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FINANCIAL INDUSTRIAL GROUPS

COST OF MONITORING AND WHY BANK OWNS FIRMS

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В работе вводится рассматривается фирма, частью которой владеет банк. Фирма управляется менеджером.. Предполагается, что интересы менеджера и владельцев различны и что только банк обладает технологией контроля над менеджером и издержки этого контроля отрицательно зависят от доли акций фирмы, которыми владеет банк. В работе ищется оптимальные для банка и для остальных владельцев доли акций фирмы, которыми владеет банк и исследуются их свойства.

Khoroshilov Yu.M. Financial industrial groups cost of monitoring and why bank owns firms. / Working Paper #BSR/98/006 E - Moscow, New Economic School, 1998. - 20 p. (Engl.)

This paper considers a firm that is partially hold by a bank and partially by non-banking agents. We assume that there is a moral hazard on behalf of the managers. Bank is the only owner of the firm that has a monitoring technology. The costs of monitoring depend negatively on the number of shares of the firm that the bank has. We find the optimal for the bank and the other shareholders stake of the bank ownership and analyze there properties.

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INTRODUCTION

There are many different reasons for the creation of Financial-Industrial Groups (FIGs) in Russia. Enterprise mergers in general can lead to more efficient production, or to greater monopoly power, or to a reduction in transaction costs. Mergers among enterprises can take place through vertical integration (perhaps to decrease transaction costs) or through horizontal integration (which could extend market power). But a merger between a bank and an enterprise has its own specific features, in particular because the bank should think not only about the enterprises productive efficiency, but also about repayment of its loans. So, it would seem that one of the main reasons why banks merge with firms is improved monitoring: by sharing ownership with a productive enterprise, the bank may be in a better position to detect and influence the enterprise's use of loans.

Two types of monitoring can be distinguished: monitoring over the firm and monitoring over the manager. The paper of Burkart, Gromb and Panunze (1997), considers the problem of monitoring the manager. In their model there is no need for investment, and the large shareholder in a firm is not specified as a bank. In reality, however, there is often a need for investment. Moreover, because such investment funds often come from a bank in the form of a loan, banks require some assurance of repayment of the debt. Because of the very long bankruptcy procedure in Russia and because of the high costs of implementing this procedure, an attractive alternative for a bank to secure its loans is to take partial ownership in the firm. Thus, in Russia, banks usually play the role of large shareholders. But the bank is also a lender, so we do not have the usual principal-agent problem: the principal here is a bank, and it benefits not only by receiving profit as a shareholder, but also as a lender.

Nevertheless, banks generally do not buy all of the shares of the enterprise, to become the sole owner. Why? Should a bank seek full control, or should it give some freedom to the manager, even if this freedom is freedom to lie or even to steal? These questions are considered further in the text, which develops a model in which a bank owns part of the firm because it needs to control the manager in a way that will promote debt repayment. As it is shown, such ownership is beneficial not only for the bank, but also for other shareholders of the enterprise.

Principal-agent problem is widely considered in the literature. In particular there is a lot of 'single principal-single agent' literature. Papers of Harris and Raviv (1979), Holmstrom (1979), and Shavell (1979) develop the conditions when monitoring of additional information about an agent helps to resolve moral hazard problems. The standard principal-agent problem answers the question: how, under the asymmetric information, it is possible to induce manager to do what principal wants. The aim in this case is to build an optimal contract such that it becomes profitable for the manager to do what the principal wants. This contract usually sets the manager's wage as a function of an observable outcome. Another approach to this problem could be found in the paper of Burkart, Gromb and Panunze (1997). They do not look precisely at the manager's contract but they want to answer the question: how the principal should act to pursue manager to work optimally for the principal. Trying to influence manager's decisions the main shareholder may change his stock of shares. At the same time, the probability of the manager to be controlled changes. The main shareholder with some probability controls the manager and this probability is the function of the stake of shares the main shareholder has. The other shareholders in this situation are free-riders and they want main shareholder to have more shares than it is optimal for him (such a free-rider problem was considered in Burkart (1995)). Burkart, Gromb, and Panunze consider the model in which there are several projects that can not be distinguished initially. The manager by taking costly actions can distinguish these projects with some probability. If these projects are already distinguished by the manager then the main shareholder through costly actions can distinguish them with another probability. In my paper I've used this framework, but with different initial assumptions. Burkart, Gromb, and Panunze (1997) assumed that all projects are costless, but it is not a good assumption. I consider the case when these projects can be implemented after proper investments and the bank which gives the money for investments is the main shareholder. In this case the bank's control over the manager has positive external effect not only on the other shareholders, but also for the bank itself as a lender. Thus, the question who wants the bank has more shares (bank itself or the other shareholders) is not trivial. I also assume that the cost needed to distinguish projects for the bank is decreasing with increasing the bank's stake in the firm (this assumption is also discussed further in the paper).

Burkart, Gromb, and Panunze (1997) give a wide review of the 'principal-agent' literature. A lot of property rights literature (such as Grossman and Hart (1986) and Hart and Moor (1990)) argues that parties without ownership may be discouraged from undertaking asset-specific investments because the owners of asset can use their control rights to hold them up. This theory, however, is not able to capture the separation of ownership and control precisely since it equates these two concepts. Following Aghion and Tirole (1997) I suggest that control rights translate into effective control only when their holders have incentives to exercise them. I argue that the ownership structure is a powerful technology to allocate effective control in a way that mitigates the holdup problem. Several papers show how an investor's inability to commit to abstain from rent extraction has adverse effect on the agents incentives. In Rajan (1992) and von Thadden (1995), its informational monopoly allows a firm's exclusive lender to dictate the terms of continuation finance, thus distorting the firm's investment choice. Shleifer and Summers (1988) propose that hostile takeovers are a means to extract stakeholders' ex post rent by removing managers committed to uphold implicit contracts. The papers of Acemoglu (1995) and Myers (1996) independently analyze the trade-off between the benefits of tighter control and lower incentives for insiders associated with outside ownership concentration. Both are free cash flow frameworks with exogenous costs of exercising control. Cremer (1995) analyses a principal's trade-off between solving a moral hazard problem by remaining uninformed about his agent's type, and solving an adverse selection problem by becoming informed. The principal is assumed to be able to commit to his choice. In my paper the firm's ownership structure constitutes a commitment technology that balances the conflicting effect of information acquisition optimally.

THE MODEL

Consider a firm which is deciding among four possible investment projects. Let this firm be run by a manager. Each project gives some benefit to the firm and some private benefit to the manager. Each project costs \$1.

Project #4 can be characterized as 'do nothing' and this project yields (1,0) with certainty (\$1 to the firm and nothing to the manager).

Project #3 yields $(-\infty,-\infty)$ with certainty.

Project #2 yields (P,b) with probability λ and $(0,b)$ with probability $(1-\lambda)$.

Project #1 yields (P,b) with probability λ and $(P,0)$ with probability $(1-\lambda)$.

Projects #1, #2 and #3 can not be distinguished prior to implementing the project unless the manager exerts some effort.

Suppose that there is a bank which can make a loan of \$1 to the firm to finance a project. Let ρ be the amount to be repaid, including the principal (\$1) and an interest charge. For convenience, we will call ρ the "interest factor".

Mechanism of repayment of the debt: Debt can be (at least partially) repaid only if the firm has a positive profit. If the profit of the firm is greater than ρ then the bank receives ρ. If the profit is less than ρ then the bank receives all of the profit (and, so, shareholders of the firm receive nothing).

Let α represent the fraction of the shares of the firm that is owned by the bank.

The manager by exerting effort in the amount $\frac{e^2}{2}$ can distinguish among projects #1,2 and 3 with probability e. The bank can also obtain through effort $\frac{E^2}{2\alpha}$ a probability E chance of acquiring the same information that the manager has. Let e and E be chosen simultaneously. There are two different approaches to the problem of control. Some economists argue that the control function should be discrete, for example, there is no control if the bank has less than 50% of the shares and

there is a full control if the bank has more than 50% of the shares. Alternatively, control can be viewed as a continuous concept, and perhaps this approach is a better reflection of reality. It is likely that the more shares of the enterprise the bank owns, the greater the influence of the bank's opinion on the firm's actions. Even agreed that more shares lead to more control, some economists argue that larger control leads not to the cheaper access to the information, but to the more information. The cost function $\frac{E^2}{2\alpha}$ reflects cost of actions needed to distinguish projects with given information, and this function does not reflect the costs needed to receive this information. We should also notice that there are significant arguments supporting this type of cost function. While working the project manager receives a lot of auxiliary information, with which it can distinguish projects in future. The manager can voluntary disclose the part of this information to the bank (i.e. the manager can cheat). The more truthful information manager can give to the bank, the cheaper the control over the manager for the bank. If the manager cheats the bank will try to fire the manager. The more shares of the firm the bank has, the more its voting power and the easier it can convince other shareholders to fire the manager. (The concept of voting power can be found in the Perotti (1992).) To prevent full control over him from the bank the manager will voluntary provide the part of the information it has to the bank. And the bigger the treat to fire the manager the more information will be available for the bank. Thus, the more of auxiliary information about the projects is available for the bank the larger possibility for the bank to distinguish projects. We have that if the bank has more shares in the firm, the technology of project distinguishing becomes cheaper for the bank. The functional form of bank costs $\frac{E^2}{2\alpha}$ reflects this fact.

The game:

The bank makes a loan with interest factor ρ.

The bank and the manager simultaneously choose e and E. Then, if the manager can not distinguish among the projects, project #4 is chosen. If only the manager distinguishes among the projects, he chooses his best project (#2). If the bank also can distinguish among the projects, then the best project for the bank (#1) is chosen; i.e. if the bank has information about the payoffs of the project, it can control the manager's choice. After this the chosen project is implemented and the payoffs are received.

Note: in this model the bank plays two roles:

(1) The bank is a lender.

(2) the bank is a shareholder in the firm (as in Burkart, Gromb and Panunzi, 1997).

This model can now be used to address some interesting questions, including:

1. How does the probability that the manager acquires the information e and the probability that that the bank matches the manager's information E depend on the bank's share α of ownership of the firm?

2. What is the bank's optimal level of ownership α_1 of the firm?

3. What level of ownership by the bank α_2 maximizes the value of the firm?

4. How do α_1 and α_2 depend on the parameters λ, b and P?

Moreover, if the bank owns no shares of the firm ($\alpha = 0$), then $E = 0$. In this case, for an expected return to the bank of zero, $(1-e)+e\lambda \min\{\rho, P\} = 1$. So, $\min\{\rho, P\} = \frac{1}{\lambda}$ for the bank to earn normal profits. But if $P < \frac{1}{\lambda}$ then with $E = 0$, the bank cannot break even and the firm can not receive a loan. So,

5. Can partial ownership of the firm by the bank improve the situation, in the sense that profitable loans can be made even when $P < \frac{1}{\lambda}$?

SOLVING THE MODEL

First, let $P > \frac{1}{\lambda}$, so that even without any bank ownership, the enterprise can still receive a loan. We assume that investment projects are large (i.e., we think about the investment cost of \$1 as a large amount of money) and that the private profit of the manager is small in comparison to the cost of the project ($b << 1$). Let us now find equilibrium strategies for the manager and the bank (e and E correspondingly), under the assumption that α is fixed.

The problem for the manager will be:

$$(1-e)\cdot 0 + e[E\lambda b + (1-E)b] - \frac{e^2}{2} \to \max_e$$

So, F.O.C.: $e = \min\{Eb(\lambda - 1) + b, 1\}$

To write the problem for the bank we should note that through its efforts in the amount of $\frac{E^2}{2\alpha}$, it receives profit as a shareholder in the amount

$$\alpha\{\lambda(1-e)\cdot 0 + e[E(P-\rho) + (1-E)\lambda(P-\rho)]\},$$

and as a lender it receives: $-1 + (1-e) + e[E\rho + (1-E)\rho]$.

So, the bank's problem will be:

$$\alpha e[E(P-\rho) + (1-E)\lambda(P-\rho)] - 1 + (1-e) + e[E\rho + (1-E)\lambda\rho] - \frac{E^2}{2\alpha} \to \max_E$$

and F.O.C. gives us: $E = \min\{\alpha e(1-\lambda)[P\alpha + \rho(1-\alpha)], 1\}$. Because we assume that *b* is small, we have:

$$\begin{cases} e = Eb(\lambda - 1) + b \\ E = \alpha e(1-\lambda)[P\alpha + \rho(1-\alpha)] \end{cases}.$$

If we denote $x = P\alpha^2 + \rho\alpha(1-\alpha)$ we can solve this system and find:

$$\begin{cases} e = \dfrac{1}{1 + b(1-\lambda)^2 x} \\ E = \dfrac{x(1-\lambda)}{1 + b(1-\lambda)^2 x} \end{cases}.$$

Because $\frac{\partial x}{\partial \alpha} > 0$ for $\alpha \in [0, 1]$, there is a one-to-one correspondence between x and α, and $\alpha(x)$ is an increasing function. Thus, to determine the dependence of the choice variables of the problem on α we need only to study their dependence on x.

Proposition 1. $\frac{\partial E}{\partial \alpha} > 0; \frac{\partial e}{\partial \alpha} < 0.$

Proof: Because $\frac{\partial E}{\partial x} > 0$, $\frac{\partial e}{\partial x} < 0$, and $\frac{\partial x}{\partial \alpha} > 0$ we have $\frac{\partial E}{\partial \alpha} > 0$ and $\frac{\partial e}{\partial \alpha} < 0.$

This result accords well with economic intuition: when the bank's stake of shares increases, first, the profits of ordinary shareholders become more important to the bank, and second, the cost of monitoring $\frac{E^2}{2\alpha}$ becomes smaller. So, E becomes higher.

For the manager, however, an increase in the bank's stake leads to a decrease in e. Indeed, enhanced control of the manager by the bank (a larger E) decreases the probability that the manager will choose the project himself, leading to a diminution in the manager's effort to acquire information about the payoffs of the projects.

It is interesting to determine which α_2 maximizes the market value of the firm, which α_1 maximizes the profit of the bank, and which of these α_i is larger. The comparison of these shares is both of theoretical and practical interest. For example, when establishing a company its founders decide how many shares to sell on the external market. If they want to get a bank interested in the project they can simply sell some stake of the assets of their firm to the bank at a price below the market one, if such ownership will increase the market value of the firm. Moreover, if $\alpha_1 > \alpha_2$ then by selling only α_2 shares to the bank and withholding the other shares the firm can achieve its maximal value. If $\alpha_1 < \alpha_2$ then the above procedure is impossible since the bank can sell the excess $\alpha_2 - \alpha_1$ shares to outsiders, thereby increasing its profit while lowering the market value of the firm.

To find α_2 (the level of α which maximizes the value of the firm), we can write the value of the firm as a function of α:

$$W(\alpha) = e\left[E(P-\rho) + (1-E)\lambda(P-\rho)\right] = (P-\rho)\left[eE(1-\lambda) + e\lambda\right]$$

where e and E are functions of α.

Because $\frac{\partial \alpha}{\partial x} > 0$ we can rewrite this expression as a function of x:

$$W = (P-\rho)\left[\frac{x(1-\lambda)^2}{(1+b(1-\lambda)^2 x)^2} + \frac{\lambda}{1+b(1-\lambda)^2 x}\right] \to \max_x.$$

So, the F.O.C. with respect to x yields

$$\frac{(1+b(1-\lambda)^2x)^2(1-\lambda)^2 - x(1-\lambda)^2 2b(1-\lambda)^2(1+b(1-\lambda)^2x)}{(1+b(1-\lambda)^2x)^4} - \frac{\lambda b(1-\lambda)^2}{(1+b(1-\lambda)^2x)^2} = 0$$

$$1+b(1-\lambda)^2x - x(1-\lambda)^2 2b - \lambda b\left(1+b(1-\lambda)^2x\right) = 0 \ ,$$

and we have $x_2 = \frac{1-\lambda b}{b(1-\lambda)^2 + \lambda b^2(1-\lambda)^2} = \frac{1-\lambda b}{(1-\lambda)^2 b(1+\lambda b)}$.

Proposition 2. The α_2 which maximizes the value of the firm does not depend on the maximum firm's revenue P, and decreases when the manager's private benefit b increases.

Proof. x_1 does not depend on P;

$x_1 = \frac{1-\lambda b}{(b+\lambda b^2)(1-\lambda)^2}$ but $1-\lambda b$ decreases in b and $b+\lambda b^2$ increases in b so x_1 decreases in b.

Moreover, $\frac{\partial \alpha}{\partial x} > 0$, and therefore the claim is proved.

Proposition 2 indicates that the profit of the shareholders can be either 0 or $(P-\rho)$, and therefore, the expected profit of the shareholders is highest when they receive $(P-\rho)$ with the maximal probability. This probability depends on α and does not depend on P.

If the private benefit of the manager, *b,* increases, there will be two effects on the shareholders:

i) because the manager has an increased incentive to work the bank can strengthen the monitoring over the manager's behavior (i.e., increase E). This increased monitoring can then be facilitated through an increase of α;

ii) on the other hand, relaxing the monitoring of the manager (by making E smaller) further increases the manager's incentive to work, and this can be beneficial for shareholders, in that it becomes more likely that a profitable project will be undertaken as opposed to doing nothing.

In our case we can see that the second effect dominates the first one, so increases in b lead to a lower α_2.

For finding α_1 (the α which maximizes the problem of the bank), it is helpful look at the problem of the bank in a different way: Imagine that the bank initially is not an owner of the firm's shares but that it may want to buy these shares on the competitive market.

If the bank has already purchased β shares then the market value of the firm will be:

$$e(\beta)\left[E(\beta)(P-\rho)+(1-E(\beta))\lambda(P-\rho)\right]$$

and if the bank buys α shares then its total expenditure on shares is

$$\int_0^{\alpha} \beta\, e(\beta)\left[E(\beta)(P-\rho)+(1-E(\beta))\lambda(P-\rho)\right]d\beta .$$

The profit of the bank can be written as

$$V=\alpha\, e(\alpha)\left[E(\alpha)(P-\rho)+(1-E(\alpha))\lambda(P-\rho)\right]-$$
$$-\int_0^{\alpha} \beta\, e(\beta)\left[E(\beta)(P-\rho)+(1-E(\beta))\lambda(P-\rho)\right]d\beta+$$
$$+(1-e(\alpha))+e(\alpha)\left[E(\alpha)\rho+(1-E(\alpha))\lambda\rho\right]-1-\frac{E(\alpha)^2}{2\alpha}$$

where $\alpha\, e(\alpha)\left[E(\alpha)(P-\rho)+(1-E(\alpha))\lambda(P-\rho)\right]$ is its profit as a shareholder,

$(1-e(\alpha))+e(\alpha)\left[E(\alpha)\rho+(1-E(\alpha))\lambda\rho\right]-1$ is its gross profit as a bank, and

$(1-e(\alpha))+e(\alpha)\left[E(\alpha)\rho+(1-E(\alpha))\lambda\rho\right]-1-\frac{E(\alpha)^2}{2\alpha}$ is its net of monitoring costs profit as a bank.

Thus, we have $V=\pi_i+\pi_l$ where

$$\pi_i=\alpha\, e(\alpha)\left[E(\alpha)(P-\rho)+(1-E(\alpha))\lambda(P-\rho)\right]-$$
$$-\int_0^{\alpha} \beta\, e(\beta)\left[E(\beta)(P-\rho)+(1-E(\beta))\lambda(P-\rho)\right]d\beta$$

is the net profit of the bank as an investor and,

$\pi_l=(1-e(\alpha))+e(\alpha)\left[E(\alpha)\rho+(1-E(\alpha))\lambda\rho\right]-1-\frac{E(\alpha)^2}{2\alpha}$ is the net profit of the bank as a lender.

How would the bank act if it maximized its profit only as an investor? When buying an additional share, the bank pays an amount proportional to the market value of the firm. Thus, from the purchase of this particular share alone it does not receive any additional profit. But after buying this share the bank's behavior changes the market value of the firm, and thus the additional share also changes the bank's revenues from the previously purchased shares.

So, the bank's profit as an investor is maximized when $\alpha = \alpha_2$ (i.e., in the case when the market value of the firm is maximal**).** But the bank, in optimally choosing α_1 looks not only at its profit as an investor (π_i) but also at its profit as a lender (π_l). So, to find whether α_1 is greater than α_2 we should look at $\frac{\partial \pi_l}{\partial \alpha}$ at the point $\alpha = \alpha_2$, and if $\frac{\partial \pi_l}{\partial \alpha} > 0$, then it is profitable for the bank to increase α. And, so, in this case $\alpha_1 > \alpha_2$. If, on the other hand, $\frac{\partial \pi_l}{\partial \alpha} < 0$, then it is profitable for the bank to decrease α yielding $\alpha_1 < \alpha_2$.

The sign$(\frac{\partial \pi_l}{\partial x})$ can be determined formally as follows:

$$\pi_l = eE\rho(1-\lambda) - \frac{E^2}{2\alpha} + e(\lambda\rho - 1) = \frac{x(1-\lambda)^2\rho}{(1+b(1-\lambda)^2 x)^2} - \frac{x^2(1-\lambda)^2}{2\alpha(1+b(1-\lambda)^2 x)^2} + \frac{\lambda\rho - 1}{1+b(1-\lambda)^2 x} =$$

$$= \frac{x(1-\lambda)^2(2\alpha\rho - x)}{2\alpha(1+b(1-\lambda)^2 x)^2} + \frac{\lambda\rho - 1}{1+b(1-\lambda)^2 x}.$$

Because $\frac{\partial \alpha}{\partial x} > 0$, it is enough to find sign$(\frac{\partial \pi_l}{\partial x})$.

$$\frac{\partial \pi_l}{\partial x} = \frac{(1-\rho\lambda)b(1-\lambda)^2}{(1+b(1-\lambda)^2 x)^2} +$$

$$+ \frac{(1-\lambda)^2}{2\alpha(1+b(1-\lambda)^2 x)^4}[(2\alpha\rho - 2x)(1+b(1-\lambda)^2 x)^2 - 2b(1-\lambda)^2(1+b(1-\lambda)^2 x)x(2\alpha\rho - x)],$$

hence,

$$\text{sign}(\frac{\partial \pi_l}{\partial x}) = \text{sign}[(1-\lambda\rho)b2\alpha(1+b(1-\lambda)^2 x) +$$

$$+ (2\alpha\rho - 2x)(1+b(1-\lambda)^2 x) - 2b(1-\lambda)^2 x(2\alpha\rho - x)] =$$

$$= \text{sign}[x\{2\alpha(1-\rho\lambda)b^2(1-\lambda)^2 - 2 + 2\alpha\rho b(1-\lambda)^2 - 2\alpha\rho b(1-\lambda)^2\} +$$

$$+ 2\alpha b(1-\rho\lambda) + 2\alpha\rho] =$$

$$= \text{sign}[x\{2\alpha(1-\rho\lambda)b^2(1-\lambda)^2 - 2\} + 2\alpha b(1-\rho\lambda) + 2\alpha\rho].$$

After substituting here $x = x_2 = \frac{1-\lambda b}{b(1-\lambda)^2(1+\lambda b)}$ we have

$$\operatorname{sign}\frac{\partial \pi_l}{\partial x} = \operatorname{sign}[(1-\lambda b)\{2\alpha(1-\rho\lambda)b^2(1-\lambda)^2-2\}+\{(1-\rho\lambda)b+2\alpha\rho\}b(1-\lambda)^2(1+\lambda b)] =$$
$$= \operatorname{sign}[-2+bH(b)]$$

where *H(b)* is a bounded function for small *b*.

Because we have assumed that *b* is small, $\frac{\partial \pi_l}{\partial x} < 0$. So, we have proved the following proposition:

Proposition 3.

The share of the firm ownership that is optimal from the point of view of the bank, α_1 is less than α_2, the share which maximizes the market value of the firm.

This proposition also suggests an economic interpretation: the outside shareholders resemble free riders, because the cost of monitoring the manager is paid for only by the bank. So, outside shareholders will prefer a higher E than the E which the bank will choose. But E positively depends on α. Therefore, outside shareholders will prefer a higher α than the α preferred by the bank. This explains why the α_2 which maximizes the market value of the firm is greater than the α_1 which maximizes the bank's profit.

Now consider the case when $P < \frac{1}{\lambda}$.

If $\alpha = 0$ then, obviously, the bank will not give a loan to the firm and the firm can not invest in a project. Is it possible that there exists an $\alpha < 1$ such that the bank will lend to the firm and the firm can invest in a project? Note that the firm can not get a loan from another bank. So, the bank which holds the firm's shares can choose any interest factor $\rho \le P$. It is easy to show that the profit of the bank increases with ρ. Hence, in any equilibrium in this case $\rho = P$. This implies that the profit of shareholders is zero. Is it possible that the bank will have a positive profit? When the profit of shareholders is equal to zero, the profit of the bank is

$$\pi = (1-e)+e[E\rho+(1-E)\lambda\rho]-\frac{E^2}{2\alpha}-1.$$

Is there an α for which it possible that $\pi > 0$?

$\pi > 0 \Leftrightarrow$

$$e[E\rho + (1-E)\lambda\rho - 1] - \frac{E^2}{2\alpha} > 0 \quad \Leftrightarrow$$

$$\frac{E^2}{e} < 2\alpha[E\rho + (1-E)\lambda\rho - 1] \quad \Leftrightarrow$$

$$\frac{x^2(1-\lambda)^2}{1+b(1-\lambda)^2 x} < 2\alpha[\frac{\rho(1-\lambda)^2 x}{1+b(1-\lambda)^2 x} + (\lambda\rho - 1)] \quad \Leftrightarrow$$

$$x^2(1-\lambda)^2 < 2\alpha[\rho(1-\lambda)^2 x + (\lambda\rho - 1)(1+b(1-\lambda)^2 x)].$$

Recall that $x = P\alpha^2 + \rho(1-\alpha)\alpha$. Using $\rho = P$, we have $x = \rho\lambda$. Hence, we can rewrite the previous inequality as follows:

$$\rho\alpha(1-\lambda)^2 < 2[\rho^2(1-\lambda)^2\alpha + (\lambda\rho - 1)(1+b(1-\lambda)^2\rho\alpha] \quad \Leftrightarrow$$

$$\alpha\rho^2(1-\lambda)^2 < \alpha[2\rho^2(1-\lambda)^2 + (\lambda\rho - 1)b(1-\lambda)^2\rho] + 2(\lambda\rho - 1) \quad \Leftrightarrow \text{(note: } \lambda\rho < 1)$$

$$\alpha > \frac{2(1-\lambda\rho)}{2\rho^2(1-\lambda)^2 + \lambda\rho b(1-\lambda)^2\rho - \rho^2(1-\lambda)^2} \quad \Leftrightarrow$$

$$\alpha > \frac{2(1-\lambda\rho)}{\rho^2(1-\lambda)^2 - (1-\lambda)^2\rho b(1-\lambda\rho)}. \qquad (*)$$

For the firm to be able to invest in a project when $P \le \frac{1}{\lambda}$, it is necessary that the bank receive a positive profit for some $\alpha < 1$. That is, the following inequality is needed:

$$1 > \frac{2(1-\lambda\rho)}{\rho^2(1-\lambda)^2 - (1-\lambda)^2\rho b(1-\lambda\rho)} \quad \Leftrightarrow$$

$$\rho^2(1-\lambda)^2 - 2 + 2\lambda\rho - (1-\lambda)^2\rho b(1-\lambda\rho) > 0. \qquad (**)$$

This is the condition that must be satisfied if there exists an $\alpha < 1$ under which the firm will invest. To show that this condition can be satisfied, consider a very small *b* such that we can ignore the term $(1-\lambda)^2\rho b(1-\lambda\rho)$. And, let us also consider the largest possible ρ. Because $\rho = P$ and $P \le \frac{1}{\lambda}$, the largest possible ρ is $\frac{1}{\lambda}$. So, the condition (**) becomes $\frac{1}{\lambda^2}(1-\lambda)^2 - 2 + 2 > 0$, which is always true. Hence, condition (**) can be satisfied. Therefore, the following proposition is proved:

Proposition 4.

If $P < \frac{1}{\lambda}$ and $\alpha = 0$ (no cross ownership) then the firm can not obtain a loan and, consequently, can not invest in a project. But if the parameters P, λ and b are such that condition (**) is satisfied (where $\rho = P$), and if the bank holds α shares of the firm where $\alpha \in [\frac{2(1-\lambda\rho)}{\rho^2(1-\lambda)^2 - (1-\lambda)^2 \rho b(1-\lambda\rho)}, 1]$ then the firm will invest, and the manager and the bank will both have positive profits while the shareholders will have a profit of zero.

FUTURE POSSIBLE EXTENSIONS TO THIS MODEL

It is possible to add another step to the game: imagine that after implementing a chosen project, only the manager can observe the result. The bank, by expending additional efforts $\frac{\varepsilon^2}{2}$, can observe the result with probability ε.

The game is as follows: the bank chooses ε, and the manager simultaneously announces the result of the project.

If the bank can not observe the result, and the manager lies, then all agree on what the manager said and the payoffs occur (the manager obtains his private benefit plus that part of the firm's benefit which he has hidden).

If the bank can observe the result and the manager tells the truth then the payoffs occur.

If the bank can observe the result, and the manager lies, then the real result is announced by the bank, and the payoffs occur, where the manager has additional losses (for example, he or she goes to prison or pays a penalty).

We leave for future research the questions of how this model works and how this extension influences the results of the basic model concerning $(e, E, \alpha_1, \alpha_2)$.

CONCLUDING REMARKS

As demonstrated in the model, partial bank ownership of an enterprise can be helpful in two ways: first, it permits the firm to obtain credit in situations where it would not receive credit in the absence of partial ownership and, second, it leads to a more efficient solution. However, full ownership is not the best solution either for bank or for the shareholders, because all agents can benefit when there is not full bank control and the manager has an opportunity to choose projects independently. Independence leads to the manager willing to invest more effort in learning the quality of projects. In the model, the principal-agent problem was solved not by giving the manager the right to residual revenue, but rather by giving him residual control (with some positive probability).

Finally, the model has implications for the distribution of additional income arising from the efficiency gain. As noted, owners can benefit from selling part of their shares to the bank. So, the price for these shares can be below the prevailing market price. On the other hand, the bank also benefits from this deal because it may give a loan to the firm at the market interest rate, which yields more than a fair return for this loan. So, the bank makes positive economic profit. This suggests the possibility that the price for the shares which the shareholders sell to the bank can be higher than market price. Thus, the surplus presents a bargaining game between the bank and shareholders. The level of competition of firms and banks at the market will determine the relative bargaining strength of the parties.

For example, if there is perfect competition among banks, and it is impossible to buy a large quantity of shares on the open market (for example, if it is a state enterprise which the government wants to sell), then prices for the shares will be higher than the “fair” price (the value of the firm), and all of this surplus will be received by the initial shareholders.

If, on the other hand, capital is scare and there is competition among firms, than prices for shares will be lower than their "fair" value, and the bank receives all the gain

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