subject to the same source of risk (i.e., all units either produce a high return or all units produce a low return at $t = 2$), it will make no difference whether we think of agents individually investing their endowment of the capital good or giving it to firms who then issue to them shares reflecting a proportional claim to the capital's return at $t = 2$. Thus a "stock market" is equivalent to individual investment of the capital good.

Let us then consider the stock market equilibrium in this full information case. All agents' utility levels will be determined once we solve for the equilibrium price of the capital good in terms of the consumption good at date $t = 1$. We do this for the four possible states of nature realized at date $t = 1$; $\{i, j\}$, $i = h, l$, $j = H, L$, where i refers to a high or low proportion of early consumers, while j refers to a high or low return on the capital good. Let p_{ij} denote the date $t = 1$ value of one unit of the capital good in terms of units of the consumption good when state i, j occurs.

At $t = 1$ early consumers will wish to purchase the consumption good in exchange for their endowment of one unit of the capital good. Early consumers, in total, own Nw_i units of the capital good which they are willing to sell. The aggregate quantity of the endowment good demanded by the early consumers is $Nw_i p_{ij}$. Since the late consumers are the only agents from whom the early consumers can buy endowment of the consumption good, the late consumers will end up selling some or all of their endowment of the consumption good to the early consumers.

Let the amount of consumption good supplied by the late consumers be $S(p_{ij})$. If everything is supplied, then $S(p_{ij}) = Ne_1(1 - w_i)$. Otherwise some amount less than $Ne_1(1 - w_i)$ will be supplied.

We now determine the price, p_{ij}, which clears the market at date $t = 1$ in each state of the world $\{i, j\}$. Market clearing equates the demand for the consumption good with supply. Thus:

(1) $$N w_i p_{ij} \leq N e_1 (1 - w_i) \ .$$

There are two separate cases to consider, one where late consumers sell all of their consumption endowment (condition (1) holds with equality) and one where they sell only part, choosing to store some (condition (1) being a strict inequality).

When there is no storage in equilibrium, condition (1) becomes an equality. Solving for the price of the capital good, we have:

(2) $$p_{ij} = \frac{e_1 (1 - w_i)}{w_i} \ . \qquad \text{(No Storage)}$$

This case holds under the parametric restriction:

(3) $$R_j > \frac{e_1 (1 - w_i)}{w_i} \ .$$

When storage occurs in equilibrium, later consumers must be just indifferent between buying and holding the capital good and storing the consumption good, i.e.,

(4) $$p_{ij} = R_j \ . \qquad \text{(Some Storage)}$$

This case holds when the inequality sign in condition (3) is reversed.

Hereafter, we will make the assumption that condition (3) holds for $j = H$, so that in equilibrium, no storage will occur for the states, $\{h, H\}$ and $\{l, H\}$, where the return on capital is high. In addition, we will assume that condition (3) does not hold for $j = L$, so that in equilibrium, some storage will occur for the states, $\{h, L\}$ and $\{l, L\}$, where the return on capital is low. These assumptions can be summarized by the following condition;

(5) $$R_H > \frac{e_1 (1 - w_l)}{w_l} > \frac{e_1 (1 - w_h)}{w_h} > R_L$$

Condition (5) amounts to assuming a sufficiently high variance in asset returns relative to the variance in the proportion of early consumers. This assumption will lead to a more interesting problem when we consider the effects of asymmetric information.

Note that for this full information case, type (i) consumers have no incentive to trade in the capital good at date $t = 1$. Whenever there is a high return on capital, the rate of return on capital exceeds that of storing endowment, so type (i) consumers will choose not to sell capital. When there is a low return on capital, the rate of return on capital just equals the return to storage, so that type (i) traders are indifferent to purchasing endowment.

Since type (i) agents do not trade, their expected utility (consumption) per unit of capital endowment at date $t = 0$ is:

(6) $$E[C_2] = e_2 + \overline{R} \ .$$

where $\overline{R} \equiv \frac{1}{2}(R_H + R_L)$.

The expected utility of liquidity traders can be computed from our previous results:

(7) $$\begin{aligned} E[C_1 + C_2] = {} & \frac{q_h}{2}\left[w_h(e_1 + p_{hH}) + (1 - w_h)\left(R_H + \frac{e_1 R_H}{p_{hH}}\right)\right] \\ & + \frac{q_l}{2}\left[w_l(e_1 + p_{lL}) + (1 - w_l)(R_L + e_1)\right] \\ & + \frac{q_h}{2}\left[w_h(e_1 + p_{hL}) + (1 - w_h)(R_L + e_1)\right] \\ & + \frac{q_l}{2}\left[w_l(e_1 + p_{lH}) + (1 - w_l)\left(R_H + \frac{e_1 R_H}{p_{lH}}\right)\right] \\ = {} & e_1 + \overline{R} \ . \end{aligned}$$

In what follows, we will compare the expected utility of the different agent types under alternative information and trading settings to the expected utilities given by (6) and (7).

IV. A Stock Market with Asymmetric Information

Now suppose the model is the same as that of the previous section except that only type (i) agents, the "informed traders," are assumed to have direct knowledge of the return on capital and the proportion of early consumers at date $t = 1$. In this section we restrict liquidity traders to hold their wealth only in the form of stock. Given this assumption we ask whether the informed agents can collude at date $t = 1$ to exploit the liquidity traders. First, we summarize what will happen at $t = 1$. Then we define an equilibrium. Finally, we show the existence of insider trader in equilibrium.

The liquidity traders, early and late consumers, do not know what return capital goods will earn. Nor do they know the proportion of early consumers in the economy. At date $t = 1$, however, the decision of the early consumers is straightforward. Regardless of possible information, they sell their capital goods for consumption goods. Late consumers must decide to either store their newly arrived endowments of the consumption good or sell all or parts of these endowments for capital goods. This decision, made as a function of the market price, characterizes the behavior of the late consumers.

Informed agents know (as do all agents) that, in equilibrium, prices will reveal some or all information about the true state of the world. Consequently, they will need to coordinate their trading strategies (collude) in order to gain from their superior information. We assume that there is a sufficiently small number of informed agents such that they are able to form a trading coalition, if they individually so desire.

Thus, at $t = 1$ the sequence of events is as follows. First, the informed agents communicate and choose an amount of capital goods that they will jointly supply in state $\{i, j\}$ knowing that uninformed agents will act competitively. We first solve this game between the informed agents. Then the equilibrium price is determined to clear the market between late consumers supplying endowment goods and early consumers, possibly together with informed agents, selling capital goods.

The amount supplied by the coalition in each state $\{i, j\}$ will be based on a strategy designed to make some states of nature indistinguishable from other states of nature when viewed by the uninformed agents. That is, the equilibrium prices in some states of nature will be the same as in other states of nature. In order for prices not to reveal the true states of nature in equilibrium, the optimal strategies of individual informed agents must be to supply no more capital goods than is supplied by the coalition acting on their collective behalf. The existence of the insider trading equilibrium will depend on showing that individual members of the informed agents' coalition have no incentive to deviate from the coalition strategy, by selling capital goods on their own unbeknownst to the coalition. In equilibrium it will be the interest of each informed agent to be a member of the coalition, and once having committed capital for sale by the coalition, to not supply any additional capital. This is because if any additional capital is supplied by individual informed agents (acting independently of the coalition) the equilibrium price will reveal the true state of the world. If this occurs then no informed agent can benefit. We now briefly formalize this so that we can subsequently define an equilibrium.

Let $M_{ij} \leq M$ be the amount the coalition proposes to its members as the amount to be supplied in state $\{i, j\}$, with each member supplying an identical share. The coalition's strategy will be characterized by the amount of the capital good that the coalition supplies in state $\{i, j\}$, M_{ij}. We say that M_{ij} is a self-enforcing Nash coalition in state $\{i, j\}$ if any subcoalition of informed traders, taking the capital supplied by the complement of the subcoalition as given, chooses to abide by the per capita shares assigned by the whole coalition. If this is true for all possible subcoalitions, then the coalition M_{ij} is not subject to collapse since there is no incentive for any member or group of members to deviate from the proposed M_{ij}.[2] We will refer to this coalition as the "Insider Coalition."

Market clearing will require that the price, say p_{ij}^*, equate the demand for consumption goods with the supply of consumption goods in state $\{i, j\}$:

(8) $$N w_i p_{ij}^* + M_{ij} p_{ij}^* = S\left(p_{ij}^*\right)$$

As before, the supply, $S(p_{ij})$, will be either all the endowments of the late consumers, $N(1 - w_i)e_1$, or some lesser amount if there is storage in equilibrium.

We now define a Nash-type equilibrium in this setting. An Imperfectly Competitive Rational Expectations Equilibrium is: (a) a price system, $\{p_{ij}\}$; (b) specification of storage strategies for the late consumers, $S(p_{ij})$; and (c) a specification of insider coalition strategies, $\{M_{ij}\}$; such that, given $\{p_{ij}\}$, knowledge of the model, and the information set of the informed agents in state $\{i, j\}$, the storage and coalition strategies of the respective agent types are chosen such that: (i) their respective utilities are maximized; (ii) $\{p_{ij}\}$ clears the market in state $\{i, j\}$; and (iii) $\{M_{i,j}\}$ is self-enforcing.

Let $R^* = q_h' R_h + q_l' R_L$ be the uninformed late consumers' expectation at time 1 of the return on capital when state $\{l, L\}$ actually occurs, where q_h' and q_l' are their posterior probabilities of the states being $w_i = w_h$ *and* $w_i = w_l$, respectively. The following proposition demonstrates the existence of insider trading by the informed agents:

Proposition 1: (Insider Trading) Let $\{\hat{p}_{ij}\}$ be the full information prices for states, $\{i, j\}$. Then if:

$$e_1(1 - w_h)/w_h \leq R^*$$

there exists Imperfectly Competitive Rational Expectations Equilibrium prices $\{p^*_{ij}\}$ where $p^*_{lH} = \hat{p}_{lH}; p^*_{hL} = \hat{p}_{hL}; p^*_{hH} = p^*_{lL} = \hat{p}_{hH}$. That is, these prices are fully revealing in only two of the four states.

Proof: We will verify that the following specification of prices and strategies constitutes an equilibrium for the assumed parameter values.

State {*l*, *H*}

$$p^*_{lH} = \frac{e_1(1 - w_l)}{w_l}; \; M_{lH} = 0; \; S(p^*_{lH}) = N(1 - w_l)e_1 \qquad \text{(No Storage).}$$

State {*h*, *L*}

$$p^*_{hL} = R_L; \; M_{hL} = 0; \; S(p^*_{hL}) < N(1 - w_l)e_1 \qquad \text{(Some Storage).}$$

State {*h, H*}

$$p^*_{hH} = \frac{e_1(1-w_h)}{w_h};\ M_{hH} = 0;\ S\left(p^*_{hH}\right) = N(1-w_l)\,e_1 \qquad \text{(No Storage).}$$

State {*l, L*}

$$p^*_{lL} = \frac{e_1(1-w_h)}{w_h};\ M_{lL} = \frac{N(w_h - w_l)}{(1-w_h)};\ S\left(p^*_{lL}\right) = N(1-w_h)\,e_1 \qquad \text{(No Storage).}$$

The proposed equilibrium prices in the first three states, $\{l, H\}$, $\{h, L\}$, and $\{h, H\}$ are the full information prices. In the states $\{l, H\}$ and $\{h, L\}$, prices are fully revealing and are market clearing. It remains, then, to show that the actions of the insider coalition can cause prices to only partially reveal information in the states $\{h, H\}$ and $\{l, L\}$.

In state $\{l, L\}$, the return on the capital goods is low and informed agents would like to sell their capital goods in exchange for consumption goods at the assumed equilibrium price. They will then store the consumption goods for one period. Since the proportion of the late consumers is low, w_l, the informed coalition can mimic the state $\{h, H\}$ where there are many late consumers and the informed agents don't enter the market.

Thus, if the late consumers supply all their endowment of consumption goods, then market clearing requires:

$$\text{(9)} \qquad N w_l p^*_{lL} + M_{lL} p^*_{lL} = N e_1 (1 - w_l) \ .$$

Now, set $p^*_{lL} = p^*_{hH} = e_1 \dfrac{(1-w_h)}{w_h}$ and solve for M_{lL}:

$$\text{(10)} \qquad M_{lL} = \frac{N(w_h - w_1)}{(1-w_h)} \ .$$

By supplying M_{lL} units of the capital good in exchange for the endowment good, the insider coalition can create the false impression that the state is $\{h, H\}$ when, in fact, the state is $\{l, L\}$, But, for this to be successful two further considerations need to be examined.

First, will late consumers choose to sell their endowment when they see the market clearing price p^*_{lL}? They will if, on average, it is profitable to do so, i.e., when;

$$p^*_{lL} = e_1 \frac{(1-w_h)}{w_h} \leq R^* = q_h{'} R_H + q_l{'} R_L \tag{11}$$

If late consumers form their expectation of the state being $\{l, L\}$ or $\{h, H\}$ in a Bayesian fashion, conditioning on the fact that they, themselves, are late consumers, then:

$$q_h{'} = q_h \frac{(1-w_h)}{q_h(1-w_h) + q_l(1-w_l)}$$

$$q_l{'} = q_l \frac{(1-w_l)}{q_h(1-w_h) + q_l(1-w_l)} .$$

Condition (11) says that even though late consumers know that the informed coalition will cheat them in state $\{l, L\}$, and that this cannot be detected, still it is optimal to sell all their endowment. It is optimal if $q_h{'}$ is sufficiently large, so that most often the true (but unobserved) state is $\{h, H\}$.

Secondly, we must check that M_{lL} is a self-enforcing Nash coalition. If there is a total of M units of capital owned by the informed agents, and they are all in the coalition, then each can exchange $M_{lL}M$ per unit of the capital for endowment goods. Note that if any member or group of members independently demands additional endowments, then the market clearing condition (9), will not hold at p^*_{lL}, and the new price will reveal the collusion. Uniformed agents will infer the truth. If the state $\{l, L\}$ is revealed, late consumers will not be willing to sell their endowments. If there is a deviation from M_{lL}, then the informed agents as a group will not benefit, including the member or group who deviated. Therefore, since any deviation results in a fully revealing price, and hence, no benefits to informed agents, M_{lL} is self-enforcing.

This completes the proof.

We can now calculate the expected utility per unit of capital endowment for the informed traders. While M is the total amount of capital endowment of the informed agents, the coalition can only sell M_{lL} units in state $\{l, L\}$. Therefore:

$$(12)\qquad \begin{aligned} E(C_2) &= e_2 + \frac{R_H}{2} + \frac{q_h R_L}{2} + \frac{q_l}{2}\left[R_L + w_m\left(p^*_{IL} - R_L\right)\right] \\ &= e_2 + \overline{R} + \frac{q_l}{2} w_m \left(p^*_{IL} - R_L\right) \end{aligned}$$

where $w_m \equiv \frac{M_{IL}}{M} = \frac{N(w_h - w_l)}{M(1 - w_h)}$. Since $R_L < p^*_{IL}$, by assumption (5), the expected utility of an informed trader exceeds the full information expected utility since $w_m > 0$.

Likewise, we can calculate the expected utility of liquidity traders. It is straightforward to show that;

$$(13)\qquad E[C_1 + C_2] = e_1 + \overline{R} - \frac{q_1}{2}\frac{(w_h - w_l)}{(1 - w_h)}\left[p^*_{IL} - R_L\right]$$

Note that this utility is less than that of the full information case. We now turn to investigating whether the liquidity traders can prevent being taken advantage of by the informed traders.

V. Private Transactions Contracts

In the previous section, liquidity traders were not allowed to contract. The result was the existence of insider tradering that increased the welfare of informed traders at the expense of the liquidity traders. We now allow the liquidity traders to respond by contracting. We show that allowing liquidity traders to contract can prevent insider trading by breaking the informed agents' coalition, i.e., the insider trading equilibrium analyzed in the previous section will no longer exist. Next, we show that an alternative equilibrium characterized by bank intermediation can exist. Finally, we show that the allocation achieved with the bank can be replicated with corporate debt held by money market mutual funds.

A. Bank Intermediation as a Transactions Contract

Suppose at date $t = 0$ the following contract is offered to agents. An intermediary will be set up which pools agents' capital and issues securities to them. Let $A = N_I + M_I$ be the total endowment of the capital good contributed by members of this intermediary as of date $t = 0$, where $N_I = N - N_S$ and $M_I = M - M_S$. The subscript I refers to the capital of agents joining the intermediary and S refers to the capital of agents continuing to invest in the stock market. The total return of the intermediary's assets at date $t = 2$ is AR_i, $i = H, L$. Ownership of two types of claims on this capital are offered to agents: debt claims and equity claims. Let D and E (whose sum equals A) be the total amount of capital contributed by agents who own debt and equity claims, respectively.

The contract also imposes a debt to equity ratio ceiling such that the total payment promised to debt claims, DR_D, must be less than or equal to AR_L, i.e., debt claims are required to be riskless;

(14) $$D R_D \leq A R_L = (D + E) R_L \ .$$

Therefore,

(15) $$\frac{D}{(D+E)} \leq \frac{R_L}{R_D} \quad \text{or} \quad E \geq \frac{D\,(R_D - R_L)}{R_L} \ .$$

We would like to consider whether offering agents this intermediary contract would affect the Imperfectly Competitive Rational Expectations Equilibrium analyzed in the previous section. Before stating a series of propositions related to this issue, we make an additional assumption that will simplify the proof of the first of these propositions. We assume that conditional on being a late consumer, the probability of the state being $w_i = w_h$ or $w_i = w_l$, is equally likely. If late consumers form expectations in a Bayesian manner, this implies;

(16) $$q_h(1 - w_h) = q_l(1 - w_l) \ .$$

Now suppose that liquidity traders are allowed to offer the intermediary transactions contract to all agents as a possible trading mechanism. It is clear that for R_D sufficiently high, liquidity traders are better off holding bank debt. The question is whether or not the Insider Coalition can remain self-enforcing if individual informed agents can choose to become bank equity holders. If it cannot then the equilibrium studied in the previous section will not exist.

Proposition 2: (Non-existence of Stock Market Insider Equilibrium) Consider a small number of liquidity traders, say N_I (close to zero), choosing to form a bank. Then, if the ratio of informed to uninformed agents' capital, $\frac{M}{N}$, is sufficiently large, there exists a rate of return on intermediary debt, R_D, such that; (i) debt is riskless, (ii) liquidity traders prefer to invest their capital in the debt of the intermediary rather than the stock market, and (iii) individual informed agents prefer to invest their capital in the equity of the intermediary rather than the stock market insider coalition.

Proof: See the Appendix.

Proposition 2 says that if all agents are currently investing in the stock market then a small group of liquidity traders have the incentive to alternatively invest in riskless debt. By purchasing the riskless debt of the intermediary to be used as a tradable asset at time 1, the liquidity traders can increase their expected utility. Further, an intermediary issuing equity and riskless debt can be feasible because some informed traders can be induced to also invest in the intermediary at date $t = 0$ by buying equity. These informed agents will choose to defect from the Insider Coalition if their expected return on an intermediary equity investment exceeds their expected return from being a member of the Insider Coalition. Bank equity can pay a higher rate of return if the total capital of the informed agents relative to the liquidity traders is sufficiently large.

The next proposition states that an equilibrium can exist where all liquidity traders choose to purchase the riskless debt of an intermediary and informed agents derive no advantage from operating an Insider Coalition in the stock market. The proof of this proposition assumes the following condition which includes condition (5) assumed previously;

(17) $$R_L < \frac{e_1(1 - w_h)}{w_h} < \overline{R} < \frac{e_1(1 - w_l)}{w_l} < R_H \ .$$

Proposition 3: (Existence of an Intermediary Equilibrium) If $\frac{M}{N}$ is sufficiently large, then there exists an equilibrium where; (i) all liquidity traders purchase riskless debt of the intermediary and (ii) informed agents will choose to contribute equity capital.

Proof: See the Appendix.

The intuition behind this result is that if informed agents' capital is sufficiently large relative to that of the liquidity traders, it is feasible for a bank to issue sufficient riskless debt that can be used by all liquidity traders for transactions.[3] Implicitly, the existence of this bank transactions contract allows the informed agents to be identified so that trade with them can be avoided. All liquidity traders who are early consumers will trade bank debt for endowment at date $t = 1$. Late consumers considering selling their endowment at date $t = 1$ will never choose to purchase stock market capital because they know that only informed agents will be supplying stock market capital for endowment, and then only when the return on capital is low. Thus the stock market becomes an Akerloff (1970) "Lemons" market and late consumers will choose to trade only with early consumers selling intermediary debt. In this sense, liquidity traders are able to "protect" themselves from possible disadvantageous trades with the better informed agents.

In summary, we have shown that conditions exist where liquidity traders are better off holding intermediary debt which is made riskless because some informed investors will voluntarily contribute equity capital for the intermediary. Under these conditions, with $N_I = N$ and $N_s = 0$, the advantage that the Insider Coalition derives from superior information is completely eliminated. With no one to trade with at date $t = 1$ except other informed agents, informed agents' expected rate of return on stock is simply $\bar{R}$. With sufficient defections from the Insider Coalition, the competitive expected rate of return on intermediary equity will also approach $\bar{R}$, resulting in a deposit rate, R_D, with a limiting value equal to $\bar{R}$ Hence the private intermediary contract can result in an allocation which gives all agents an expected utility arbitrarily close to the full information case.

B. Corporate Debt and Money Market Mutual Funds as a Transactions Contract

So far we have implicitly assumed that "firms" do not issue debt. That is, when we considered the stock market equilibrium in Section IV, we imagined individuals exchanging their capital with firms who issued them equity shares. In this section we briefly consider what happens if the firms are willing to buy capital at $t = 0$ in exchange for either debt or equity. So now there exists a market for corporate debt, such as commercial paper.

Suppose a firm offers to pay R_D per dollar of debt and issues an amount of debt such that $DR_D = AR_L$, where $A = D + E$ is the firm's total assets. Then it is immediately apparent that the firm can offer the same riskless debt as the intermediary we described previously. All of the above arguments about the intermediary now apply to the firm. Agents need not directly hold the claims of firms, but mutual funds could arise to specialize in holding either debt or equity claims. In particular, funds similar to money market mutual funds could purchase the high-grade debt (e.g., commercial paper) of firms. As before, the equilibrium would be for all liquidity traders to buy claims on the debt fund, and all informed traders to buy claims on the firm's equity.

VI. Deposit Insurance and a Government Debt Market

A deposit insurance system for banks can also satisfy the liquidity traders' desire for a safe asset for trading. In this section we show how deposit insurance can replicate the allocation of the previous section when intermediary debt is risky. In addition, we show that development of a government debt market is similar to deposit insurance, as it involves government creation of a risk-free asset. In a like manner, a government debt market can replicate the riskless corporate debt and money market fund transaction contract when riskless corporate debt is in insufficient supply.

As Merton (1977) has observed, "the traditional advantages to depositors of using a bank rather than making direct market purchases of fixed-income securities . . . economies of scale, smaller transactions costs, liquidity, and convenience . . . are only important advantages if deposits can be treated as riskless." Presumably, if depositors were not riskless, then small agents would face information and surveillance costs necessary to evaluate the current risk of bank liabilities. Without this information, other informed agents might then take advantage of them. Consequently, less informed agents would benefit if there was deposit insurance. Indeed, a stated goal of government deposit insurance is to protect the small investor.

Suppose that deposits are risky, i.e., $DR_D > AR_L$. This would be the case if, for example, the capital endowment of the informed agents is too small to provide enough riskless debt or if $R_L = 0$. In other words, if the low return state of the world is realized, then deposits will incur a capital loss. The insurance system works as follows. If R_L is realized, so that the bank fails, then the government is assumed to tax all late consuming agents in proportion to their endowment in order to raise enough revenue to pay off the bank debt at par.[4] The government will also charge an insurance premium that the bank pays if it does not fail, i.e., when R_H is realized, which is allocated to all late consuming agents.

Let T be the tax revenue collected when the bank fails. In order to avoid a capital loss on deposits if R_L is realized, the amount of insurance needed is: $T = DR_D - AR_L$. Each agent consuming at date $t = 2$ pays a share of T. At $t = 2$ there are informed agents who were endowed with M units of capital and $N(1 - w_i)$, $w_i = w_l$ or w_H, late consuming liquidity traders, each having been endowed with one unit of capital. This insurance arrangement will only be feasible if, regardless of the proportion of early consumers, the remaining agents can afford to pay the tax. Thus, feasibility requires:

(18a) $$T/[M + N(1 - w_i)] < e_2, \quad i = l, h$$

(18b) $$T/[M + N(1 - w_i)] < R_D + e_1 \frac{R_D}{p_{Di}}, \quad i = l, h$$

Informed agents have, at least, Me_2, their second period endowment.[5] Thus, the tax per unit capital cannot exceed the e_2 endowment. This is requirement (18a) above. Similarly, (18b) requires that the late consuming liquidity traders, who have assets of $R_D + e_1 \frac{R_D}{p_{Di}}$ be able to afford the tax. (The values of p_{Di} are given by A.21 in the Appendix).

If the bank does not fail, then the bank pays an insurance premium of ϕ to the rest of the economy, which consists of all informed agents and depositors. The expected return to the bank equity holders in the presence of deposit insurance is:

(19) $$E[R_E]E = \left(\tfrac{1}{2}\right)[R_H(D + E) - (R_D + \phi)D] + \left(\tfrac{1}{2}\right) \cdot 0 .$$

It is straighforward to solve for a fair insurance premium. Since bank failure and bank solvency are equally likely, i.e., R_L and R_H each occur with probability one half, a fair insurance premium equates the amount paid as a premium in the high state with the amount of insurance coverage in the low state:

(20) $$\phi D = T = D R_D - (D + E) R_L$$

which implies that

(21) $$\phi = R_D - \frac{(D + E)}{D} R_L \ .$$

Substituting (21), the expression for the fair deposit insurance premium, into (19), yields:

(22) $$E\,[R_E]\, E = \frac{(R_H + R_L)}{2} (D + E) - R_D D \ .$$

As in the previous section, consider a competitive equilibrium where the expected rate of return on equity approaches $\bar{R}$. In this case, equation (22) shows that R_D also approaches $\bar{R}$. Therefore, the allocation under the deposit insurance scheme gives agents the same expected utility as in the case of the private uninsured intermediary considered in the previous section. In summary, we have shown:

Proposition 4: (Deposit Insurance) When bank debt is risky, the tax-subsidy scheme $\{T, \phi\}$, defined above, can implement an allocation which gives all agents the same expected utility as in the riskless private bank deposit allocation.

Similar to government intervention as a deposit insurer, we can consider whether government intervention can benefit uninformed agents when firms issue corporate debt held by mutual funds, as was described previously. Let us start from the assumption that each firm issues riskless debt such that

(23) $$A_i R_L \geq D_i R_D$$

where A_i and D_i are the assets and debt of firm i, respectively. However, suppose that the assets of firms are of sufficient risk to preclude uninformed agents from placing their entire wealth in risk-free corporate debt. In this case, government intervention in the form of a government debt market can allow uninformed agents to replicate the allocation of the previous section IV.B where riskless corporate debt was in sufficient supply.

As with the deposit insurance scheme, the government can create additional risk-free securities backed by lump sum taxation of agents' endowment in period two. The government simply issues claims on second period endowment equal to the difference between uninformed agents time 0 endowment and the supply of risk free corporate debt, so that the government sells bonds for capital equal to $N - D$ at time zero. Since government and firm debt are perfect substitutes, they each pay a two period return of R_D, implying that the par value of government bonds at time 2, B, equals

$$B = (N - D) R_D \ . \tag{24}$$

The government is assumed to invest the capital it acquires at time 0, either directly investing it itself or giving it to firms which issue it in equity shares. At time $t = 2$, this investment is worth $(N - D)R_i$, $i = H, L$. The short fall (excess) between this investment return and the promised payments on bonds, B, is made up by lump sum taxation (subsidization) of late consumers, subject to feasibility requirements similar to (18a) and (18b). Competitive equilibrium implies that the expected return on equity as well as the return on riskless debt will equal $\bar{R}$.

Thus, the additional debt supplied by the government can allow mutual funds to purchase sufficient risk-free securities to meet the demand for transactions liabilities by uninformed agents. Hence, this intervention can also restore to uninformed agents an allocation which gives them the same expected utility as in the full information case.

VII. Conclusion

The historically popular notion that large agents can benefit at the expense of small agents is true in the setting which we have analyzed. Informed agents can form an insider coalition which is self-enforcing and can benefit at the expense of the lesser informed agents. When this condition exists, a demand for transactions contracts by uninformed agents will result. These transactions contracts have the effect of eliminating the potential advantage possessed by better informed agents. We have inquired about the nature of these contracts.

Transactions contracts can take the form of banks. We have formalized a traditional rationale or the existence of banks and deposit insurance, namely, that they exist to provide a riskless transactions medium that eliminates the need of "small" agents to trade in assets whose returns are known by better informed agents. The financial structure of a bank can create safe debt securities for trading if it can offer a sufficient quantity of equity to informed agents that has an expected return at least as high as would be earned by a stock market investment. In instances where bank asset risk is such that uninsured deposits cannot be made riskless, we have shown that deposit insurance can replicate the allocation achieved with riskless private bank deposits.

An issue which we have not considered concerns possible equilibria where banks exist but their uninsured bank deposits are risky. In this situation we conjecture that the liquidity traders would be better off than without the bank, but clearly would not be as well off as the case of riskless bank debt. The value of risky bank debt would depend on the state of nature, but to a lesser extent than would stock. Informed traders might still use their information advantage.

Private corporate debt, perhaps combined with government securities, is another form of transaction contract. Money market mutual funds can create riskless portfolios which, like bank debt, allow the uninformed to trade without fear of loss to informed agents. The recent growth of the market for short-term corporate debt, much of it held by money market mutual funds, makes the possibility of substituting these instruments for bank debt intriguing.[6] A public policy debate has smoldered around whether such alternative instruments should be encouraged or restricted as transactions media. In our analysis there is not reason to prefer bank debt over money market mutual funds. However, extending our analysis to consider the regulatory distortions and monitoring costs associated with bank deposit insurance might lead to a preference for a money market mutual fund based transactions system.

Appendix

Proof of Proposition 2

Step 1 of the proof is to consider the situation of the liquidity traders. Given the feasibility of the intermediary, we derive the conditions under which they are better off purchasing the intermediary's debt rather than investing their capital in the stock market. Step 2 considers the informed agents and shows that under the conditions derived in step 1, they may be individually better off by becoming equity holders in the intermediary rather than being members of the Insider Coalition that operates in the stock market. Thus, if informed agents are willing to contribute equity capital, the intermediary contract is feasible.

Step 1: Let p_{Dij} be the number of endowment units received in exchange for one unit of the debt claim at date $t = 1$ when the state is $\{i, j\}$ where $i = l, h$, and $j = L, H$. Because of the risk neutrality of uninformed agents, at time $t = 1$ it must be the case that

(A.1)
$$\frac{R_D}{p_{Dij}} = \frac{R^e}{p_{ij}} \equiv r_{ij}$$

where R^e is the uninformed late consumers' expectation at time $t = 1$ of the return on the capital good at time $t = 2$, and r_{ij} is defined to be this common expected re-investment rate when state $\{i, j\}$ occurs.

We can now calculate the time $t = 0$ expected utility of an uninformed agent who invests capital in the stock market, $E_S[C_1 + C_2]$, and the utility of an uninformed agent who invests capital in the debt of the intermediary, $E_I[C_1 + C_2]$.

(A.2)
$$E_S[C_1 + C_2] = \sum_{\{i,j\}} \frac{q_i}{2}(w_i(e_1 + p_{ij}) + (1 - w_i)\, r_{ij}(e_1 + P_{ij}))$$

(A.3)
$$E_I[C_1 + C_2] = \sum_{\{i,j\}} \frac{q_i}{2}(w_i(e_1 + p_{Dij}) + (1 - w_i)\, r_{ij}(e_1 + p_{Dij}))$$

The difference between (A.3) and (A.2) will determine whether uninformed agents have an incentive to invest in the intermediary or not.

(A.4)
$$E_I[C_1 + C_2] - E_S[C_1 + C_2] = \sum_{\{i,j\}} \frac{q_i}{2}(p_{Dij} - p_{ij})(w_i + (1 - w_i)\, r_{ij})$$

To determine the sign of A.4, we need to compute the prices p_{Dij} and p_{ij}. As in section IV of the text, these prices will, in general, depend on the parameters of the model as well as the actions of the informed agents. Analogous to condition (5) in the text, we state the following conditions;

$$R_H > \frac{e_1(1-w_l)}{w_l} + \frac{N_I}{N_S}\left(\frac{e_1(1-w_l)}{w_l} - R_D\right) \tag{A.5}$$

$$R_L < \frac{e_1(1-w_h)}{w_h} + \frac{N_I}{N_S}\left(\frac{e_1(1-w_h)}{w_h} - R_D\right). \tag{A.6}$$

Note that for N_I sufficiently small relative to N_S, conditions (A.5) and (A.6) will hold if condition (5) holds. Thus, we wish to examine the incentives for a small group of uninformed agents to join an intermediary, given that there currently exists a large number in the stock market.

Analogous to the results of section IV, if conditions (A.5) and (A.6) hold, then states $\{l, H\}$ and $\{h, L\}$ are fully revealing, while an Insider Coalition can form to purchase endowment in state $\{l, L\}$ to mimic the prices of all securities in state $\{h, H\}$. This, leads to the following set of state-contingent prices and time $t = 1$ re-investment rates:

$$\begin{aligned}
&p_{DlH} = \frac{e_1(1-w_l)NR_D}{w_l(N_I R_D + N_S R_H)}, \quad p_{lH} = p_{DlH}\frac{R_H}{R_D}, \quad r_{lH} = \frac{R_D}{p_{DlH}} \\
&p_{DhL} = R_D, \quad p_{hL} = R_L, \quad r_{hL} = 1 \\
&p_{DlL} = p_{DhH} = \frac{e_1(1-w_h)NR_D}{w_h(N_I R_D + N_S R^*)}, \quad p_{lL} = p_{hH} = p_{DlL} = \frac{R^*}{R_D}, \\
&r_{lL} = r_{hH} = \frac{R_D}{p_{DlL}}
\end{aligned} \tag{A.7}$$

where R* is the late consumers' expectation at time 1 of the return on capital at date 2, R^e, when the state is only partially revealed to be either $\{l, L\}$ or $\{h, H\}$. Substituting these prices and re-investment rates into (A.4) and simplifying, one obtains:

$$E_I[C_1 + C_2] - E_S[C_1 + C_2] =$$

(A.8)
$$\tfrac{1}{2}(R_D - R*)\left[\frac{(1-w_h)Ne_1(q_h w_h + q_l w_l)}{w_h(N_I R_D + N_S R*)} + q_h(1-w_h) + q_l(1-w_l)\right]$$
$$+ \tfrac{1}{2}(R_D - R_H)q_l(1-w_l)\left[\frac{Ne_1}{N_I R_D + N_S R_H} + 1\right] + \tfrac{1}{2}(R_D - R_L)q_h \ .$$

Consider the value of the expression as N_I becomes small, i.e., the limit as N_S becomes N.

$$\lim_{N_I \to 0} E_I[C_1 + C_2] - E_S[C_1 + C_2] =$$

(A.9)
$$\tfrac{1}{2}(R_D - R*)\left[\frac{(1-w_h)}{R*w_h} e_1(q_h w_h + q_l w_l) + q_h(1-w_h) + q_l(1-w_l)\right]$$
$$+ \tfrac{1}{2}(R_D - R_H)q_l(1-w_l)\left(\frac{e_1}{R_H} + 1\right) + \tfrac{1}{2}(R_D - R_L)q_h \ .$$

Recall that if late consumers form expectations in a Bayesian fashion, then their expectation at time $t = 1$ of the return on capital, $E[R_j]$, is:

(A.10)
$$R* = \frac{q_h(1-w_h)R_H + q_l(1-w_l)R_L}{q_h(1-w_h) + q_l(1-w_l)} \ .$$

Substituting (A.10) into (A.9) we see that (A.9) is linear and strictly increasing in R_D. For R_D sufficiently large, uninformed will prefer joining the intermediary.

Under the simplifying assumption that conditional on being a late consumer, the probability of the state being h of l is equally likely, i.e., condition (16), then $R* = \bar{R}$. In this case it is easy to show that condition (A.9) will be strictly positive for a value of R_D which is less than $\bar{R}$. Setting the right hand side of equation (A.9) to zero, we can solve for the minimum return on intermediary debt, R_D^m, for which uninformed agents are as well off joining the intermediary as they are staying in the stock market;

(A.11) $$R_D^m = \bar{R} - q_l(1-w_l)\left(\frac{R_H - R_L}{2}\right)\left[\frac{w_h}{1-w_h} - \frac{e_1}{R_H}\right]/\theta$$

where

$$\theta \equiv \left[\frac{(1-w_h)}{w_h}\ \frac{e_1}{\bar{R}}(q_h w_h + q_l w_l) + q_l(1-w_l)\left(3 + \frac{e_1}{R_H}\right) + q_h\right] > 0\ .$$

The term in brackets on the right hand side of (A.11) is strictly positive because of condition (5). Since (A.9) is continuous and strictly increasing in R_D, it must also be strictly positive for some value of R_D less than $\bar{R}$.

Step 2: Given that liquidity traders have an incentive to leave the stock market and join the intermediary for $R_D > R_D^m$, we now show that the intermediary contract will be feasible if informed agents can be induced to provide equity financing rather than invest their capital with the stock market Insider Coalition.

The informed agents who are members of the stock market Insider Coalition will sell their capital to mimic the state $\{h, H\}$ when the state is actually $\{l, L\}$. They purchase endowment in the amount;

(A.12) $$M_{lL} = \frac{(w_h - w_l)}{(1-w_h)}(N_S + N_I R_D / R^*)$$

which results in their time 0 expected utility per unit capital to be;

(A.13) $$E[C_2] = e_2 + \bar{R} + \frac{q_l}{2}\frac{M_{lL}}{M_S}(p_{lL} - R_L)$$

where p_{lL} is given by (A.7).

Note that for $R_D < R^*$, M_{lL} is less than in the case in which $N_I = 0$ analyzed in section IV, while p_{lL} is less than p_{lL}^* given in section IV. Thus, the expected utility of the informed agents falls in this case if M_S stays the same. Now if some informed agents defect from the Insider Coalition and invest their capital, equal to M_I, in the equity of the intermediary, their expected return would be:

(A.14) $$E[M_I R_E] = \bar{R}(N_I + M_I) - R_D N_I$$

If the intermediary's capital constraint is binding so that N_I and M_I follow the debt and equity proportions given in equation (15), then the expected return on intermediary equity equals:

(A.15)
$$E[R_E] = \overline{R} + (\overline{R} - R_L)\frac{R_L}{(R_D - R_L)}$$

Thus, comparing (A.15) with (A.13), we see that an informed agent who invests in the equity of the intermediary will have a higher expected return than an informed agent in the Insider Coalition if:

(A.16)
$$\frac{(\overline{R} - R_D)}{(R_D - R_L)} R_L > \frac{q_l}{2}\frac{(N_S + N_I R_D / R*)}{M_S}\frac{(w_h - w_l)}{(1 - w_h)}(p_{lL} - R_L) \ .$$

Consider the incentive for informed investors to defect from the stock market coalition when initially N_S is close to N. Taking the limit of (A.16) as N_I goes to zero, and re-arranging terms results in:

(A.17)
$$(\overline{R} - R_D) > \frac{q_l}{2}\frac{N}{M}\frac{(w_h - w_l)}{(1 - w_h)}\left[\frac{e_1(1 - w_h)}{w_h R_L} - 1\right](R_D - R_L) \ .$$

Now suppose R_D is set such that

(A.18)
$$\overline{R} > R_D \geq R_D^m$$

where R_D^m is given by (A.11). Both sides of condition (A.17) are strictly positive, but the right hand side of (A.17) can be made sufficiently small for M sufficiently large. (Note R_D^m is independent of M.) Thus for N/M sufficiently large, a return on intermediary debt can be offered which gives both uninformed and informed agents the incentive to start an intermediary.

<u>Proof of Proposition 3</u>

We first take the feasibility of the intermediary for $N_I = N$ as given and later present the conditions regarding M that are needed for this to hold. If all liquidity traders initially invest in the riskless debt of the intermediary, consider the possibility of the informed traders being able to strategically purchase the endowment of the late consumers when the return on stock market capital is low.

Given condition (17), consider a return on intermediary debt, R_D, such that:

(A.19)
$$e_1\frac{(1 - w_h)}{w_h} < R_D \leq \overline{R} \ .$$

Similar to the analysis of section III in the text, it is straightforward to show that a full information equilibrium would result in the time $t = 1$ prices of intermediary debt equal to:

$$p_{Dlj} = R_D \ , \quad j = L, H \qquad \text{(Some Storage)}$$

(A.20) $$p_{Dhj} = e_1 (1 - w_h)/w_h \ , \quad j = L, H \qquad \text{(No Storage)}$$

In other words, some storage occurs whenever there is a low proportion, w_l, of early consumers and no storage occurs whenever there is a high proportion, w_h of early consumers. In equilibrium, the price of stock market capital will satisfy:

(A.21) $$p_{ij} = p_{Dij} E[R_j]/R_D = p_{Dij} \frac{R_j}{R_D}$$

Now consider the case of asymmetric information. Stock market insiders would like to be able to purchase endowment and sell stock market capital at time 1 when the return on capital is low, R_L. Potentially, they could do this, as before, when state $\{l,L\}$ occurs, purchasing endowment from late consumers equal to:

(A.22) $$M_{lL} = \frac{(w_h - w_l)}{(1 - w_h)} \frac{R_D}{R*}$$

where R* is the later consumers' expectation of the return on capital when the state is actually $\{l,L\}$. If endowment could be purchased in this amount, the time $t = 1$ price of debt and stock market capital would be:

(A.23) $$p_{DlL} = e_1 \frac{(1 - w_h)}{w_h} \ , p_{lL} = p_{DlL} \frac{R*}{R_D}$$

which would seem to imply that the stock market Insider Coalition could again mimic the state $\{h, H\}$ when the state is actually $\{l, L\}$. However, this reasoning cannot be correct. The critical point is that rational late consumers would never choose to sell their endowment for stock market capital because the only sellers of stock market capital are informed agents, who the late consumers know would only choose to sell capital when the return is R_L. Unlike the situation considered in section IV where liquidity traders invested in the stock market at time zero, late consumers will now realize that they will only be trading capital with informed agents, and then only when the return on capital is R_L. Hence late consumers would only offer a price for stock market capital of:

(A.24)
$$p_{ij} = p_{Dij}\frac{R_L}{R_D}$$

At this price, there would be no incentive for informed agents to purchase endowment, so M_{IL} = 0 and p_{Dij} would always be equal to its full information price given in (A.20), as late consumers would only sell endowment for the riskless debt of early consumers. This results in the expected utility of uninformed agents being equal to:

(A.25)
$$E[C_1 + C_2] = e_1 + R_D$$

and the stock market Insider Coalition being devoid of power, their return on capital simply being equal to $\bar{R}$. Hence, in order to attract informed agents to contribute to the intermediary, R_D need only be an arbitrarily small amount less than $\bar{R}$, and uninformed agents utility would approach their full information level. In addition, it is straightforward to show that individual liquidity traders would never choose to invest their capital in the stock market rather than the intermediary, since if they turn out to be an early consumer, they can only sell their capital to late consumers at a price which always reflects the return on capital being R_L given by (A.24).

Finally, to show that the intermediary and, therefore, this equilibrium are feasible, informed agents must have sufficient capital in order to purchase the minimum amount of intermediary equity required to make the intermediary's debt riskless. Using condition (15), we have;

(A.26)
$$M > \frac{D(R_D - R_L)}{R_L}\ .$$

Note that the larger is R_L, the smaller is the amount of equity capital needed to enable the intermediary's debt to be riskless.

Footnotes

[1]Examples of models where banks solve agency problems include Campbell and Kracaw (1980) and Diamond (1984). For an example of a model where banks provide risk sharing as well as allow more efficient production, see Diamond and Dybvig (1983).

[2]See Bernheim, Peleg, and Whinston (1987) for the motivation for this definition of a self-enforcing coalition. This equilibrium concept refines the set of possible Nash equilibria of the game between the insiders when they choose the Insider Coalition strategy. For our purposes it focuses attention on equilibria of interest, namely, ones in which insider trading occurs.

[3]In addition, as is shown in the Appendix, the greater is R_L, the higher is the feasible leverage of the intermediary, i.e., the smaller is the proportion of informed agents needed to join the intermediary to make its debt riskless. The greater the leverage, the less R_D needs to be lowered in order to raise the expected rate of return on the intermediary's equity in order to attract informed agents.

[4]The government is assumed to observe the bank failure at date $t = 2$.

[5]Informed agents holding bank equity have only e_2 per unit of initial endowed capital since their bank equity is worthless, while informed agents in the stock market have $e_2 + R_L$.

[6]Perhaps an unplanned benefit of large government budget deficits has been an increased supply of riskless debt, further adding to the feasibility of a transactions system backed by money market instruments.

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