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Banks' equity stakes in borrowing firms: A corporate finance approach

Suomen Pankin keskustelualoitteita
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Abstract

In most countries, banks' equity holdings in firms that borrow from then are rather small. In light of the theoretical literature, this is somewhat surprising. For example, according to agency cost models, allowing banks to hold equity would seem to alleviate firms' asset substitution moral hazard problem associated with debt financing. This idea is formalised in John, John, and Saunders in a model where banks are modeled as passive investors and bank loans are the only source of outside finance for firms. In this paper, we argue that this alleged benefit of banks' equity holding is small or non-existent when banks are modeled explicitly as active monitors and firms have access also to market finance.

Key words: banks' equity holdings, firms' capital structure, social welfare

JEL classification numbers: D82, G32

Pankkien osakesijoitukset luotottamiinsa yrityksiin: Yritysrahoitusteoreettinen näkökulma

Suomen Pankin keskustelualoitteita 13/2003

Jukka Vauhkonen
Tutkimusosasto

Tiivistelmä

Pankkien osakesijoitukset luotottamiinsa yrityksiin ovat useimmissa maissa varsin pieniä. Teoreettisen kirjallisuuden valossa tämä on hiukan yllättävää. Esimerkiksi agentuurikustannusmallien perusteella pankkien osakesijoitukset luotottamiinsa yrityksiin näyttäisivät lievittävän velkarahoitukseen liittyvää yritysten moraali-kato-ongelmaa. John, John ja Saunders ovat formalisoineet tämän idean mallissa, jossa pankit ovat passiivisia investoijia ja yritysten ainoa ulkoisen rahoituksen lähde. Tässä tutkimuksessa osoitetaan, että pankkien osakeomistusten mahdollinen hyöty on pieni tai olematon, kun pankit mallinnetaan yritysten monitoroijiksi ja kun yritykset pystyvät hankkimaan rahoitusta suoraan rahoitusmarkkinoilta.

Avainsanat: pankkien osakeomistukset, yritysten pääomarakenne, hyvinvointi

JEL-luokittelu: D82, G32

Contents

1 Introduction

A well-known agency cost of debt, identified, for example, by Jensen and Meckling (1976), is that debt-financed entrepreneurs may benefit from investing in suboptimal projects. As shown by Jensen and Meckling (1976), this 'asset substitution' effect may be alleviated by financing the firm with equity. It is natural to think that banks, as creditors, are also faced with this asset substitution problem, and that bank's holding of equity in the borrowing firm may improve the efficiency of the entrepreneur's project choice.

This simple idea is modeled by John et al (1994). They examine the firm's risk choice in a model, where the chosen riskiness of the firm's investment project is the entrepreneur's private information and where banks are the only source of outside finance. Banks finance firms with debt and/or equity, which are characterised merely as claims to the cash flows of the project. In this simple framework, John et al (1994), find, not surprisingly, that allowing banks to invest in equity reduces the risk-taking incentives of firms.

At first glance, the idea of John et al (1994) is persuasive. However, in this paper, we argue that the benefits of banks' equity holdings may be small or even non-existent when two realistic complications are introduced to the framework of John et al (1994). First, we explicitly model banks as monitors. In John et al (1994), banks can reduce the asset substitution problem only by financing firms an appropriate mix of debt and equity claims. In other words, they treat the bank merely as a passive substitute for the firm's capital structure. In contrast to them, we assume that banks can employ a costly (interim) monitoring technology to reduce the asset substitution moral hazard problem. Second, we assume that, in addition to (informed) bank finance, firms have access to (uninformed) market finance. As far as we know and as pointed out by Santos (1999, p. 1111), there are no other studies investigating banks' equity holdings in borrowing firms when firms have access to market finance.

Our critique on John et al (1994) is close to the critique of Gorton and Winton (2002) directed towards some other models of banks' equity holdings, such as Berlin et al (1996) and Mahrt-Smith (2000). In their models, as argued by Gorton and Winton (2002, p. 44), subordinating the bank's loans accomplishes the same ends as having the bank hold equity. We, in turn, show that the monitoring by the bank and the firm's access to the market finance may accomplish the same ends as having the bank hold equity. Our critique may also be seen as a theoretical support to the well-known empirical observation that banks' equity holdings are rather small in most countries.

We consider the following model. Entrepreneurs are characterised by their initial wealth w, $0 \leq w < 1$. They need $1 - w$ units of funds from outside financiers to carry out a unit-sized investment project at date 0. The entrepreneur can invest

either in a socially efficient safe project or in a socially inefficient risky project at date 1. This assumption together with the assumption that the entrepreneur is wealth-constrained implies that there is the standard asset substitution problem between the entrepreneur and debtholders. The role of equity is to ameliorate this asset substitution problem. In order for debt to have a special role, we introduce an additional moral hazard problem to the framework of John et al (1994). Following Boyd et al (1997) and La Porta et al (2002), and to be discussed below, we assume that the entrepreneur can 'divert' or 'steal' the invested funds ('take the money and run'), albeit with a cost.[1] An important assumption of our model is that the entrepreneur's cost of diverting the funds raised by debt is higher than the cost of diverting the funds raised by equity. This assumption allows us to build a model, in which both debt and equity have distinct roles to play. Equity is superior to debt in alleviating the asset substitution moral hazard problem, and debt is superior to equity in reducing the diversion moral hazard problem.

There are two types of outside financiers: banks and uninformed financiers, such as small shareholders and bondholders. Uninformed financiers do not observe the project choice at any cost. The bank, in turn, can commit to monitor the entrepreneur's project choice at an interim date. This information enables the bank to liquidate the project, if the continuation payoff of the risky project (safe project is never liquidated) does not guarantee her a sufficient continuation payoff. Although liquidation is inefficient ex post, the bank may be able to impose a credible threat of liquidating the risky project. This threat of liquidation may act as a disciplinary device. If the project is not liquidated at date 2, it continues until date 3, at which date the payoffs of the project are divided between financiers and the entrepreneur.

In the above model, we examine how entrepreneurs, characterised by their initial wealth and the liquidation value of their projects, choose the firm's capital structure. The entrepreneur can choose between uninformed finance, bank finance, or a mixture of both (mixed finance). We examine the feasibility of different types of finance and characterise the conditions under which a combination of a bank loan and an equity investment by the bank is the only feasible financing mix for an entrepreneur.

In our model, the feasibility of finance requires that the financing mix is such that it induces the entrepreneur to invest in the safe project instead of investing in the risky project or diverting the funds and that the financiers are guaranteed a sufficient rate of return. More technically, the feasibility of finance requires that financiers' participation constraints and the entrepreneur's incentive compatibility constraints ('asset substitution constraint' and 'diversion constraint') are satisfied.

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[1] In the absence of this assumption, there would be no role for debt as equity finance would completely eliminate the asset substitution problem. The assumption of costly diversion is a simple way to introduce debt into our model.

We show that, sufficiently wealthy entrepreneurs receive cheap uninformed finance, either in the form of bonds, equity, or a mixture of both. In contrast, firms with lower wealth must rely on more expensive informed finance. Bank loans are feasible for some entrepreneurs with low-wealth but high liquidation values for whom the bank can impose a credible threat of liquidation. However, the liquidation threat is not credible for some entrepreneurs with low liquidation values, as the bank's continuation return from letting the risky project continue is higher than the liquidation value. This creates a role for mixed finance.

The role of mixed finance is that it allows a reduction in the funds contributed by the bank and thus restores the credibility of the liquidation threat. This enables some entrepreneurs, for whom uninformed finance and bank loans are unavailable, to finance their projects with mixed finance. However, similarly as in Repullo and Suarez (1998), mixed finance is not feasible for all entrepreneurs as the bank and the investor can collude at the expense of uninformed investors. More specifically, the entrepreneur can first invest in the inefficient risky project and then bribe the bank not to liquidate the project by offering the bank a new contract, to the detriment of uninformed financiers. Anticipating this, uninformed financiers do not participate in the financing unless the initial contract between the entrepreneur, the bank, and uninformed investors is renegotiation-proof. For some entrepreneurs with low wealth and low liquidation values, there are no such renegotiation-proof contracts.

To summarise the above discussion, there are some entrepreneurs with low wealth and low liquidation values for whom neither uninformed finance, bank loans nor mixed finance are feasible. Thus, there is a potential role for financing these entrepreneurs with a combination of a bank loan and an equity investment by the same bank. Our principal finding is that this mode of finance dominates other forms of finance only under quite stringent conditions. The main implication of this finding is that the social benefits of allowing banks to hold equity in their borrowing firms seem rather small, at least in the case where equity is characterised only by its cash flow rights.

The social benefits of banks' equity holdings in their borrowing firms may be small because of the following two disadvantages of banks' equity stakes. First, in general, equity finance may give rise to other moral hazard problems that are absent or smaller under debt financing. In our model, banks' equity holdings give rise to the diversion moral hazard problem. Another problem of the bank's equity stake is that it reduces the credibility of the bank's liquidation threat by increasing the bank's returns from letting the risky project continue. Mixed finance, in contrast, enhances the credibility of bank's liquidation threat. Therefore, mixed finance may be feasible for many entrepreneurs for whom the mixture of bank loans and bank's equity investment is not feasible. Despite these disadvantages of banks' equity holdings, allowing banks to hold equity may be welfare increasing,

if banks, as equityholders, are less vulnerable to the diversion moral hazard problem than uninformed equityholders.

Besides John et al (1994), there are some other theoretical papers that examine banks' incentives to hold equity in their borrowing firms. James (1995) and Berlin et al (1996) argue that a bank's equity stake may facilitate more effective bank interventions when firms are in financial distress. Sheard (1989) and Flath (1993) suggest that by holding stock in the firms they lend, banks acquire insider information facilitating their monitoring of the firms' decisions.[2] Steinherr and Huveneers (1994), in turn, suggest that banks' equity ownership strengthens the long-run relationship between the bank and the borrower. Unfortunately, they do not work out their idea in a fully specified model. In Mahrt-Smith (2000), it is easier for a firm to acquire additional funds from outside banks, if the informed inside bank holds both debt and equity. Yet another role for banks' equity ownership is provided by Boyd et al (1997) and Santos (1999), who show that banks' investments in equity alleviate the moral hazard problem caused by deposit insurance. Finally, our model is largely based on Repullo and Suarez (1998), which is a model of mixed finance. However, Repullo and Suarez (1998) do not address the issue of the banks' equity holding in borrowing firms, which is our main interest.

The rest of the article is organised as follows. In section 2, we present the model. In sections 3, 4, and 5, we examine the feasibility of uninformed finance, bank finance, and mixed finance, respectively. In section 6, we collect the results and present our major results. Section 7 concludes.

2 The model

2.1 Ingredients

A. Investment technology

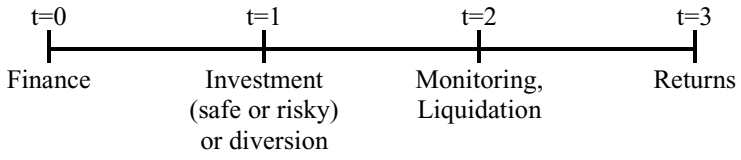
Consider a model with four dates ($t = 0,1,2,3$) and a continuum of risk-neutral owner-managed firms (henceforth 'entrepreneurs' or 'firms') characterised by their initial wealth $w \in [0,1)$ and the liquidation value $L \in [0,1)$ of their project. The cost of the project is normalised at one, and the investment is made at date 1. To carry out the investment project, the entrepreneur needs $1 - w$ outside funds from informed or uninformed investors at date 0. The entrepreneur can invest either in the socially efficient safe project or in the socially inefficient risky project.

[2] Their view, however, is challenged by Berlin et al (1996, p. 890) who argue that large investors acquire similar information whether or not their claim includes an equity component.

Alternatively, the entrepreneur can simply divert or 'steal' the borrowed funds. We assume that the diversion is costly for the entrepreneur. The returns of the safe and the risky project and the costs of diversion will be specified below.

If the entrepreneur invests in the safe or in the risky project, the assets purchased can be liquidated by creditors at date 2. Since $L < 1$, the liquidation is always inefficient. Note that the firm-specific liquidation value is the same for the safe and the risky project. At date 3, the liquidation values depreciate to zero. If the project is not liquidated at date 2, it yields monetary returns at date 3. The safe project yields a return $S > 1$ with certainty. Risky projects yield a good return G with probability $1/2 < p < 1$ and a bad return 0 with probability $1 - p$. For project returns it holds that $G > S > 1 > pG$, implying that risky projects are socially inefficient.

The following time line displays the sequence of events.



B. Financiers

Following Rajan (1992) and Repullo and Suarez (1998), for example, we differentiate between informed (bank) finance and uninformed (market) finance. Banks differ from uninformed investors in that at date 2 they can learn the firm's choice between the safe and the risky project at a cost c. We assume that c is sufficiently small, $c < S - 1$. On the basis of this information acquired by monitoring, the bank can either liquidate the firm's assets or let the project continue. To avoid the issues related to endogenous monitoring, we assume that the bank can *commit* to use the monitoring technology. We further assume that the information acquired by monitoring is not verifiable. Because of unverifiability of information, financial contracts cannot be conditional on the choice of project.

In contrast to banks, uninformed investors are unable to observe the project choice. We regard uninformed investors as small investors, who either lack the ability to monitor or have no incentives to monitor because of free-rider problems.

The markets for both bank finance and uninformed finance are assumed to be competitive.

C. Contracts

We allow two types of contracts: debt and equity. The contract between the entrepreneur and the financier is signed at date 0, and it defines the size of the financier's investment, and her share of the success returns if the project is not liquidated.

The *debt contract* between the entrepreneur and the type f financier $f \in \{i, u\}$, where i denotes the bank (informed investor) and u denotes the uninformed investor, is denoted by a pair $(I_{f,d}, D_f)$. $I_{f,d}$ denotes the size of the debt provided by a type f financier, and D_f is her required debt repayment.

We assume that debtholders have a right to force the firm to repay the loan early if demanded. We can assume, for example, that debtholders can demand an early repayment of the debt under 'materially adverse circumstances' (see eg Brealey and Myers 1996, p. 692–693). In our model, the materially adverse circumstances correspond to the entrepreneur investing in the risky project. Note that the right to call the debt right is worthless for the uninformed financier as she does not observe the entrepreneur's project choice. In contrast, the right to liquidate is valuable for the bank. Although the liquidation is inefficient from the social point of view, we show that the bank can in some circumstances use the liquidation threat as a *disciplinary device* that induces the entrepreneur to invest in the socially efficient safe project.

We further assume that the bank debt is senior. Thus, in the event of default the bank is paid before other financiers. It seems that seniority is a typical characteristic of bank debt contracts (see eg Gorton and Kahn 1993). Furthermore, in their moral hazard setup Repullo and Suarez (1998) show that the seniority of informed (bank) debt is a feature of optimal security design.

The standard limited liability assumption implies that in case the project is not liquidated, the type f financier's profit from a debt contract $(I_{f,d}, D_f)$ is $R_f = [\tilde{x}, D_f] - I_{f,d}$, where $\tilde{x}$ = S, G or 0.

Equity contracts are characterized by a pair $(I_{f,e}, \alpha_f)$. The variable $I_{f,e}$ denotes the size of the equity investment made by a type f investor. The variable α_f denotes the type f investor's share of the firm profit (of which debt repayments have been deducted). We assume that at most one type of financiers holds equity in any firm. Thus, if a firm raises funds by issuing equity, then equity is held either by the bank or by uninformed investors but not by both. We can show that this assumption implies no loss of generality. Given this assumption, the type f equityholder's return from an equity contract $(I_{f,e}, \alpha_f)$ for a return realisation $\tilde{x}$ and for given realised total debt repayments R_T is simply $\alpha_f(\tilde{x} - R_T)$. Note that we treat outside equity merely as a claim to the future cash flows of the project. Thus, we assume that outside equityholders have no control rights in the firm. We,

in effect, assume that the firm is controlled by the entrepreneur, who simply controls the board, and thus is able to make decisions that serve his own interests.

As explained above, debt and equity differ by their cash flow and liquidation rights. We assume that there is an additional difference between debt and equity: Debt is better than equity in protecting financiers from direct expropriation by the entrepreneur. This difference is discussed next.

D. Diversion of funds

The large 'agency cost' literature, initiated by Jensen and Meckling (1976), shows how the separation of ownership and control can induce self-interested managers to waste investors' funds. In our model, the entrepreneur can waste investors' funds in two ways. First, as discussed above, he can invest in the socially inefficient risky project. Second, to be discussed in this subsection, he can simply divert or steal the funds provided by the financier.[3] Of course, in reality the expropriation may take more subtle forms. For example, the entrepreneur can transfer firm resources in the form of salary or invest in the managerial perquisites as in Jensen and Meckling (1976). For simplicity, however, we follow Boyd et al (1998) by assuming that the entrepreneur can directly divert funds from financiers to himself. In case of diversion, the invested funds yield financiers no profit and no liquidation value (the entrepreneur takes the money and run).

Following Burkart et al (1998) and La Porta et al (2002), we assume that the diversion is costly. The costs of diversion include, among other things, the costs of legal or illegal maneuvering to divert profits and the costs of taking the risks of legal challenges. Because of the costs of diversion, the entrepreneur's profit from diverting an investment $I_{f,s}$, is only

$$\Pi^E = (1 - k_{f,s})I_{f,s} \tag{2.1}$$

In equation 1, $k_{f,s}$ denotes the *cost-of-theft parameter* (La Porta et al 2002). The cost-of-theft parameter determines the profits of the entrepreneur who diverts the investment $I_{f,s}$ made by a type f investor in the form of type s security (debt or equity). We make the following two key assumptions on the cost-of-theft parameters.

[3] In contrast to Hart (1995, ch. 5) and La Porta et al (2002), for example, we assume that the entrepreneur cannot steal the final cash flows.

Assumption 1. $k_{i,d} = k_{u,d} = 1$.

Assumption 2. $0 < k_{u,e} \leq k_{i,e} < 1$.

These two assumptions present two important ideas. First, in many countries, it seems to be more difficult for entrepreneurs to expropriate debtholders than equityholders. Debtholders' rights are almost universally more clearly defined than equityholders' rights, which makes it easier for courts to verify the violation of the debt contract (La Porta et al 1998). In particular, debt contracts commonly contain a wide range of covenants requiring the borrower to take or refrain from various actions. If covenants are violated, debtholders receive certain well-defined rights, such as the right to repossess collateral or the right to force the firm into the bankruptcy. As documented by La Porta et al (1998), in most countries the legal rules and the enforcement of these rules favour debtholders. Our assumptions 1 and 2 express the idea that debt contracts generally protect financiers against the managerial expropriation better than equity contracts. More specifically, assumption 1 implies that the entrepreneur's profit from diverting funds raised by debt is zero, while the profit from expropriating funds raised by equity is positive by assumption 2.

The second idea, formalised in assumption 2, is that the diverting an equity investment made by a bank is at least as costly as diverting the equity investment made by an uninformed investor. This assumption can be defended by several arguments. First, uninformed investors are often too small and too poorly informed to exercise even the control rights they actually have (Shleifer and Vishny 1997). Moreover, the free-rider problem may reduce their incentives to acquire information about the firms. Second, banks may have a large degree of monopoly power (say, because of their informational advantage) over any future credit extended to the firm. This monopoly power may reduce the entrepreneur's incentives to expropriate the bank's equity investment. Third, even in the absence of legal protection against expropriation, banks may be able to impose, using the terminology of Diamond (1984), stricter nonpecuniary penalties (ie the loss of reputation) than small equityholders against the dishonest firms.

Although our formulation of the firm's expropriation possibilities is clearly simplistic, we believe that assumptions 1 and 2 capture two important insights. First, legal systems generally protect debtholders better than equityholders and, second, large informed equityholders (such as banks) may be able to reduce the expropriation at least as effectively as small uninformed investors. Moreover, the assumption that the entrepreneur's returns from expropriating debtholders is zero (assumption 1) allows us to create a clear trade-off between debt and equity. Namely, as will be shown below, equity is superior to debt in alleviating the standard project choice moral hazard (the choice between the safe and risky

project), whereas debt is superior to equity in alleviating the expropriation moral hazard problem (the choice between stealing and the safe project).

E. Information

Here we collect our assumptions on information. Everyone knows the entrepreneur's initial wealth w and the liquidation value L at date 0. Informed investors observe the entrepreneur's date 1 choice between the safe and the risky project at a cost c at date 2. However, that choice is unobservable for uninformed investors, and unverifiable for courts. Finally, date 3 returns are observable and verifiable.

2.2 First-best equilibrium and feasible contracts

The first-best equilibrium is particularly easy to define. According to our assumptions, liquidation, diversion of funds and investing in the risky project are all socially inefficient. Thus, in the first-best equilibrium all firms, irrespective of their initial wealth and the liquidation value of their projects, should receive finance and invest in the safe project. However, as will be shown below, asymmetric information and the imperfect legal protection against the managerial expropriation render the first-best contracts unfeasible for some low-wealth, low-liquidity value firms.

As the first-best choice of the safe project is not contractible, financiers must induce the entrepreneur to choose the safe project voluntarily. In other words, the equilibrium capital structure must be incentive compatible. In what follows, we define the *feasible capital structure* as a combination of debt and equity contracts that induces the entrepreneur to choose the safe project instead of the risky project or instead of diverting the funds, and that, at the same time, satisfies all parties' participation constraints.

In sections 3–5, we examine the feasibility of uninformed finance, bank finance, and mixed finance, respectively. In section 6, we bring the results together to examine the firm's optimal capital structure.

3 Uninformed finance

Uninformed finance is feasible only if the financial contract between the entrepreneur and the uninformed investor induces the entrepreneur to choose the safe project while satisfying the investor's participation constraint.

Formally, the feasible contract must satisfy three constraints. First, the entrepreneur must prefer the safe project to the risky project ('asset substitution incentive compatibility constraint'). Second, the entrepreneur must prefer the safe project to diverting the invested funds ('diversion incentive compatibility constraint'). Third, contracts must yield the investor at least zero profits (investor's participation constraint).

We analyse three types of uninformed capital structures. In section 3.1, we examine the case when the firm is financed only with uninformed debt. In section 3.2, we examine the case of pure uninformed equity finance. In section 3.3, we study the case of mixed uninformed finance, when uninformed finance consists of both debt and equity.

3.1 Uninformed debt

By assumption 1, the entrepreneur's profits of diverting the funds raised by uninformed debt is zero. Thus, when defining the feasible contract under uninformed debt finance, we can ignore the diversion incentive compatibility constraint.

Given this observation, uninformed debt is feasible only if the required debt repayment D_u is set so as to satisfy the asset substitution constraint and the participation constraint of the uninformed financier.

$$S - D_u - w \geq p(G - D_u) - w \tag{3.1}$$

$$D_u - (1 - w) \geq 0 \tag{3.2}$$

The asset substitututution incentive compatibility constraint (3.1) requires that the entrepreneur's profits from investing in the safe project must be higher than those of investing in the risky project. The uninformed investor's participation constraint (3.2) requires that she must earn non-negative profits.

The assumption of competitive financial markets allows us to set (3.2) as equality. Solving D_u from the binding participation constraint (3.2) and inserting it into (3.1) yields the following result.

Lemma 1. *Any entrepreneur with* $w \geq w_{u,d} > 0$, *where* $w_{u,d} = [p(G-1) - S + 1]/(1-p)$, *receives uninformed debt with* $I_{u,d} = D_u = 1 - w$. *For entrepreneurs with* $0 \leq w < w_{u,d}$, *uninformed debt is not feasible.*

We rule out the uninteresting case that all entrepreneurs receive uninformed debt by assuming that parameters p, G, and S are such that $0 < w_{u,d} < 1$.

Lemma 1 states that only sufficiently wealthy entrepreneurs receive uninformed debt. Uninformed debt is not feasible for some low-wealth entrepreneur, as high leverage would induce them to invest in the risky project. This is the standard asset substitution moral hazard problem of debt financing.

3.2 Uninformed equity

In this section we derive feasible uninformed equity contracts in a situation where all the needed outside finance consists of uninformed equity, that is, when $I_{u,e} = 1 - w$.

The problem of deriving the feasible uninformed equity contracts is simplified by the following elementary observation. By assumption, $S > pG$. This implies that $(1 - \alpha_u)S > (1 - \alpha_u)pG$ for all α_u, $0 < \alpha_u \leq 1$. Thus, under equity finance, the entrepreneur's payoff from investing in the safe project is always higher than his expected payoff from investing in the risky project. In other words, there is no asset substitution problem when the firm is financed with equity. This observation allows us to ignore the asset substitution incentive compatibility constraint when deriving the feasible equity contract.

However, equity finance gives rise to another moral hazard problem, which was absent under debt finance. Namely, by equation (2.1) and assumption (2), some low-wealth firms rather divert the funds raised by equity than invest them in the safe project.

Now, uninformed equity is feasible only if

$$\left[(1-\alpha_u)S - w\right] \geq \left[(1-k_{u,e})(1-w)\right], \tag{3.3}$$

$$\alpha_u S - (1-w) \geq 0, \tag{3.4}$$

where (3.3) is the entrepreneur's diversion incentive compatibility constraint and (3.4) the participation constraint of the equityholder. The incentive compatibility constraint is satisfied if the entrepreneur's profits from investing in the safe project exceed the profits from diverting the funds. According to the participation constraint, the returns from equity must cover the equityholder's initial equity investment.

We derive the feasible equity contracts similarly as above. In competitive markets, the investor's participation constraint (3.4) binds. Solving α_u from the binding constraint (3.4) and inserting it into (3.3) yields the following result.

Lemma 2. *Any entrepreneur with $w \geq w_{u,e} > 0$, where $w_{u,e} = 1 - (S - 1)/(1 - k_{u,e})$, receives uninformed equity with $I_{u,e} = 1 - w$, $\alpha_u = (1 - w)/S$. For entrepreneurs with $0 \leq w < w_{u,e}$, uninformed equity is not feasible.*

We concentrate only in the interesting case, where parameters S and $k_{u,e}$ are such that $0 < w_{u,e} < 1$.

Similarly as with uninformed debt finance, some low-wealth entrepreneurs are denied funding under uninformed equity finance. However, now the reason is different. Under uninformed debt finance, the asset substitution moral hazard prevents outside financing. Under uninformed equity finance, it is the diversion moral hazard problem that renders uninformed equity unfeasible.

The feature of our model that equity finance resolves the asset substitution moral hazard problem whereas debt finance resolves the diversion moral hazard problem provides a prima facie case for mixed uninformed finance. One could expect that some low-wealth entrepreneurs for whom the pure forms of uninformed finance are not feasible could finance their investments with mixed uninformed finance. That possibility is analysed next.

3.3 Mixed uninformed finance

Under mixed uninformed finance, the entrepreneur finances his investment with a combination of uninformed debt and uninformed equity. Thus, the sum of the funds raised by uninformed debt and uninformed equity, $I_{u,d} + I_{u,e}$, equals the total needed outside finance, $1 - w$.

Denote the required debt repayment under uninformed mixed finance by $D_{u,m}$ and the uninformed investor's share of the profit by $\alpha_{u,m}$. Under uninformed mixed finance, the feasible contract must satisfy the following three constraints:

$$(1 - \alpha_{u,m})(S - D_{u,m}) - w \geq (1 - \alpha_{u,m})p(G - D_{u,m}) - w\,, \tag{3.5}$$

$$(1 - \alpha_{u,m})(S - D_{u,m}) - w \geq (1 - k_{u,e})I_{u,e}\,, \tag{3.6}$$

$$D_{u,m} + \alpha_{u,m}(S - D_{u,m}) - (1 - w) \geq 0\,, \tag{3.7}$$

where (3.5) is the asset substitution incentive compatibility constraint, (3.6) is the diversion incentive compatibility constraint and (3.7) is the uninformed investor's participation constraint.

As shown in Lemmas 1 and 2, any entrepreneur with wealth $w \geq \min[w_{u,d}, w_{u,e}]$ can receive either uninformed debt finance or uninformed equity finance. Therefore, we focus, in particular, on entrepreneurs for whom these pure forms of uninformed finance are not feasible, that is, for whom $w < \min[w_{u,d}, w_{u,e}]$.

Proposition 1. *The following family of mixed uninformed contracts is feasible for any entrepreneur with wealth* $w \geq w_{u,m}$, *where* $w_{u,m} = w_{u,d} + w_{u,e} - 1 > 0$: $0 < I_{u,d} \leq 1 - w_{u,d}$, $0 < I_{u,e} \leq 1 - w_{u,e}$, *such that* $I_{u,d} + I_{u,e} = 1 - w$; $D_{u,m} = I_{u,d}$ *and* $\alpha_{u,m} = (1 - w - D_{u,m})/(S - D_{u,m})$.

Proof: Start by simplifying the incentive compatibility constraints (3.5) and (3.6). First, (3.5) reduces to $S - D_{u,m} \geq p(G - D_{u,m})$. Second, setting (3.7) as an equality, solving for $\alpha_{u,m}$ and inserting $\alpha_{u,m} = (1 - w - D_{u,m})/(S - D_{u,m})$ into (3.6) reduces (3.6) to $S - 1 \geq (1 - k_{u,e})I_{u,e}$. Thus, the feasibility constraints (3.5)–(3.7) reduce to the following two constraints.

$$S - D_{u,m} \geq p(G - D_{u,m}) \qquad (3.5')$$

$$S - 1 \geq (1 - k_{u,e})I_{u,e}\,. \qquad (3.6')$$

Notice a special feature of the constraints (3.5') and (3.6'). The asset substitution incentive compatibility constraint (3.5') is independent of the size of the equity, and the diversion incentive compatibility constraint (3.6') is independent of the size of the debt. Thus, $D_{u,m}$ can be set to a level at which (3.5') binds without affecting the constraint (3.6'). Similarly, $I_{u,e}$ can be set to a level at which (3.6') binds without affecting the constraint (3.5'). For the least wealthy entrepreneur who receives uninformed mixed finance, both (3.5') and (3.6') must be binding. By Lemma 1, condition (3.5') binds when $w = w_{u,d}$. This implies that for any entrepreneur the maximum size of the debt is $1 - w_{u,d}$. By (3.3) and (3.4), (3.6') binds when $w = w_{u,e}$. Thus, for any entrepreneur the maximum size of the uninformed equity investment is $1 - w_{u,e}$. The least wealthy entrepreneur who receives uninformed finance raises the maximum amounts of both debt and equity. Thus, the critical entrepreneurial wealth required for financing under mixed uninformed finance is determined by $1 - w = (1 - w_{u,d}) + (1 - w_{u,e})$. Solving for w yields $w_{u,m} = w_{u,d} + w_{u,e} - 1$. Thus, an entrepreneur with $w \geq w_{u,m}$ can raise any combination of debt and equity such that $I_{u,d} \leq 1 - w_{u,d}$, $I_{u,e} \leq 1 - w_{u,e}$, and such that the total amount raised $I_{u,d} + I_{u,e}$ is equal to the needed

finance 1 – w. Finally, because of competition in financial markets, $D_{u,m}$ and $\alpha_{u,m}$ can be set at their competitive levels, $D_{u,m} = I_{u,d} = 1 - w_{u,d}$ and $\alpha_{u,m} = (1 - w - D_{u,m})/(S - D_{u,m})$. QED

Similarly as with uninformed debt finance and with uninformed equity finance, we concentrate on the interesting case that mixed finance is feasible for some entrepreneurs and infeasible for others by assuming that the parameters of the model are such that $0 < w_{u,m} < 1$.

The following corollary follows directly from the definition of $w_{u,m}$ and from the assumption that $0 < w_{u,d}, w_{u,e} < 1$.

Corollary 1. The minimum entrepreneurial wealth required for financing under mixed uninformed finance, $w_{u,m}$, is lower than that under uninformed debt finance, $w_{u,d}$, or under uninformed equity finance, $w_{u,e}$.

This result is a simple consequence of the 'dichotomised" nature of our model, conveyed in conditions (3.5') and (3.6'). The maximum amount of debt that any entrepreneur can raise is determined solely by (3.5'). Similarly, the maximum amount of equity is determined solely by (3.6') whereas (3.5') is independent of equity. Because of this dichotomisation, allowing for mixed uninformed finance enables the entrepreneur to supplement his initial financing (debt or equity) from a new source of finance while not affecting his ability to raise finance from the initial source.

4 Bank finance

In this section we introduce an alternative source of finance, bank finance. Bank finance differs from uninformed finance in two ways. First, banks learn with a cost c the entrepreneur's choice between the safe and the risky project. Second, by assumption 2, it may be more difficult for entrepreneurs to divert the equity investment made by a bank than that made by uninformed equityholders. In this section we examine how these two differences affect the terms and feasibility of bank finance compared with the terms and feasibility of uninformed finance.

We assume that the monitoring technology is similar to that in Repullo and Suarez (1998). By paying a monitoring cost c, the bank learns the entrepreneur's project choice. The information acquired through monitoring, however, is unverifiable to the court. Therefore, the contract between the bank and the entrepreneur cannot be contingent on monitoring. However, we assume that the bank can use the information acquired by monitoring when deciding between the liquidation and continuation of the project at date 2. Namely, we assume that the

bank has a right to 'call' the debt, that is, a right to demand the entrepreneur to repay the loan before the final maturity date. Furthermore, to avoid the difficulties involved in endogenising the monitoring decision, we assume that the bank can contractually commit to monitor. In addition, we rule out stochastic monitoring.

In our model, the liquidation has a disciplinary role. We show that under certain circumstances the bank can impose a credible threat of liquidation. The credible threat of liquidation induces the entrepreneur, who would otherwise choose the risky project, to choose the safe project instead. Importantly, we show (in section 6) that some low-wealth entrepreneurs, who are denied uninformed finance, receive bank finance because of the discipline involved in it.

We examine two types of bank finance. In section 4.1, we examine a situation when the firm is financed only with a bank loan, and in section 4.2 the situation when the bank finances the firm with a combination of debt and equity.

4.1 Bank loans

In this section we assume that all the borrowed funds are in the form a bank loan: $I_{i,d} = 1 - w$. When deriving the feasible bank loan contracts, we can, by assumption 1, ignore the diversion moral hazard constraint. Let us start solving the feasible bank loan contracts by dividing entrepreneurs into two categories: (i) those who would invest in the safe project even in the absence of the liquidation threat, and (ii) those who would invest in the safe project only in the presence of the (credible) liquidation threat.

For the first group of entrepreneurs, the feasibility conditions are similar to those under uninformed debt finance (conditions 3.1 and 3.2) except that the bank's participation constraint (4.2) includes the monitoring cost c.

$$S - D_i - w \geq p(G - D_i) - w\,, \tag{4.1}$$

$$D_i - (1 - w + c) \geq 0\,, \tag{4.2}$$

where D_i denotes the required debt repayment of the bank loan. Setting (4.2) as equality, and inserting D_i into (4.1) yields the following result.

Lemma 3. *Under bank lending, the minimum entrepreneurial wealth that induces the entrepreneur to invest in the safe project regardless of the liquidation value of the firm's assets is* $\overline{w}_{i,d} = w_{u,d} + c$.

Thus, the entrepreneurs characterised in Lemma 3, if financed by bank loans, would invest in the safe project even in the absence of the liquidation threat involved in bank finance.

Now, consider the other group of entrepreneurs, that is, the entrepreneurs with $w < \overline{w}_{i,d}$. These entrepreneurs invest in the safe project at date 1 only if the bank can credibly threaten to liquidate risky project at date 2. We show that the bank can impose a credible threat of liquidation for some of these low-wealth entrepreneurs, if the liquidation value of the entrepreneur's project is high enough with respect to the entrepreneur's wealth.

The bank loan is feasible for any firm with $w < \overline{w}_{i,d}$ if and only if the liquidation of the risky project is a *subgame perfect* decision for the bank at date 2. The subgame perfectness requires that the bank's return from the liquidation is at least as high as the expected return from letting the risky project continue. Thus, the liquidation threat is credible if and only if $L \geq pD_i$. Insert $D_i = 1 - w + c$ from the binding participation constraint (4.2) of the bank into this inequality and solve for L. It follows that the liquidation threat is credible, if

$$L \geq p(1 - w + c). \tag{4.3}$$

Setting this as equality and solving for w yields the following lemma.

Lemma 4. *Under bank lending, the minimum entrepreneurial wealth required for the bank's liquidation threat to be credible is the following function of the liquidation value of the firm's assets:* $w_{i,d}(L) = 1 + c - (L/p)$.

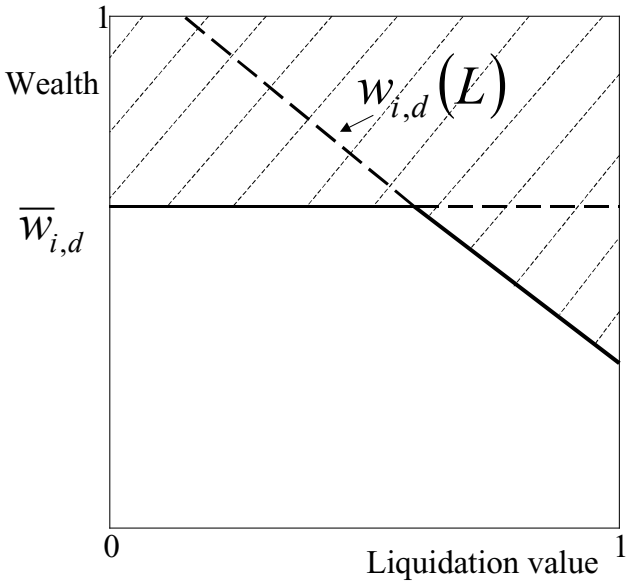
Thus, the bank can impose a credible threat of liquidation for entrepreneurs with $w \geq w_{i,d}(L)$. On the other hand, the bank's threat to liquidate the assets of entrepreneurs with $w < w_{i,d}(L)$ is not credible *ex-post*. Thus, these entrepreneurs, if financed by the bank, would invest in the risky project. Anticipating this, the bank refuses to lend to these entrepreneurs.

The next proposition combines the results of lemmas 3 and 4.

Proposition 2. *Bank loans are feasible for any entrepreneur with* $w \geq min\left[\overline{w}_{i,d}, w_{i,d}(L)\right]$ *with terms* $I_{i,d} = 1 - w$ *and* $D_i = 1 - w + c$. *Bank loans are not feasible for entrepreneurs with* $w < min\left[\overline{w}_{i,d}, w_{i,d}(L)\right]$.

Figure 1 shows how the curves $\overline{w}_{i,d}$ and $w_{i,d}(L)$ divide the (w, L)-space into two non-overlapping regions. Bank loans are feasible for all entrepreneurs in the upper region, $w \geq \min\left[\overline{w}_{i,d}, w_{i,d}(L)\right]$, and infeasible for all entrepreneurs in the lower region, $w < \min\left[\overline{w}_{i,d}, w_{i,d}(L)\right]$.

Figure 1. **Feasibility of bank loans**
This figure shows the region in the (liquidation value, wealth)-space, where bank loans are feasible



4.2 Bank's equity stake in the borrowing firm

In this section we begin addressing the principal problem of our paper: What are banks' incentives to hold equity stakes in their borrowing firms?

Suppose that the firm is financed with a mix of a bank loan and an equity investment by the bank such that $I_{i,d} + I_{i,e} = 1 - w$. For shorthand, we denote this type of finance by *mixed bank finance*. Denote the required debt repayment and the required share of the final profits under mixed bank finance by $D_{i,m}$ and $\alpha_{i,m}$, respectively. Since, by proposition 2, entrepreneurs with $w \geq \min\left[\overline{w}_{i,d}, w_{i,d}(L)\right]$ receive bank loans, we focus in this section on entrepreneurs with $w < \min\left[\overline{w}_{i,d}, w_{i,d}(L)\right]$.

Mixed bank finance is feasible for a firm characterised by a pair (w, L) if the debt and equity contracts $(I_{i,d}, D_{i,m})$ and $(I_{i,e}, \alpha_{i,m})$ satisfy the following conditions.

$$\begin{aligned}&(1-\alpha_{i,m})(S-D_{i,m}) - w \geq (1-\alpha_{i,m})p(G-D_{i,m}) - w \\ &\vee\, L \geq p\left[D_{i,m} + \alpha_{i,m}(G-D_{i,m})\right]\end{aligned} \tag{4.4}$$

$$(1-\alpha_{i,m})(S-D_{i,m}) - w \geq (1-k_{i,e})I_{i,e} \tag{4.5}$$

$$D_{i,m} + \alpha_{i,m}(S - D_{i,m}) \geq 1 - w + c \qquad (4.6)$$

Condition (4.4) is the asset substitution incentive compatibility constraint. As discussed in the previous section, this constraint is satisfied if at least one of the following two conditions is satisfied: (i) the entrepreneur invests in the safe project even in the absence of the liquidation threat, (ii) the entrepreneur invests in the safe project only if the liquidation threat is credible. The presence of equity in the firm's capital structure implies that we must also take the diversion incentive compatibility constraint (4.5) into account. Inequality (4.6) is the informed investor's participation constraint.

The next proposition shows that mixed bank finance is feasible for some entrepreneurs for whom bank loans are not feasible.

Proposition 3. *For any entrepreneur with* $\overline{w}_{i,m} \leq w < min\left[\overline{w}_{i,d}, w_{i,d}(L)\right]$, *where* $\overline{w}_{i,m} = \overline{w}_{i,d} + w_{i,e} - 1$ *and* $w_{i,e} = (S - 1 - c)/(1 - k_{i,e}) > 0$, *bank loans are not feasible but the following family of mixed bank finance contracts is feasible:* $0 < I_{i,d} \leq 1 - \overline{w}_{i,d}$ *and* $0 < I_{i,e} \leq 1 - w_{i,e}$, *such that* $I_{i,d} + I_{i,e} = 1 - w$; $D_{i,m} = I_{i,d} + c$, $\alpha_{i,m} = (1 - w + c - D_{i,m})/(S - D_{i,m})$.

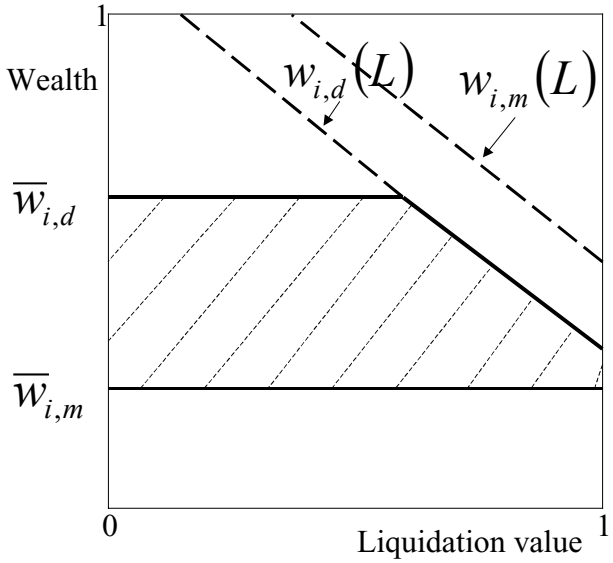
Proof: See Appendix.

We ignore the uninteresting case that all entrepreneurs would receive mixed bank finance by assuming that the parameters of the model are such that $0 < \overline{w}_{i,m} < 1$.

Figure 2 depicts the shaded region in the (w, L) space where mixed bank finance is feasible and bank loans are not feasible. Mixed bank finance enables entrepreneurs to supplement their bank loans by an equity investment from the bank. The maximum size of the bank loan that the entrepreneur can raise is determined solely by the project choice incentive compatibility constraint (4.1), which is independent of the amount of outside equity. Thus, the low-wealth entrepreneurs in the shaded region who cannot raise enough outside funds by bank loans only, are able to finance their investments with a mixture of bank loan and an equity investment by the bank.

Note, however, that a disadvantage of the bank's equity stake is that it weakens the credibility of the liquidation threat, as the bank's equity stake in its borrowing firm increases the bank's expected continuation return from letting the risky project continue (see the proof of Proposition 3 for details). This result can also be seen from Figure 2. In figure 2, the line $w_{i,m}(L)$ which depicts the minimum required wealth level required for the bank's liquidation threat to be credible under mixed bank finance, is situated to the right of the $w_{i,d}(L)$, which is the corresponding line under bank lending.

Figure 2. **Region where informed bank finance is feasible but where bank loans are not feasible**
By proposition 3, in the shaded region, mixed bank finance is feasible whereas bank loans are not feasible.



5 Mixed finance

In previous sections we examined the feasibility of different capital structures under the assumption, that entrepreneurs are funded exclusively by the bank or, alternatively, by uninformed investors. In this section we examine the possibility that entrepreneurs may in some circumstances prefer a combination of bank finance and uninformed finance to other forms of finance. We derive the feasible three-party contracts between the entrepreneur, the bank and the uninformed investor, and show that such three-party contracts can indeed improve the feasibility of the two-party contracts for some entrepreneurs.

Without loss of generality, in this section we concentrate on the case where the entrepreneur is financed with a combination of a bank loan and uninformed debt (such as bonds)[4]. In what follows, we denote the combination of a bank loan and uninformed debt simply as *mixed finance* to differentiate it from mixed bank finance and mixed uninformed finance.

As will be shown below, the benefit of mixed finance is that it improves the credibility of the liquidation threat by reducing the bank's share of the provided funds. As we showed in section 4.1, the bank's liquidation threat is not credible for some entrepreneurs since the liquidation value L of the investment project is

[4] We can show that no entrepreneur strictly prefers any other mode of mixed finance.

low compared to the funds $1 - w + c$ contributed by the bank. In this section we show that the introduction of a passive uninformed lender allows some entrepreneurs with low liquidity values to receive mixed finance by enabling the reduction of funds contributed by the bank.

The presence of an uninformed third party complicates the derivation of feasible contracts by introducing the possibility of renegotiation between the entrepreneur and the bank at the expense of the uninformed lender. By renegotiation we refer to the possibility that the entrepreneur, after investing in the risky project at date 1, attempts to bribe the bank not to liquidate the project by offering it a new contract that changes the promised debt repayment from $D_{i,M}$ to $D'_{i,M}$. The uninformed lender does not take part in the renegotiation because of her inability to observe the project choice. Moreover, as discussed by Repullo and Suarez (1998), the non-contractibility of the project choice precludes the use of any mechanism that would truthfully reveal this information to the uninformed lender.

As investing in the risky project is always inefficient, the uninformed lender accepts the three-party contract only if it is *renegotiation-proof*. Mixed finance contracts are renegotiation-proof in two cases. First, they are renegotiation-proof if the bank's maximum expected payoff under continuation is smaller than it would get upon liquidation, that is, if $[L, D_{i,M}] \geq p(G - D_{u,M})$.

The initial contract is also renegotiation-proof if the renegotiated contract is so expensive for the entrepreneur that he rather invests in the safe project. Let us consider this possibility. In the renegotiation game, the status quo payoffs of the entrepreneur and the bank are $p(G - D_{i,M} - D_{u,M})$ and $pD_{i,M}$, respectively. In addition, the value of the bank's outside option is the liquidation value $\min[L, D_{i,M}]$ of the project. Now, assume that the entrepreneur has chosen the risky project at date 1 and proposes the bank a new contract at date 2. By the outside option principle[5], the new contract is given by

$$\begin{aligned} &D'_{i,M} = D_{i,M}, \text{ if } pD_{i,M} \geq \min\left[L, D_{i,M}\right], \\ &\min\left[L, D_{i,M}\right]/p, \text{ otherwise.} \end{aligned} \tag{5.1}$$

Thus, the entrepreneur's expected payoff from investing in the risky project is $p(G - D_{u,M} - D'_{i,M})$, where $D'_{i,M}$ is defined in (5.1).

[5] Roughly speaking, the outside option principle states that the outside option (the option to quit the negotiations and liquidate the project) affects the bank´s equilibrium payoff only if the value of the outside option is higher than his equilibrium payoff in a game with no outside option (the status quo payoff). In that case his equilibrium payoff in the renegotiation game must be equal to the value of the outside option. For a more detailed exposition of the outside option principle, see Repullo and Suarez (1998), Sutton (1986) or Osborne and Rubistein (1990).

Now, the feasibility conditions of mixed finance are the following. Mixed finance, characterised by contracts ($I_{i,d}$, $D_{i,M}$) and ($I_{u,d}$, $D_{u,M}$), is feasible if the following conditions hold.

$$S - D_{u,M} - D_{i,M} \geq p(G - D_{u,M} - D'_{i,M}) \vee \min\left[L, D_{i,M}\right] \geq p(G - D_{u,M}) \tag{5.2}$$

$$I_{i,d} + I_{u,d} = 1 - w + c, \qquad D_{i,M} \geq I_{i,d} + c, \qquad D_{u,M} \geq I_{u,d}, \tag{5.3}$$

The next proposition characterises the feasible contracts under mixed finance.

Proposition 4. *Any entrepreneur with* $w \geq w_M(L)$, *where* $w_M(L) = \overline{w}_{b,d} - L$, *receives mixed finance with terms* $I_{i,d} = L - c$, $D_{i,M} = L$, $I_{u,M} = 1 - w - L + c$. *Mixed finance is not feasible for entrepreneurs with* $w < w_M(L)$.

Proof: See the Appendix.

We explain the Proposition 4 as follows. To receive mixed finance, the entrepreneur designs the mixed finance contract so that (i) the bank has the right incentives to liquidate, and, related to the first objective, so that (ii) the bank and the entrepreneur have no incentives to collude. The bank has right incentives to liquidate when the size of the loan is sufficiently low to make the liquidation threat credible. That is, for a given L, the size of the bank loan $I_{i,d}$ should be sufficiently low so as to satisfy $L \geq pD_{i,M}$. On the other hand, the size of the bank loan should be as high as possible to reduce the incentives of the bank and the entrepreneur to collude and renegotiate the initial contract. The conflict between these two objectives is lowest when the bank's required debt repayment $D_{i,M}$ is set so that the constraint $L \geq pD_{i,M}$ is binding. Setting this as equality and assuming competitive markets yields the result the highest feasible size of the bank loan is L – c. As the entrepreneur needs 1 – w outside finance, the size of the uninformed debt is 1 – w – L + c. In addition, competition in financial markets guarantees that the debt repayments $D_{b,M}$ and $D_{u,M}$ are as defined in Proposition 4.

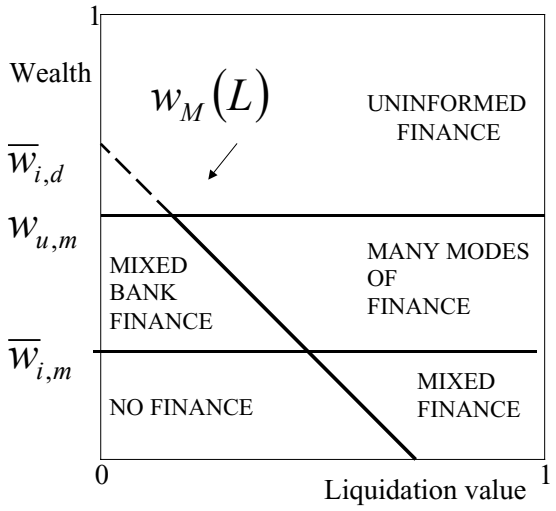
According to Proposition 4, the higher is the liquidation value of the firm the lower is the minimum entrepreneurial wealth required for financing under mixed finance. The reason is the following. As discussed above, the maximum size of the bank loan under mixed finance is determined by the liquidation value of the firm's assets. The higher the liquidation value of the firm the larger share of the needed outside finance 1 – w can be in the form of bank loan (L – c), and the lower share need to raised in the form of uninformed debt (1 – w – L + c). The bigger the bank loan the more costly it is for the entrepreneur to collude with the bank and to renegotiate the terms of the initial contract. If the liquidation value is sufficiently high with respect to the needed outside finance, the entrepreneur

never chooses the risky project as he anticipates that the renegotiation with the bank is too costly. Conversely, suppose that the liquidation value of the assets is low relative to the needed outside finance. Then, only a small share of the needed funds could be raised from the bank and the rest would have to be raised from the uninformed financier. In that case, it is impossible for the entrepreneur to set the terms of the initial contract in such a way that the bank loan is sufficiently small to preserve the bank's ex-post incentive to liquidate the risky project, and, at the same time, sufficiently large to eliminate the entrepreneur's and the bank's ex-post incentive to collude and renegotiate the initial contract. Anticipating that the initial contract is not renegotiation-proof, the uninformed investor is not willing to participate in the funding.

6 The choice between uninformed finance, bank finance, and mixed finance

In this section we collect our results. Figure 3 summarises the results of the previous sections by showing the regions in the (w, L)-space where different forms of finance are feasible. By Proposition 1, uninformed finance is feasible for entrepreneurs with $w \geq w_{u,m}$. By Proposition 2, bank loans are feasible for entrepreneurs with $w \geq \min\left[\overline{w}_{i,d}, w_{i,d}(L)\right]$. By Proposition 3, the mixture of a bank loan and an equity investment by the bank is feasible while informed debt is infeasible for entrepreneurs with $\overline{w}_{i,m} \leq w \leq \min\left[\overline{w}_{i,d}, w_{i,d}(L)\right]$. By Proposition 4, mixed finance is feasible for entrepreneurs with $w \geq w_M(L)$.

Figure 3. **Optimal modes of finance**



In drawing the figure 3, we have assumed that the critical wealth required for financing under uninformed finance, $w_{u,m}$, is higher than the corresponding critical wealth under informed mixed finance, $w_{i,m}$. It can be shown that $w_{i,m} < w_{u,m}$ if and only if

$$\Phi(k_{i,e}, k_{u,e}) \equiv \frac{S-1}{1-k_{i,e}} - \frac{S-1}{1-k_{u,e}} > c \qquad (6.1)$$

Now, we are ready to present our two principal results.

Proposition 5. Provided that $\Phi(k_{i,e}, k_{u,e}) > c$, then for any entrepreneur with $\overline{w}_{i,m} \le w < \min\left[w_{u,m}, w_M(L)\right]$ the only feasible mode of finance is a mixture of a bank loan and an equity investment by the bank.

Proposition 6. For any entrepreneur with $w_M(L) \le w < w_{i,m}$, the only feasible mode of finance is mixed finance.

Proposition 5 characterises the conditions under which the only way for some firms to receive finance is to let the informed financier (such as a bank) to hold equity in its borrowing firm. For these firms, other modes of finance are not feasible. Bank loans are not feasible because the bank cannot impose a credible threat of liquidation, and mixed finance is not feasible because debt contracts with multiple financiers are not renegotiation-proof. Uninformed finance, in turn, is not feasible since the entrepreneur cannot raise enough uninformed equity (to supplement uninformed debt) as uninformed equityholders are poorly protected against managerial expropriation.

According to condition (6.1), informed bank finance dominates uninformed finance for any entrepreneur only if the entrepreneur's cost of diverting the bank's equity investment is sufficiently low compared to the cost of diverting uninformed investors' equity investment. One interpretation of this result is that, according to our model, banks' equityholding in their borrowing firms should be more common in those countries where uninformed minority equityholders rights are poorly protected against managerial expropriation. In countries where uninformed minority shareholders are well protected, banks' right to hold equity in their borrowing firms provide little if any social benefits.

According to Proposition 6 and as illustrated in Figure 3, for some entrepreneurs with very low wealth but with sufficiently high liquidation values the only feasible mode of finance is mixed finance, more specifically, a combination of a bank loan and uninformed debt. The benefit of mixed finance compared to other modes of finance is that that the liquidation threat is as

effective as possible under mixed finance. As a consequence, high liquidation values allow some very low wealth entrepreneur to raise mixed finance, since the credible liquidation threat induces them to invest in the safe project. Thus, our model yields a testable prediction that especially those investments involving nonspecific, highly liquid and tangible assets are most likely to be financed with mixed finance. This result is close to that in Repullo and Suarez (1998). In Repullo and Suarez (1998), however, firms with low wealth but with high liquidation values always prefer informed finance to mixed finance. For those firms in our model, mixed finance is the only feasible mode of finance.

7 Conclusions

In this paper, we examine in a double moral hazard model the feasible capital structures for firms characterised by their wealth and their liquidation value. Firms can raise funds to finance their investment project from three different sources, from the bank, from uninformed investors, or from both types of investors by issuing two types of securities, debt or equity. Uninformed (market) finance is cheaper than the bank finance, but banks are superior to uninformed investors in reducing the entrepreneurial moral hazard because of their ability to monitor the entrepreneur's project choice, and because banks may be better protected against managerial expropriation. Debt and equity are, following the tradition of Jensen and Meckling (1976), characterised by their cash flow rights. The only exception is that debtholders have, in addition to their cash flow rights, the right to liquidate the investment project.

We characterise the conditions under which the only feasible mode of finance for some firms consists of the mixture of a bank loan and an equity investment made by the same bank. In our model, the bank's equity stake in its borrowing firm aligns the bank's and the entrepreneur's conflicting interests allowing some firms, who otherwise would not receive finance, to invest in (efficient) projects. The role of bank's equity stake is similar to that in John et al (1994). However, in their model, the bank is a passive substitute of the firm's capital structure. We show that banks may have incentives to hold equity also in our model, where the differences between banks and uninformed investors are clearly specified, and where the bank finance and uninformed (market) finance coexist. In addition, in contrast to most other models of universal banking, our explanation of the benefits of bank's equity stakes is not control-related. In our model, the bank may have incentives to hold equity in its borrowing firm even when outside equity is characterised only by its cash flow rights. However, if the rights of the small, uninformed equityholders are well-defined and well-protected, the social benefits of banks' equityholding are likely to be small or non-existent.

Appendix

Proof of Proposition 3. The idea of the proof can be seen from figure 2. In terms of figure 2, mixed bank finance can potentially improve the feasibility of bank loans in two ways. First, if the curve $\overline{w}_{i,m}$, corresponding to the curve $\overline{w}_{i,d}$ in the case of bank loans, is located underneath $\overline{w}_{i,d}$, and second, if the curve $w_{i,m}(L)$ corresponding to the curve $w_{i,d}(L)$ in the case of bank loans is located to the left of the $w_{i,d}(L)$-curve. In this proof we that show mixed bank finance improves the feasibility of bank loans because $\overline{w}_{i,m}$ is indeed located underneath $\overline{w}_{i,d}$. We also show that $w_{i,m}(L)$-curve is *not* located to the left of $w_{i,d}(L)$-curve but to the right instead.

Let us start by showing that the curve $w_{i,m}(L)$ is located to the right of $w_{i,d}(L)$-curve, defined in Lemma 4. By rewriting $\alpha_{i,m}(G - D_{i,m})$ as $\alpha_{i,m}(S - D_{i,m}) + \alpha_{i,m}(G - S)$ and solving $\alpha_{i,m}(S - D_{i,m})$ from the binding participation constraint (4.6), we can reduce $L \geq p\left[D_{i,m} + \alpha_{i,m}(G - D_{i,m})\right]$ to $L \geq p(1 - w + c + \alpha_{i,m}(G - S))$. Setting this as an equality and solving for w yields the critical wealth level for the liquidation threat to be credible under mixed bank finance: $w_{i,m}(L) = 1 + c - (L/p) + \alpha_{i,m}(G - S)$. Since the last term $\alpha_{i,m}(G - S)$ is positive, it follows that $w_{i,m}(L) > w_{i,d}(L)$. This implies that the $w_{i,m}(L)$-curve is located to the right of the $w_{i,d}(L)$-curve.

Now consider the inequality $(1 - \alpha_{i,m})(S - D_{i,m}) - w \geq (1 - \alpha_{i,m})p(G - D_{i,m}) - w$. The derivation of the minimum entrepreneurial wealth $\overline{w}_{i,m}$ that satisfies this inequality and the derivations of the contract terms $I_{i,d}$, $I_{i,e}$, $D_{i,m}$ and $\alpha_{i,m}$ follow the steps of the proof of Proposition 1. By following those steps, we get $\overline{w}_{i,m} = \overline{w}_{i,d} + w_{i,e} - 1$. Since $0 < w_{i,e} < 1$, it follows that $\overline{w}_{i,m} < \overline{w}_{i,d}$. Thus, in figure 2, $\overline{w}_{i,m}$ is located below $\overline{w}_{i,d}$.

The findings $\overline{w}_{i,m} < \overline{w}_{i,d}$ and $w_{i,m}(L) > w_{i,d}(L)$ reveal that, for entrepreneurs with $\overline{w}_{i,m} \leq w < \min\left[\overline{w}_{i,d}, w_{i,d}(L)\right]$, mixed bank finance is feasible whereas bank debt is not feasible. QED

Proof of Proposition 4. Let us first show that the inequality $\min\left[L, D_{i,M}\right] \geq p(G - D_{u,M})$ is never satisfied in our model. This inequality holds most likely when $D_{i,M}$ and $D_{u,M}$ are set in such a way that left-hand-side of the above inequality is as large and the right-hand-side inequality as small as possible, under the condition that $D_{i,M} + D_{u,M} = 1 - w + c$ (from the binding participation constraints and the financing requirement in (5.3)). It is easy to see that the above inequality holds most likely when $D_{i,m} = L$ and $D_{u,M} = 1 - w + c - L$. By inserting these values into $\overline{w}_{i,m}$, we get $L \geq p\left[G - (1 - w - L + c)\right]$. This condition is

satisfied for all entrepreneurs with $L \geq p(G-1+w-c)/(1-p)$. This inequality never holds, since $0 \leq L < 1$ and since the right-hand-side is always bigger than one by assumptions $1/2 < p < 1$ and $c < G - 1$.

Now, let us examine the constraint $S - D_{u,M} - D_{i,M} \geq p(G - D_{u,M} - D'_{i,M})$. Since the participation constraints in (5.3) bind, this reduces to $S - (1 - w + c) \geq p(G - I_{u,d} - D'_{i,M})$, where $D'_{i,M}$ is given by (5.1). By (5.1), $D'_{i,M} = D_{i,M}$, if $pD_{i,M} \geq L$ and $\min\lfloor L, D_{i,M} \rfloor / p$ otherwise. Suppose first that $pD_{i,M} \geq L$, which implies that $D'_{i,M} = D_{i,M}$. In that case, (5.2) reduces to $S - (1 - w + c) \geq p(G - (1 - w + c))$. By Lemma 3, this holds for all entrepreneurs with $w \geq \overline{w}_{i,d}$.

Now, suppose that $pD_{i,M} < L$. In that case, by (5.1), $D'_{i,M} = \min\lfloor L, D_{i,M} \rfloor / p$. By inserting this into (5.2) and using the fact that the participation constraints in (5.3) bind, we obtain

$$S - (1 - w + c) \geq p(G - I_{u,d} - \min\lfloor L, I_{i,d} + c \rfloor / p) \qquad \text{(A5.2')}$$

Let us now derive the lowest value of w such that (A5.2') is satisfied. For that lowest feasible value of w, the right-hand-side of (A5.2') must be as low as possible. It is easy to see that for any given L, and given that $I_{u,d} + I_{i,d} = 1 - w$, the right-hand-side of (A5.2') reaches its lowest possible value when $I_{i,d} = L - c$ and $I_{u,d} = 1 - w - L + c$. Inserting these into (A5.2') and solving for w yields the result that (A5.2') is satisfied for all entrepreneurs with $w \geq \overline{w}_{i,d} - L$. Finally, by inserting $I_{i,d} = L - c$ and $I_{u,d} = 1 - w - L + c$ into the binding participation constraints (5.3), we obtain the rest of the terms in the mixed finance contract in Proposition 4, $D_{i,M} = L$ and $D_{u,M} = 1 - w - L + c$. QED

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