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Seniority Structure and Financial Intermediation

Abstract The financial structure of firms is diverse. Firms issue many different types of financial claims. This article focuses on the seniority structure of debt contracts. It is outlined under what conditions firms can improve the outcome of their financial decisions by choosing seniority structure. The main reason for issuing debt contracts with different priority is that in case of financial distress firms only have to renegotiate with a smaller number of creditors. This outcome makes observation of the firm‘s condition by creditors more likely. If observation occurs seniority decreases observation costs. But observation can also harm the owner so that seniority could be inferior to a debt structure which treats all creditors identically. Later on we introduce a financial intermediary into the model. It is outlined how a financial intermediary can be welfare improving on the junior level.

Keywords Seniority Structure, Financial Intermediation, Asymmetric Information.

JEL classification D82, G21, G32, G33.

1. Introduction

The central issue of the corporate finance literature is the determination of a firm's financial structure. Especially since the pathbreaking article by Modigliani and Miller (1958) there has been much research in this field. Many articles deal with this problem by just focusing on the two main claims, namely debt and equity. But this does exclude important other financing claims. In reality firms issue many claims with different seniorities. This means, that creditors are repaid in order of their position within the seniority structure. This position is very important in case of insolvency. For example, Barclay and Smith (1995) examine the priority structure across a sample of nearly 5000 firms. Moreover, there are several articles that study the impact of the absolute priority rule in case of bankruptcy.[1] Nevertheless, there are only a few explanations why firms can benefit by these different claims.[2] As will be proven in our model the reason to issue claims with different seniority is to make observation of the firm's condition more likely. Observation can be benefical if financial constraints are loosened or if it has an impact on a firm's policy in favor of the owner. But observation could also harm the owner so that a seniority structure does not necessarily have to be the optimal choice.

Hoshi, Kashyap and Scharfstein (1990) point out that a crucial decision by firms is the actual source of financing. Firms have the choice of financing with banks (= private debt, limited number of creditors) or using the capital market (= public debt, unlimited number of creditors). As Gilson, Kose and Lang (1990) show, it should be widely accepted that firms in financial distress are more likely to restructure the lower the number of creditors involved is.[3] These points can be summarized by quoting Fama (1985). He outlines that banks are used for the general problem of minimization of information costs. He suggests that "bank loans are especially useful to avoid duplication of information costs. Bank loans usually stand last

[1] See for example Altman and Eberhart (1994), Eberhart, Moore and Roenfeldt (1990), Franks and Torous (1989) and Weiss (1990).

[2] See for example Winton (1995), Berglf and von Thadden (1994), Berkovitch and Kim (1990), Diamond (1993) and Hart and Moore (1995).

[3] See also for example Hart (1995) who claims that renegotiation is more likely to break down with multiple investors.

or close to last in the line of priority among contracts that promise fixed payoff".[4] Finally, as Stiglitz (1985) states, banks focus on issues related to states with probability of default and the net worth of the firm in these default states. These facts just mentioned are used in this article to give a further reason how an owner of a firm can increase his expected utility with a seniority structure where banks hold junior claims.

The presented model is a two-period one. The cash-flows of the underlying investment project arise at the end of each of the two periods. The realizations of the cash-flow are uncertain. Furthermore, the owner possesses an existing project that has a random return at $t = 1$. This return is costly observable but non-verifiable. If the firm is insolvent at date $t = 1$ the creditors receive the control rights of the firm. In this case the creditors can liquidate the firm. The owner of the firm receives a control rent in case that the firm is continuing its operations until date $t = 2$. As a consequence there can be a conflict between the owner and the creditors about the optimal liquidation policy. Since the control rent is non-transferable and the output of the existing project is costly observable, liquidation might occur too early from the owner's point of view. It will be proven that splitting the cash-flow into different claims makes an improved firm policy from the owner's point of view more likely. Moreover, choosing a financial intermediary as the financing source for the junior claims is superior to financing with a large number of investors.

The outlined model is closely related to serveral other ones. Harris and Raviv (1990) deal with a two-period model where debt, which is only issued for the first period, contains an informational role. The problem is that the owner of the firm wants the firm to be ongoing until the end of the second period whereas in case of insolvency the creditors prefer liquidating the firm if it is efficient from their point of view, i.e. if the liquidation value exceeds the value of the firm in case of continuation.[5] As a result, there is a conflict of interests between the owner of the firm and its creditors. The same conflict is present in our model. Again, the owner has a private benefit from holding the firm alive whereas the creditors just care about their

[4] See Fama (1985), p. 38.

[5] See for example Haugen and Senbet (1978), who claim that this optimal liquidation point of time is independent of the capital structure and the state of the firm.

(expected) repayments. In contrast to Harris and Raviv in our model debt does not contain any information that can be used. The future development of the second period cash-flow is independent of the past. Moreover, seniority is chosen to induce observation of the condition of the firm and renegotiation in times of financial distress. Without a seniority structure this does not occur and thus triggers too early liquidation from the owner‘s point of view.

The motivation by Hart and Moore (1995) for issuing debt with different seniorities is due to the fact that one wants to prevent the management from making bad investment decisions. They derive conditions under which a seniority structure is benefical in an uncertain environment. As such, at the beginning of the time horizon one does not know how the investment opportunities are going to develop. With the seniority structure one wants to leave enough freedom to the management to conduct good investment projects, this means projects with a positive net present value but to exclude the bad ones. The management has a tendency to conduct each investment project if it can finance it. The reason for this harmful behavior is that its utility increases by the size of investment projects. Our motivation is closer to Gertner and Scharfstein (1991). Gertner and Scharfstein consider the case of companies financed by a large number of small investors. In a renegotiation process investors free-ride because they think that their decision is not important for the overall outcome. Thus, in equilibrium they neglect their effect on the firm‘s investment decision. In our article one tries to get around the problem that many small investors do not make the best decisions in the interest of the firm by splitting up the cash-flow into parts. In case of default the number of creditors who have to make decisions decreases. As such, each creditor becomes more important and as the number of potential decision makers decreases a firm policy in favor of the owner becomes more likely.

A model that is also very close to ours is a model developed by Winton (1995). In his one-period model he supposes that there are two reasons to have different seniorities. The first one is better risk-sharing between the financer and financee. This reason is not present in our model because we assume risk-neutrality throughout the whole model. The second one seems to be more important and introduces seniority as a way to save observation costs. For this reason he splits the entire cash-flow into claims with different seniorities. In his model the

realization of the cash-flow is uncertain in a bounded intervall. The creditor with the lowest fixed payment gets the highest priority, the one with the second lowest fixed payment receives the following priority. Finally, the claims with the highest fixed payment possess the lowest priority. Winton chooses this structure so that the number of creditors who have to observe the cash-flow decreases in case of default. Since default is costly a seniority structure can reduce the capital costs. He mainly focuses on the fact that the investor with the lowest claim has highest priority because this investor is the easiest to satisfy and thus disappears faster than any other possible investor that has to observe and thus waste capital. This is independent of the probability distribution of the cash-flow. In other words, Winton allocates the creditors over the possible realizations of the cash-flow to minimize a doubling of observation costs. This distribution does not rely on any probability structure.

In our model we are more closely involved with the probabilities of realizations of the cash-flow. Of course the level of the cash-flow is uncertain, too. One part of the cash-flow arises for sure and the level of the second part is uncertain. As such, it seems natural to divide the cash-flow into claims with different seniorities and respective probabilities for satisfying these claims. But this is not the main focus of our model. In contrast to Winton it is outlined that seniority makes renegotiation more likely. This is the main reason in our model why one should try to lower the number of investors that have to observe in times of financial distress. Observation is not a problem in Winton‘s model. This means that he does not deal with the case that observation could be too costly so that it does not occur at all. In a different context Winton points very slightly into the direction of our article. He claims that fixed costs suggest that verification should be delegated. But due to uncertainty risk should be allocated so that, starting at the bottom, the claims with lowest priority should be held by just one creditor and with increasing priority the number of creditors could rise, as well. Moreover, in contrast to Winton we try to show the effects of seniority structure on the firm‘s future policy. Thus, there are two main differences between Winton and our article. One lies in the different time structure of each model. Since Winton dealt only with a one-period model he did not have to look at a firm‘s future policy. Thus, the articles can be viewed as complements. The other one is the focus to induce renegotiation through a decreased number of investors. In this context it is proven that seniority is not always benefical for the owner.

Our model stands in contrast to Welch (1997), who mainly claims that bank debt should be senior. The debt structure is the same as the one outlined below. He focuses on lobbying and litigation costs, which have to minimized to lower the cost of capital. The bank is assumed to be the toughest fighter for its claims because it only acts in its own interests whereas the capital market is too dispersed to be a focused opponent in times of financial distress. Due to the fact that the bank is going to spend capital on lobbying and litigation anyway it is in the interest of the owner to give the bank the senior claims so that the absolute priority rule is not violated. Otherwise, as a junior creditor the bank would waste too much capital on trying to influence the insolvency proceeding in its interests to break down the absolute priority rule. The meaning of these lobbying and litigation costs is equal to the observation costs in our model. Both are a waste and because they are anticipated the owner has to carry them. Welch's model and our one use the same reasoning. Banks are used at that point where wasteful costs could arise. This is the underlying fact by the introduction of the financial intermediary.

Finally, our model is related to the financial innovation and security design literature. In each of the following articles the cash-flow is divided into different components. Ross (1989) presents a model that explains how one can reduce marketing costs by issuing riskless and risky claims. Allen and Gale (1988) derive the result that one should issue as many claims as there are states of nature. Madan and Soubra (1991) can be seen as a mixture of these two articles because they use the Allen and Gale framework to show that dividing the cash-flow can lead to lower marketing costs. At last, Boot and Thakor (1993) explain in their article why an issuer may wish to raise external capital by selling multiple financial claims that partition its total asset cash-flow, rather than a single claim. Boot and Thakor derive a seniority structure as the optimal debt structure where the senior claim is riskless. Our model is connected to these ones for three reasons, (i) in our model the firm also issues a riskless bond, (ii) the firm has as many different claims as there are states of nature and (iii) the debt structure is based on seniority.

Our model is different from the ones just mentioned in one point. Winton and Welch use the seniority structure to lower the capital costs and the security design models split the cash-flow

to lower the marketing costs. The focus of introducing seniority structure in the presented model is to get a better firm policy in times of financial distress by making renegotiation more likely. With the introduction of the financial intermediary one lowers the expected payment schedule in a second step.

This article is organized as follows. In section 2 the basic model is presented. Section 3 deals with the capital market as the only financing source. In section 4 a financial intermediary is introduced and it is shown in which situations its existence is welfare improving. The article closes with a summary in section 5.

2. The Model

In this section the basic model is presented. We consider a two-period model with an owner and many creditors. At date $t = 0$ a firm owns a potential investment project I and an already existing project Y. We assume that the owner cannot influence the outcome of each investment project. Both, the outcome of the new investment project and of the existing one is random viewed from $t = 0$. The existing project creates an output only at $t = 1$. In contrast to this the new project's cash-flows appear at $t = 1$ and at $t = 2$ if the firm is not liquidated before this time point. Due to the fact the owner cannot sell the existing project Y at $t = 0$ he has to borrow capital to finance the potential one. The focus of this article is seniority and not optimal security design, so that we take a short-term standard debt contract as given. The owner has two problems of how to finance I. First, the owner can only get capital from the capital market but he is free to choose the seniority structure. That is, he has the choice of borrowing one unit of capital from I creditors[6] which are all treated identically or he splits the creditors into two groups, one holding senior claims and the other one holding junior ones. In a second step he is able to choose the financing source which is either the capital market or a financial intermediary and the structure of the debt contracts.

At $t = 1$ the owner has to repay the borrowed capital. Before we specify the means the owner can use for these repayments the entire structure of the model is outlined. At first, the cash-

[6]The endowment of each creditor is equal to one unit of capital.

flow of the new project occurs at this point of time. With probability p_1 the cash-flow is X_1^s and with the counter probability $(1 \Leftrightarrow p_1)$ it is $X_1^s + X_1^j$. Thus, the level of X_1^s is realized for sure after the first period.[7] Secondly, the firm could be liquidated. The liquidation value is either $L^l = 0$ with probability p_L or L^h with probability $(1 \Leftrightarrow p_L)$.[8] Both, the first period cash-flow and the liquidation value are observable and verifiable. Thirdly, the value of the initial project occurs at $t = 1$, as well. We assume that with a probability of p_Y this project has a zero output $(=Y^l)$ and with the counter probability $(1 \Leftrightarrow p_Y)$ the output is high $(=Y^h)$. In contrast to the outcome of the new project this realized output is costly observable but non-verifiable at $t = 1$.[9] This means that its value cannot be determined in court. The owner can consume Y at this point of time or sell it with revenues being realized at $t = 2$. This sale is also costly observable but non-verifiable at $t = 1$. If this sale was conducted due to the investors it occurs under their names so that we do not have any problems concerning observability and verification at $t = 2$. At $t = 1$ we do not distinguish between observation about the level of the output and its sale. Thus, the output and its sale can only be observed together and one has to spend once some capital on observation. It is important to emphasize that liquidation of the firm refers to the new project because the output of the existing project is non-verifiable. This means that simultaneously the firm could be liquidiated and the owner can consume the entire output Y by himself. Or, liquidation occurs independently of a consumption or a sale of the output.

If the firm is insolvent at $t = 1$ the firm can be liquidated or continued. The creditors who are involved in this insolvency have to decide unanimously about the firm policy. This means

[7] The idea for this design is that if an owner evaluates a project he cannot predict the future cash-flows for sure but he might be able to assume a lower safe bound of the cash-flows.

[8] Without further insights one could make the liquidation value, the level of the output and the second period cash-flow dependent of the first period outcome and the results were still robust to such an adjustment.

[9] The difference in the structure of the two investment projects can be explained in serveral ways. For example, one could assume that the new project is one which is undertaken in the home country, whereas the initial one is located abroad. Or, the outcome of the initial project is a patent or another immaterial good. Thus, it could be prohibitely costly or even impossible to evaluate the value of this project. In any case, the owner did not have to think about verification problems in advance because the initial project affected only the owner. This is different with the new project for which the owner is dependent on external financing.

that the firm is only continued if each creditor prefers continuation. Without an unanimous agreement the firm is liquidated. The creditors have to make their decision independently from each other so that we exclude situations in which creditors could draw conclusions from each other's behavior. Thus, a typical free-rider problem cannot arise.[10] In case the firm is insolvent and these creditors observe Y they can use their information about this level in case of renegotiation. The creditors can use liquidation as a threat point to demand that the output should be sold and the revenues are handed over to the creditors.

If the firm is not liquidated at $t = 1$ the second period cash-flow of the new project appears at the end of the second period. The level of the second period cash-flow is uncertain, too. The cash-flow is either X_2^l or X_2^h with the respective probabilities of p_2 and $(1 \Leftrightarrow p_2)$. To simplify it is assumed that X_2^l is equal to zero. Furthermore, we set the liquidation value L_2 at $t = 2$ equal to zero. Finally, if the output was sold the revenues are realized.

The whole model structure is known to all participating individuals. For simplicity we set the riskless interest rates, the owner's and the investors' discount rates equal to zero. Moreover, we assume that all variables are independent from each other. This does not influence our results but makes the calculations much easier. The new investment project is worth to be undertaken in general so that the following inequality holds,

$$I < p_1 \cdot [X_1^s + (1 \Leftrightarrow p_2) \cdot X_2^h] + (1 \Leftrightarrow p_1) \cdot [X_1^s + X_1^j + (1 \Leftrightarrow p_2) \cdot X_2^h] = E[X_1] + E[X_2]. \quad (1)$$

The owner of the firm maximizes the expected value of his utility function. His utility function is,

$$U = X_1^i + X_2^i + Y^i \Leftrightarrow c(X_1, L_1, Y, X_2) + y \cdot k, \quad (2)$$

[10] It is common in the financial intermediation literature that each creditor has to decide on its own and, if necessary, spend capital on observation. This means, they cannot cooperate so that only one can act in the others' interests. That was the reason why the existence of a financial intermediary was benefical. See Diamond (1984) and Williamson (1986).

where i is the state of the world, c stands for the state contingent payments to the creditors and k is the control rent of the owner. He is able to consume this control rent if the firm is ongoing until the end of the second period. Thus, y is a binary variable which is zero if the firm is liquidated at date $t = 1$ and one otherwise. One can justify a large control rent in the following context. The entire assets of the firm become worthless after the second period. Thus, the owner has to look for a new job. As such, his reputation is quite important so that he never wants the firm to be liquidated because having been the owner of a liquidated firm would be a bad signal about his abilities. This situation is given so that k is exogenous.

The investors are also assumed to be risk-neutral. As said in footnote **??** each possesses one unit of capital so that the firm has to borrow from I individuals. At $t = 0$ there is competition among investors so that the owner has the bargaining power. Thus, they demand an expected repayment for handing over their capital so that they receive the same repayment they would otherwise get with the riskless interest rate. The terms of the debt contract will be specified later. In contrast to $t = 0$ at $t = 1$ we assign the full bargaining power to the creditors which is only relevant if the firm is insolvent. In this case the creditors make a take-it-or-leave-it offer to the owner. The terms of this offer will be specified below.

Before we start with the model in detail we want to constrain the levels of the parameters which simplifies the following investigations. The high liquidation value is larger than the expected second period cash-flow, $L^h > (1 \Leftrightarrow p_2) \cdot X_2^h$. As such, from the creditors‘ point of view liquidation is the superior choice if the high liquidation value is realized and continuation is the one with a zero liquidation value. Furthermore, $Y^h > L^h$ so that if the output is high, the owner could sell it and give the creditors more than they get by liquidation. To sum up, we get the following row of inequalities, $Y^h > L^h > (1 \Leftrightarrow p_2) \cdot X_2^h$. If $X_1^s + X_1^j$ is realized the fixed payment of debt can be repaid entirely.[11]

In the following section the owner can choose the financial structure of the firm and in section 4 both, the financial structure and the financing source. Through these choices he is able to

[11] We assume that if the project is doing well the owner is able to fully repay the debt. Thus, $X_1^s + X_1^j$ is sufficiently large and it will be shown that the expected payments to the creditors are independent of a specified level. As a consequence the expected payments are not constrained by this assumption.

influence the expected repayments and partly the decision about the firm‘s policy in times of financial distress.

3. Capital Market as Financing Source

In this section the capital market is the only financing source. Thus, we examine the question if and possibly under what conditions an owner can profit from a seniority structure. This means that we are interested in the fact how seniority has an effect of the probability of observation and the impact on the firm‘s policy. First, it is assumed that the owner chooses no seniority structure and afterwards the outcome of choosing a seniority structure is investigated. We start by analyzing the consequences of each financing decision at $t = 1$ and then derive the optimal choice of the financial structure at $t = 0$.

3.1 Many creditors and no seniority

The results of this choice are quite obvious in case that the high cash-flow $X_1^s + X_1^j$ arises after the first period. The outstanding debt is entirely satisfied and the owner can continue the firm without any trouble. The payments to the parties are $I(1 + r_{01})$ for the creditors and for the owner is left $X_1^s + X_1^j \Leftrightarrow I(1 + r_{01})$, the output Y plus the consumption of the control rent k and the second period cash-flow X_2. The term $(1 + r_{01})$ is the short term risk-adjusted interest rate for debt from $t = 0$ to $t = 1$.

The outcome of the situation in which the low cash-flow is realized is more interesting. Now, the firm is insolvent and as a consequence the creditors can decide about the firm‘s future policy. Before we go into detail we have to comment on the choices the creditors possess at $t = 1$. Many creditors have the choice to observe the value of the output Y. Since the creditors have the power to liquidate the firm they could force the owner to sell this output and give the creditors the revenues. As said above we assume that each creditor has to spend the costs c_1 if one wants to get to know the value. It seems very questionable if observation could occur with a very large number of investors. Below we give conditions so that observation by many creditors does not happen.

One can divide the possible situations of a low realized cash-flow into two parts.

1. $X_1 = X_1^s$ and $L_1 = L^l = 0$ with probability $p_1 \cdot p_L$.

First of all, one could assume that the firm is always liquidated in case of insolvency. Especially since we deal with many creditors such an assumption could be justified. Nevertheless the firm is not liquidated in this situation because the creditors can only benefit from a continuation. The decision problem each creditors faces is if one should observe the value of Y. Remember, we said above that no creditor can free-ride on others' costs. Each investor has to spend capital on observation and one cannot act in behalf of the others.[12] Since the situation is the same among the investors, so that if it is benefical for one to observe it is benefical for the others, too, there are only two possible equilibria that could arise.[13] One is that every creditor observes the value and makes a decision contingent on the observation. The other one is that no creditor observes and decides with incomplete information. Within each equilibrium there is no difference in the decision by the creditors because they have the same underlying information. The equilibrium which will occur in each setting depends on the parameters of the model.

In this situation there is no reason to go through the case if many creditors would observe. The reasoning goes as follows: One has to recognize that the firm is continued in any case due to the low liquidation value, independent of the result of potential observation. Connected with this low liquidation value a credible commitment problem arises. This problem can only arise with a high output value. Normally, in this case observation was benefical for the creditors because they try to force the owner to sell the output if the firm should not be closed down. The problem is that liquidation is not the subgame perfect policy. If the owner does not sell the output a continuation would still be the only optimal strategy for the creditors. As a consequence the creditors cannot force the owner to sell it because the firm is continued in any case. Given that the firm is continued in any case the owner does not voluntarily sell his output. As such, the creditors do not observe at first place. Thus, we can summarize that even if observation would be benefical for the creditors observation does not occur. Since liquidation is not credible if the low liquidation value is realized, the creditors do not waste

[12] Compare with footnote **??**.

[13] This fact will become clear later.

capital on observation. The creditors can only recover partly their losses by continuing the firm. At this point of time the creditors cannot be sure how large the cash-flow is going to be at the end of the second period. Thus, the expected repayments are $[p_2 \cdot 0 + (1 \Leftrightarrow p_2) \cdot X_2^h]$. The owner can consume his control rent and the output for sure.

2. $X_1 = X_1^s$ and $L_1 = L^h$ with probability $p_1 \cdot (1 \Leftrightarrow p_L)$.

In this situation we exclude the case that it is benefical for many creditors to observe Y so that the firm is liquidated with a high liquidation value. Without observation it is individual rational for each creditor to prefer liquidation because $L^h > (1 \Leftrightarrow p_2) \cdot X_2^h$. To achieve a continuation and force the owner to sell his output each one has to vote for continuation and make a take-it-or-leave-it offer. Thus, each investor is important for the outcome. Therefore, a continuation can only occur if each investor observes and the output is high. To make observation unattractive by all creditors the following condition has to be valid, $L^h > p_Y \cdot L^h + (1 \Leftrightarrow p_Y) \cdot (1 \Leftrightarrow \alpha) \cdot Y^h + (1 \Leftrightarrow p_Y) \cdot (1 \Leftrightarrow p_2) \cdot X_2^h \Leftrightarrow I \cdot c_1$.[14] This means that liquidation gives the creditors a higher (expected) payoff. We have to explain this condition, especially the appearance of $(1 \Leftrightarrow \alpha)$ in more detail, where $\alpha \in (0, 1)$. The right hand side stands for the expected payoff with observation. Since $L^h > (1 \Leftrightarrow p_2) \cdot X_2^h$ the creditors would only continue the firm if the high output value is realized (with probability $1 \Leftrightarrow p_Y$). If this is not the case the firm is liquidated (with probability p_Y). But if $Y = Y^h$ the creditors receive only a fraction of Y $(= 1 \Leftrightarrow \alpha)$. Remember that the creditors possess the full bargaining power. Thus, given observation they make a take-it-or-leave-it offer to the owner. Take-it means that the owner accepts the offer and if he leaves it the firm is liquidated. This offer will be designed so that the owner receives the same utility he would otherwise get by liquidation. As a consequence,

[14] By substracting $I \cdot c_1$ it is clear that this condition contains the assumption that each creditor has to observe the value. What would happen if only one creditor observes and the rest votes for continuation because one is enough to reach liquidation? In the financial intermediation literature each creditor has to observe the realized cash-flow if the firm is insolvent. Otherwise he gets nothing so that the owner discriminates within the group of investors. Applying this outcome to our situation would mean that (i) if the observer votes for liquidation the firm is liquidated and the liquidation value is splitted equally among the investors, (ii) if the firm is continued the observer gets his share from $(1 - \alpha) \cdot Y^h$ plus X_2^h and the others get only their share from X_2^h. Thus, the owner discriminates in this setting, as well. This is independent of the bargaining power because the non-observing investors do not know if the owner sold Y and can therefore be treated differently.

if $Y = Y^l$ the owner would not get anything but this is not important because the firm is liquidated. Whereas, if $Y = Y^h$ his reservation utility is Y^h. As a consequence the creditors offer the owner a continuation of the firm (=benefit equal to k) and a fraction α of Y^h so that $k + \alpha Y^h = Y^h$.[15] In equilibrium the owner would take the offer and the firm would be continued.

Neglecting the control rent of the owner a liquidation is the efficient firm policy. Of course the owner of the firm dislikes this early liquidation and it is a disadvantage that observation does not occur and that the creditors cannot benefit from a high output. Since even if the output's value is high he is not able to compensate them for L^h due to lack of credibility. The reason for the lack of credibility is the observability of the sale only under spending some capital which does not happen in this scenario. Therefore, the owner would always claim that the output is high and that he sold it. Thus, with a high liquidation value the firm is liquidated.

To summarize, only if $L_1 = L^h$ the firm is liquidated. Renegotiation does not occur because in the first situation the creditors obtain the entire second-period cash-flow in any case and in the second one a potential compensation is not credible. The expected payments to the creditors are

$$p_1 \cdot [X_1^s + (1 \Leftrightarrow p_L) \cdot L^h + p_L \cdot (1 \Leftrightarrow p_2) \cdot X_2^h] + (1 \Leftrightarrow p_1) \cdot I(1 + r_{01}). \tag{3}$$

Now, one is able to derive the individual rationality constraint of the creditors,

$$p_1 \cdot [X_1^s + (1 \Leftrightarrow p_L) \cdot L^h + p_L \cdot (1 \Leftrightarrow p_2) \cdot X_2^h] + (1 \Leftrightarrow p_1) \cdot I(1 + r_{01}) \geq I. \tag{4}$$

In equilibrium this condition will be fulfilled with equality. From this equilibrium condition we can specify the fixed payment the creditors are going to demand for handing over their capital. This fixed payment is

[15] The case $k > Y^h$ is trivial because the owner would always prefer a seniority structure. This point becomes clearer below.

$$I(1+r_{01}) = \frac{I \Leftrightarrow p_1 \cdot X_1^s \Leftrightarrow p_1 \cdot (1 \Leftrightarrow p_L) \cdot L^h \Leftrightarrow p_1 \cdot p_L \cdot (1 \Leftrightarrow p_2) \cdot X_2^h}{1 \Leftrightarrow p_1}. \tag{5}$$

3.2 Many creditors and seniority structure

In this section we assume that the owner splits the creditors into different groups, each group holding different claims of seniority. Remember that a seniority structure means that the creditors receive payments in order of their claims. Thus, without violation of the absolute priority rule the senior creditors are fully repaid before the junior ones get any payments.

The question is what determines the seniority structure. In the preceding subsection the problem of the owner is that he cannot credibly commit to a sale of the output if the firm is insolvent. Thus, by choosing a seniority structure he tries to solve this problem so that observation occurs by the creditors who are affected by insolvency. As such, the number of possible creditors who have to observe Y has to be minimized. Therefore, the safe part of the cash-flow should contain as many creditors as possible. Since each creditor has one unit of capital there should be X_1^s senior creditors. To derive the entire debt structure endogenous one has to know the exact insolvency proceeding. In our context it is enough to assume only one class of junior claims because the focus of this article is to show how an owner can increase his expected utility by a seniority structure. The terminology introduced in section 2 was used with regard to this fact. The owner of the firm splits the creditors into two parts, the first one has senior financial claims and the second one holds junior debt contracts.[16] Thus, the number of the senior creditors equals X_1^s and as a consequence to this the firm borrows capital from $I \Leftrightarrow X_1^s$ junior creditors.

Again, we use the same structure as in the preceding subsection. Therefore, we divide the situations occuring with insolvency into two parts. Before we start one should note that it is obvious that the financial structure matters only in case the low cash-flow is realized. Otherwise the creditors receive their entire repayments. The following discussion has insolvency as the underlying condition of the firm. We just have to look at the junior creditors and their

[16] Ross (1989) used this splitting into a safe and a risky part in a totally different context. In his model the use of different claims arises from the fact that selling risky claims demands more marketing costs than riskless ones. As a consequence it is possible to lower marketing costs.

decisions because nothing changes for the senior ones. Their payments are independent of the decisions made by the junior creditors.

1. $X_1 = X_1^s$ and $L_1 = L^l = 0$ with probability $p_1 \cdot p_L$.

In this situation the low liquidation value is realized. To analyze if the financial structure were relevant we would have to investigate if the junior creditors observe the output. But we already know from the discussion in the previous subsection that it is not important if observation by the junior creditors can occur because any take-it-or-leave-it offer is not credible. To repeat ourselves, in this situation the only subgame perfect equilibrium is a continuation of the firm and no observation by junior creditors. As such, in case of insolvency and $L_1 = L^l$ the decisions the junior creditors are going to make equal the ones made by many creditors without seniority structure. Furthermore, seniority structure does not matter in this situation. From the viewpoint of the owner this is actually no problem because the firm is continued in any case.

2. $X_1 = X_1^s$ and $L_1 = L^h$ with probability $p_1 \cdot (1 \Leftrightarrow p_L)$.

In contrast to situation 1 the liquidation value is high. Now, we actually have to analyze if the junior creditors observe the value of Y in this scenario. To be consistent we start with the assumption that $L^h > p_Y \cdot L^h + (1 \Leftrightarrow p_Y) \cdot (1 \Leftrightarrow \alpha) \cdot Y^h + (1 \Leftrightarrow p_Y) \cdot (1 \Leftrightarrow p_2) \cdot X_2^h \Leftrightarrow (I \Leftrightarrow X_1^s) \cdot c_1$. This leads to the result that the junior creditors do not observe. As before without observation the decisions by the junior creditors equal the ones made by many creditors. Since we know each decision for every state of the world if obervation does not occur we can calculate the fixed payment of the debt contracts. Afterwards we go into more detail in case that junior creditors observe. The senior creditors lend X_1^s to the firm and receive the same amount after the first period. The case is more complicated for the junior creditors. With probability $(1 \Leftrightarrow p_1)$ the firm is able to repay its debt in full. In case of insolvency, which occurs with probability p_1, the junior creditors liquidate the firm with a high liquidation value. The probability for this event is $(1 \Leftrightarrow p_L)$. Last but not least the junior creditors receive a payment if they continue the firm with a zero liquidation value and the high second period cash-flow is realized. The probability that this happens is $p_L \cdot (1 \Leftrightarrow p_2)$. The expected repayments for the junior creditors look as follows,

$$p_1 \cdot (1 \Leftrightarrow p_L) \cdot L^h + p_1 \cdot p_L \cdot (1 \Leftrightarrow p_2) \cdot X_2^h + (1 \Leftrightarrow p_1) \cdot (I \Leftrightarrow X_1^s)(1 + r_{01}^j), \tag{6}$$

where $1 + r_{01}^j$ is the risk-adjusted interest rate for junior creditors. This gives us the following individual rationality constraint for the junior creditors,

$$p_1 \cdot (1 \Leftrightarrow p_L) \cdot L^h + p_1 \cdot p_L \cdot (1 \Leftrightarrow p_2) \cdot X_2^h + (1 \Leftrightarrow p_1) \cdot (I \Leftrightarrow X_1^s)(1 + r_{01}^j) \geq I \Leftrightarrow X_1^s. \tag{7}$$

Again, this condition is satisfied with equality in equilibrium. Solving for $(I \Leftrightarrow X_1^s)(1 + r_{01}^j)$ leads to the fixed payment the junior creditors are going to demand

$$(I \Leftrightarrow X_1^s)(1 + r_{01}^j) = \frac{I \Leftrightarrow X_1^s \Leftrightarrow p_1 \cdot (1 \Leftrightarrow p_L) \cdot L^h \Leftrightarrow p_1 \cdot p_L \cdot (1 \Leftrightarrow p_2) \cdot X_2^h}{1 \Leftrightarrow p_1}. \tag{8}$$

We can now sum up the two fixed payments to get the total amount of them,

$$I(1 + r_{01}) = X_1^s + (I \Leftrightarrow X_1^s)(1 + r_{01}^j) = x_s + \frac{I \Leftrightarrow X_1^s \Leftrightarrow p_1(1 \Leftrightarrow p_L)L^h \Leftrightarrow p_1 p_L(1 \Leftrightarrow p_2)X_2^h}{1 \Leftrightarrow p_1}$$

$$= \frac{I \Leftrightarrow p_1 \cdot X_1^s \Leftrightarrow p_1 \cdot (1 \Leftrightarrow p_L) \cdot L^h \Leftrightarrow p_1 \cdot p_L \cdot (1 \Leftrightarrow p_2) \cdot X_2^h}{1 \Leftrightarrow p_1}. \tag{9}$$

This result is the same we got from the previous subsection. It should be clear that this is not surprising because the seniority structure did not change anything until now. Since we are dealing with risk-neutral individuals we have to rise the default-premium for the junior creditors and can lower it for the senior ones so that on average the overall default-premium remains constant. This means that the financial structure does not really matter. There are two reasons to explain this outcome. Firstly, the observation costs were only indirectly important because they prevented all investors from observing the output. Secondly and more important, the outcome is the result of the assumption about the preferences of the owner and the creditors. If they were not risk-neutral the two fixed payments would not sum up to the one without seniority.

In a last scenario we assume that the junior creditors observe the output, $L^h < p_Y \cdot L^h + (1 \Leftrightarrow p_Y) \cdot (1 \Leftrightarrow \alpha) \cdot Y^h + (1 \Leftrightarrow p_Y) \cdot (1 \Leftrightarrow p_2) \cdot X_2^h \Leftrightarrow (I \Leftrightarrow X_1^s) \cdot c_1$. Even though it is questionable

if this case would actually occur in reality we go through this case for two reasons: (i) the advantage of a financial intermediary becomes clearer and (ii) perhaps the owner can lower the number of junior creditors sufficiently so that observation and renegotiation could occur with a small number of investors.[17] As said in section 2 the creditors possess the bargaining power in case of renegotiation. In general one should realize that it should not be important for the expected payments to the creditors, who gets the bargaining power because this shifts payments from one state to another. Nevertheless the bargaining power is quite important to induce a certain behavior.

We divide this scenario into two parts. One can give an outlook for these parts. If we do not take into account the control rent of the owner a liquidation policy is the efficient policy ($L^h > (1 \Leftrightarrow p_2) \cdot X_2^h$). But since the owner does not want the firm to be liquidated he tries to influence the firm‘s policy in favor of his preferences. The means he uses is the output.

(i) $X_1 = X_1^s$, $L_1 = L^h$ and $Y = Y^l$ with probability $p_1 \cdot (1 \Leftrightarrow p_L) \cdot p_Y$.

In this situation the firm is liquidated due to a low output value. The expected second period cash-flow is too low to make continuation advantageous and the output cannot be used as a compensation means for the liquidation value. Thus, in this situation the firm is liquidated and the owner did not reach the aim of no liquidation. The payments to the junior creditors are L^h.

(ii) $X_1 = X_1^s$, $L_1 = L^h$ and $Y = Y^h$ with probability $p_1 \cdot (1 \Leftrightarrow p_L) \cdot (1 \Leftrightarrow p_Y)$.

In contrast to (i) the output has a high value, which is by assumption larger than the liquidation value. Thus, the owner can compensate the junior creditors if they do not liquidate the

[17] This assumption is critical because in reality one can observe that in case of insolvency firms with several creditors are nearly always liquidated, so that the assumption of observation and renegotiation by junior creditors seems to be questionable. Hart and Moore (1995) claim that with a large number of investors the renegotiation process will break down and as a consequence the firm is liquidated. Moreover, Gilson et al. (1990) give evidence that renegotiation frequently fails in pratice and this failure becomes more likely the higher the number of creditors. For a further reference see Gilson (1991). As will be shown below we do not rely on this assumption because with the introduction of a financial intermediary one can prove the advantage of a seniority structure.

firm. The creditors make a take-it-or-leave-it offer to the owner. Since the owner can consume Y^h for sure his reservation utility is Y^h. As a consequence the junior creditors offer the owner a continuation of the firm and a fraction Y^h so that $k + \alpha Y^h = Y^h$. This time a liquidation is credible because $L^h > (1 \Leftrightarrow p_2) \cdot X_2^h$. In equilibrium the owner accepts this offer and the firm is continued. At $t = 2$ the payments to the junior creditors are $(1 \Leftrightarrow \alpha) \cdot Y^h$ and X_2^i. [18]

The difference between situations without observation (= no seniority structure, seniority structure but observation too costly) and this one is that the junior creditors renegotiate in case of insolvency and observe the sale of the output. If observation did not occur compensation was not credible. Assuming that observation occured if $L = L^h$ the entire expected payments to the junior creditors can be summarized:

$$(1 \Leftrightarrow p_1) \cdot (I \Leftrightarrow X_1^s)(1 + r_{01}^j) + p_1 \cdot p_L \cdot (1 \Leftrightarrow p_2) \cdot X_2^h + p_1 \cdot (1 \Leftrightarrow p_L) \cdot p_Y \cdot L^h +$$
$$p_1 \cdot (1 \Leftrightarrow p_L) \cdot (1 \Leftrightarrow p_Y) \cdot (1 \Leftrightarrow \alpha) \cdot Y^h + p_1 \cdot (1 \Leftrightarrow p_L) \cdot (1 \Leftrightarrow p_Y) \cdot (1 \Leftrightarrow p_2) \cdot X_2^h.$$

This gives us the following individual rationality constraint

$$(1 \Leftrightarrow p_1) \cdot (I \Leftrightarrow X_1^s)(1 + r_{01}^j) + p_1 \cdot p_L \cdot (1 \Leftrightarrow p_2) \cdot X_2^h + p_1 \cdot (1 \Leftrightarrow p_L) \cdot p_Y \cdot L^h +$$
$$p_1 \cdot (1 \Leftrightarrow p_L) \cdot (1 \Leftrightarrow p_Y) \cdot (1 \Leftrightarrow \alpha) \cdot Y^h + p_1 \cdot (1 \Leftrightarrow p_L) \cdot (1 \Leftrightarrow p_Y) \cdot (1 \Leftrightarrow p_2) \cdot X_2^h \geq (I \Leftrightarrow X_1^s) + (I \Leftrightarrow X_1^s) \cdot p_1 \cdot (1 \Leftrightarrow p_L) \cdot c_1.$$

As usual this condition is satisfied with equality in equilibrium if we give the owner of the firm the bargaining power at $t = 0$. Thus, we are now able to derive the fixed payment of junior debt,

$$(I \Leftrightarrow X_1^s)(1 + r_{01}^j) = \frac{I \Leftrightarrow X_1^s + (I \Leftrightarrow X_1^s) \cdot p_1 \cdot (1 \Leftrightarrow p_L) \cdot c_1 \Leftrightarrow p_1 \cdot p_L \cdot (1 \Leftrightarrow p_2) \cdot X_2^h}{1 \Leftrightarrow p_1}$$
$$\frac{\Leftrightarrow p_1 \cdot (1 \Leftrightarrow p_L) \cdot p_Y \cdot L^h \Leftrightarrow p_1 \cdot (1 \Leftrightarrow p_L) \cdot (1 \Leftrightarrow p_Y) \cdot (1 \Leftrightarrow \alpha) \cdot Y^h}{1 \Leftrightarrow p_1}.$$

[18] It is not important if $(I - X_1^s)(1 + r_{01}^j)$ is larger or smaller than $(1 - \alpha) \cdot Y^h + X_2^h$ because the junior creditors have the bargaining power and demand the entire cash-flow of the project.

$$\frac{\Leftrightarrow p_1 \cdot (1 \Leftrightarrow p_L) \cdot (1 \Leftrightarrow p_Y) \cdot (1 \Leftrightarrow p_2) \cdot X_2^h}{1 \Leftrightarrow p_1}$$

As the entire fixed payment we get [19]

$$I(1 + \tilde{r}_{01}) = X_1^s + (I \Leftrightarrow X_1^s)(1 + r_{01}^j) \tag{10}$$

$$= \frac{I \Leftrightarrow p_1 \cdot X_1^s + (I \Leftrightarrow X_1^s) \cdot p_1 \cdot (1 \Leftrightarrow p_L) \cdot c_1 \Leftrightarrow p_1 \cdot p_L \cdot (1 \Leftrightarrow p_2) \cdot X_2^h \Leftrightarrow p_1 \cdot (1 \Leftrightarrow p_L) \cdot p_Y \cdot L^h \Leftrightarrow}{1 \Leftrightarrow p_1}$$

$$\frac{\Leftrightarrow p_1 \cdot (1 \Leftrightarrow p_L) \cdot (1 \Leftrightarrow p_Y) \cdot (1 \Leftrightarrow \alpha) \cdot Y^h \Leftrightarrow p_1 \cdot (1 \Leftrightarrow p_L) \cdot (1 \Leftrightarrow p_Y) \cdot (1 \Leftrightarrow p_2) \cdot X_2^h}{1 \Leftrightarrow p_1}. \tag{11}$$

To sum up, if the junior creditors observe the firm is only liquidated in one case, namely with the high liquidation value and a zero output. For the owner this is actually an improvement because he is able to consume his control rent k in more states of nature. The question arises how high is the price the owner pays for this improved firm policy. Since we derived the two fixed payments without and with observation one could compare the outcome of these two scenarios. But a comparison of these two fixed payments does not give evidence because the underlying scenarios under which we derived them were different. In the first calculation we did not take the development of the output into account. Thus, we had less states of nature to analyze. Since observation is advantageous for the junior creditors the fixed payment $I(1+\tilde{r}_{01})$ has to be lower. The difference between the fixed payments is[20]

$$I(1+\tilde{r}_{01}) \Leftrightarrow I(1+r_{01}) = (I \Leftrightarrow X_1^s) \cdot c_1 \Leftrightarrow (1 \Leftrightarrow p_Y) \cdot (1 \Leftrightarrow \alpha) \cdot Y^h + (1 \Leftrightarrow p_Y) \cdot (L^h \Leftrightarrow (1 \Leftrightarrow p_2) X_2^h). \tag{12}$$

If this difference is below or above zero depends on the parameters of the model. Using the condition for observation, $(1 \Leftrightarrow p_Y)L^h = (1 \Leftrightarrow p_Y) \cdot (1 \Leftrightarrow \alpha) \cdot Y^h + (1 \Leftrightarrow p_Y) \cdot (1 \Leftrightarrow p_2) \cdot X_2^h \Leftrightarrow (I \Leftrightarrow X_1^s) \cdot c_1$ as an upper bound for L^h we get $I(1 + \tilde{r}_{01}) \Leftrightarrow I(1 + r_{01}) = 0$. But since $(1 \Leftrightarrow p_Y)L^h$ is strictly

[19] To show the difference in the fixed payment we use the sign ˜ if observation occurs.

[20] Compare with appendix.

less than the right hand side we get as a result that $I(1+\tilde{r}_{01}) \Leftrightarrow I(1+r_{01}) < 0$. This shows very clearly that the fixed payment $I(1+\tilde{r}_{01})$ is lower than $I(1+r_{01})$.

The fixed payments are worthless to give information about the costs for the owner to achieve a better firm policy. Thus, we try to outline these costs now. It is already known that liquidation is the efficient policy if the liquidation value is high. Since the owner prefers a continuation in any state of nature he somehow has to compensate the junior creditors for an inefficient continuation. Neglecting Y he could compensate them by an adjusted default-premium so that they receive on average their opportunity costs even if they continue in the high liquidation state. But this is not enough. To be subgame perfect it also has to be in the interest of the junior creditors not to liquidate the firm. Thus, the only means the owner possesses is the output. Normally the owner would be able to benefit from this output alone, but due to the observation the junior creditors get to know its value. Thus, he loses a fraction $(1 \Leftrightarrow \alpha)$ of the output if the project goes badly and the liquidation value is large. Even though this harms the owner at first sight it still helps him to reach his aim of no liquidation in as many states as possible. As a consequence, the owner has the trade-off between being able to benefit from the output by choosing no seniority or using it as a means to prevent liquidation. The outcome of this trade-off depends on the control rent k, this means how high has the control rent to be so that the owner is willing to pay the higher price, which is partly losing Y^h. The effect on the expected utility is outlined in the following subsection. A threshold k^* for the control rent is derived below, if k is smaller than this threshold no seniority structure is preferred and vice versa. This means that a seniority structure can actually be inferior if the control rent is not large enough. In this case the owner rather risks being liquidated if $L = L^h$ and being able to benefit from the output alone for sure.

3.3 The optimal choice of the owner

The owner maximizes the expected utility. Thus, he has to compare his expected utility with each financing decision. The maximization problem is

$$max\{E[U^1(i)], E[U^2(i)]\}$$

$$U^1(i) = X_1^i + X_2^i + Y^i \Leftrightarrow c(r_{01}) + y(r_{01}) \cdot k \tag{13}$$

and

$$U^2(i) = X_1^i + X_2^i + Y^i \Leftrightarrow c(r_{01}^s, r_{01}^j) + y(r_{01}^s, r_{01}^j) \cdot k \tag{14}$$

The expected utility of a debt structure without seniority is,

$$E[U^1(i)] = p_1 \cdot p_L \cdot k + (1 \Leftrightarrow p_1) \cdot [(X_1^s + X_1^j) \Leftrightarrow I(1 + r_{01}) + k] + (1 \Leftrightarrow p_1) \cdot (1 \Leftrightarrow p_2) \cdot X_2^h + (1 \Leftrightarrow p_Y) \cdot Y^h.$$

The expected utility with a seniority structure and observation by junior creditors has the following form,

$$E[U^2(i)] = p_1 \cdot p_L \cdot k + p_1 \cdot (1 \Leftrightarrow p_L) \cdot (1 \Leftrightarrow p_Y) \cdot k + p_1 \cdot p_L \cdot (1 \Leftrightarrow p_Y) \cdot Y^h$$

$$+p_1 \cdot (1 \Leftrightarrow p_L) \cdot (1 \Leftrightarrow p_Y) \cdot \alpha \cdot Y^h + (1 \Leftrightarrow p_1) \cdot [(X_1^s + X_1^j) \Leftrightarrow I(1 + \tilde{r}_{01}) + k] +$$

$$(1 \Leftrightarrow p_1) \cdot (1 \Leftrightarrow p_2) \cdot X_2^h + (1 \Leftrightarrow p_1) \cdot (1 \Leftrightarrow p_Y) \cdot Y^h.$$

Result

As shown in the appendix, if

$$k > k^* = L^h \Leftrightarrow (1 \Leftrightarrow p_2) \cdot X_2^h + \frac{(I \Leftrightarrow X_1^s) \cdot c_1}{1 \Leftrightarrow p_Y} \tag{15}$$

the owner increases his expected utility by choosing a seniority structure. This means that the owner could also harm himself by choosing a seniority structure if the control rent is not large enough. This result is in contrast to Winton‘s who draws the conclusion that seniority is always benefical. In our model seniority can be disadvantegous because observation could occur by the junior creditors even though this is not in the interest of the owner. To resolve this problem the owner has to choose a debt structure which treats all investors identically.

Let us explain the inequation more in detail. We already know that $L^h > (1 \Leftrightarrow p_2) \cdot X_2^h$ so that the sum of the right hand side is for sure larger than zero. If this were not true the result would be trivial and seniority is always superior. Surprisingly, the probabilities p_1 and p_L do not occur in this condition. As a consequence, the probability of the low cash-flow after the first period and of a high liquidation value does not matter. We try to resolve this surprising result. The probability p_1 stands for the probability of the low first period cash-flow. But what does the owner try to influence by choosing a seniority structure? He tries to affect the decision about the future policy at $t = 1$. For this policy the probability of the first period cash-flow is not important. This fits to the probability p_L, as well. As we know by now the owner tries to influence the future policy by choosing a seniority structure given a high liquidation value. Moreover, the high ouput value Y^h is also not present in this condition. The reasoning goes as follows: the owner gets Y^h in any case if it appears. It is just a question of how the owner uses this value. By choosing no seniority he keeps it himself and with seniority he hands it partly over to the junior creditors if the project is bad and the liquidation value is large in exchange for a better firm policy.

If one looks from point $t = 1$ into the future and given that the high liquidation value is realized the only variables that are important appear in this condition. This means, it is important if the firm is liquidated or continued and if the output is observed. Let us explain the inequation in more detail. The liquidation value L^h gives the outside option. The junior creditors can choose if they want to liquidate the firm or to continue it. In this case they receive an expected second period cash-flow $(1 \Leftrightarrow p_2) \cdot X_2^h$. To make this point clearer one could substract $p_2 \cdot 0$ on the right hand side. This difference $L^h \Leftrightarrow (1 \Leftrightarrow p_2) \cdot X_2^h$ is of crucial importance because it expresses the price the owner has to pay for the induced firm policy. The larger this difference the more costly it is for the owner to implement continuation in an increased number of states. Moreover, it is important how much the junior creditors have to spend on observing the output. If one looks from $t = 0$ into the future of course the expected observation costs are important to know. But at $t = 1$ it is only of interest how high these costs really are. Finally, the probability of the situation with an improved firm policy by choosing seniority appears in this inequality, which is $1 \Leftrightarrow p_Y$, given that the firm is insolvent and L^h occured.

It is interesting to observe what happens if the threshold k^* increases. At first, this can occur because the high liquidation value L^h rises. A higher liquidation value means that liquidation becomes even more attractive. As a consequence, the expected payments could be reduced if the firm policy is liquidation at $t = 1$. But if the owner still prefers continuation he does not benefit from this higher liquidation value in any situation. Put simply, a continuation is more expensive and therefore does the threshold k^* has to rise, too. Secondly, an increase in k^* could be influenced by a decrease of the expected second period cash-flow $(1 \Leftrightarrow p_2) \cdot X_2^h$. In this case continuation becomes less appropriate respectively more expensive. What is left over is the last term. We start with the probability $1 \Leftrightarrow p_Y$. A decrease in the probability makes it less likely that the junior creditors receive full repayment and continue the firm. Thus, the risk-adjusted interest rate $\tilde{r}_{01}$ and the threshold k^* become larger. It is the other way around with the numerator. If the observation costs rise the control rent k^* has to increase as well, because it becomes more expensive to reach a better firm policy.

4. A Financial Intermediary as the Financing Source

In this section we introduce a financial intermediary (FI) as a possible financing source. We do not deal with the refinancing side of the FI so that the meaning of this section does not change if one thinks about one large investor instead of a FI. To stress this point we assume that the observation costs remain the same, so that the FI has to spend the amount c_1 on observing the condition of the firm, but only once in contrast to several creditors. Furthermore, we introduce a cost variable contingent on the size of borrowed capital. Thus, we multiply this level with a small constant c_2. This leads to the first result concerning a FI. Its existence can possibly only be an improvement on the junior level and not on the senior one. One can justify this assumption with the costs of intermediation. As Hoshi, Kashyap and Scharfstein (1990) noted these costs arise due to administration expenses, reserve requirements and the illiquidity of bank loans. Fama (1985) and James (1987) proved that these costs are carried by the borrowers of bank loans.

We divided the investigation concerning seniority structure into two parts, one without observation and one with observation. As a consequence of this there are two situations in which

the FI's existence can be benefical.

No Observation by Junior Creditors

Since the junior creditors did not observe the output they based their decisions on date $t = 0$ information. This led to an too early liquidation from the owner's point of view. To partly avoid this problem the owner could decide to finance with a FI. The FI can satisfy the condition for observation easier than junior creditors. In case of observation it makes the same decisions that were made by the junior creditors with observation. There is no necessity to go through each situation in detail again. The FI liquidates only if the liquidation value is high combined with a low value of the output in place. As such, this existence is only partly improving because the firm is still liquidated in one state of the world. The individual rationality constraint for the FI is

$$\begin{aligned}(1 \Leftrightarrow p_1) \cdot (I \Leftrightarrow X_1^s)(1 + r_{01}^j) + p_1 \cdot p_L \cdot (1 \Leftrightarrow p_2) \cdot X_2^h + p_1 \cdot (1 \Leftrightarrow p_L) \cdot p_Y \cdot L^h + \\ p_1 \cdot (1 \Leftrightarrow p_L) \cdot (1 \Leftrightarrow p_Y) \cdot (1 \Leftrightarrow \alpha) \cdot Y^h + p_1 \cdot (1 \Leftrightarrow p_L) \cdot (1 \Leftrightarrow p_Y) \cdot (1 \Leftrightarrow p_2) \cdot X_2^h \\ \geq (I \Leftrightarrow X_1^s) + p_1 \cdot (1 \Leftrightarrow p_L) \cdot c_1 + (I \Leftrightarrow X_1^s) \cdot c_2.\end{aligned}$$

Fulfilled with equality and solved for $(I \Leftrightarrow X_1^s)(1 + r_{01}^j)$ it follows,

$$\begin{aligned}(I \Leftrightarrow X_1^s)(1 + r_{01}^j) = \frac{I \Leftrightarrow X_1^s + p_1(1 \Leftrightarrow p_L) \cdot c_1 + (I \Leftrightarrow X_1^s) \cdot c_2 \Leftrightarrow p_1 \cdot p_L \cdot (1 \Leftrightarrow p_2) \cdot X_2^h}{1 \Leftrightarrow p_1} \\ \frac{\Leftrightarrow p_1 \cdot (1 \Leftrightarrow p_L) \cdot p_Y \cdot L^h \Leftrightarrow p_1 \cdot (1 \Leftrightarrow p_L) \cdot (1 \Leftrightarrow p_Y) \cdot (1 \Leftrightarrow \alpha) \cdot Y^h}{1 \Leftrightarrow p_1} \\ \frac{\Leftrightarrow p_1 \cdot (1 \Leftrightarrow p_L) \cdot (1 \Leftrightarrow p_Y) \cdot (1 \Leftrightarrow p_2) \cdot X_2^h}{1 \Leftrightarrow p_1}.\end{aligned}$$

As a sum we get the entire fixed payments to the creditors as

$$I(1 + \tilde{r}_{01}) = X_1^s + (I \Leftrightarrow X_1^s)(1 + r_{01}^j) \tag{16}$$

$$= \frac{I \Leftrightarrow p_1 \cdot X_1^s + p_1(1 \Leftrightarrow p_L) \cdot c_1 + (I \Leftrightarrow X_1^s) \cdot c_2 \Leftrightarrow p_1 \cdot p_L \cdot (1 \Leftrightarrow p_2) \cdot X_2^h \Leftrightarrow p_1 \cdot (1 \Leftrightarrow p_L) \cdot p_Y \cdot L^h \Leftrightarrow}{1 \Leftrightarrow p_1}$$

$$\frac{\Leftrightarrow p_1 \cdot (1 \Leftrightarrow p_L) \cdot (1 \Leftrightarrow p_Y) \cdot (1 \Leftrightarrow \alpha) \cdot Y^h \Leftrightarrow p_1 \cdot (1 \Leftrightarrow p_L) \cdot (1 \Leftrightarrow p_Y) \cdot (1 \Leftrightarrow p_2) \cdot X_2^h}{1 \Leftrightarrow p_1}. \tag{17}$$

Again, the decision the owner is going to make depends on a comparison between the expected utilities of each financing decision. Equating the two utility schedules gives us the result that if

$$k > k^{*`} = L^h \Leftrightarrow (1 \Leftrightarrow p_2) \cdot x_2^h + \frac{c_1}{1 \Leftrightarrow p_Y} + \frac{(I \Leftrightarrow X_1^s) \cdot c_2}{p_1 \cdot (1 \Leftrightarrow p_L) \cdot (1 \Leftrightarrow p_Y)} \tag{18}$$

the owner increases his expected utility by choosing a seniority structure with the FI holding the junior claims.

Observation by Junior Creditors

Now, we compare the situation in which the junior creditors would spend the observation costs on getting to know the output. This led to a duplication of the observation costs because each junior creditor had to spend them. If the existence of the FI can be welfare improving depends on the relation between $p_1 \cdot (1 \Leftrightarrow p_L) \cdot c_1$ and c_2.[21] Let us assume that $p_1 \cdot (1 \Leftrightarrow p_L) \cdot c_1 > c_2$. Then the FI can be benefical in two different ways.

First, if the owner preferred the seniority structure of debt initially it is true that

$$k > L^h \Leftrightarrow (1 \Leftrightarrow p_2) \cdot x_2^h + \frac{(I \Leftrightarrow X_1^s) \cdot c_1}{1 \Leftrightarrow p_Y} > L^h \Leftrightarrow (1 \Leftrightarrow p_2) \cdot x_2^h + \frac{c_1}{1 \Leftrightarrow p_Y} + \frac{(I \Leftrightarrow X_1^s) \cdot c_2}{p_1 (1 \Leftrightarrow p_L)(1 \Leftrightarrow p_Y)}. \tag{19}$$

It is obvious that the FI is welfare improving in this case. The observation costs are wasted only once instead of many times. As a consequence the owner can lower the repayments to the financing sources. As said above, the FI is only a welfare improvement on the junior level. This result supports the quotation by Fama (1985) of minimizing observation costs mentioned in the introduction. The owner was able to lower the fixed payment but he did not influence the firm‘s policy by this decision.

Secondly, he actually influences the firm policy in times of financial distress if

[21] Compare with the appendix.

$$L^h \Leftrightarrow (1 \Leftrightarrow p_2) \cdot x_2^h + \frac{(I \Leftrightarrow X_1^s) \cdot c_1}{1 \Leftrightarrow p_Y} > k > L^h \Leftrightarrow (1 \Leftrightarrow p_2) \cdot x_2^h + \frac{c_1}{1 \Leftrightarrow p_Y} + \frac{(I \Leftrightarrow X_1^s) \cdot c_2}{p_1 (1 \Leftrightarrow p_L)(1 \Leftrightarrow p_Y)}. \quad (20)$$

The left hand side stands for the case that junior creditors would observe but k is not large enough. Without a FI the owner did not choose a seniority structure because the observation costs were too high. This means, the level of the control rent was too low to afford observation by junior creditors. Now, the existence of the FI makes it more likely that he prefers a seniority structure due to lower observation costs if the contingent cost variable of borrowed capital c_2 is not too high.

Finally, one has to mention that by choosing a seniority structure with a FI holding the junior claims the owner can profit from this structure with a lower control rent. Nevertheless, this structure could also harm the owner easier because the FI is willing to observe for more paramater constellations than junior creditors.

5. Summary

We outlined a model in which the owner could not influence the payoff of his investment project. The only thing he was able to determine was the financial structure of the debt contracts and the financing source. Haugen and Senbet (1978) supposed that the liquidation decision can be separated from the capital structure of the firm and its current state. This is valid in their environment but this result does not fit into our model due to (i) the information structure in our model and (ii) the non-transferable control rent for the owner of the firm. Without the FI the financial structure gains only importance if the junior creditors observe the condition of the firm. In case they used the complete date $t = 1$ information they nearly made the efficient policy from the owner‘s point of view. This relies on the assumption that the control rent was large enough, $k > k^*$. Otherwise a seniority structure could harm the owner so that he prefers a debt structure with all creditors being treated identically.

The existence of the FI was benefical in three different ways, given a sufficiently large control rent and assuming that the condition $p_1 \cdot (1 \Leftrightarrow p_2) \cdot c_1 > c_2$ holds. Firstly, observation did not occur by the junior creditors because it was too expensive for them. In this situation the

financial structure was not important. The FI improved this situation if observation occured. As a consequence of observation the financial structure became important. Secondly, the owner chooses a seniority structure and observation occurs by the junior creditors. In this case the existence of the FI reduces only the fixed payment, the firm‘s policy remains the same. Thirdly, the junior creditors would have observed but this time it was too expensive from the owner‘s point of view. This means that k was too small so that the owner chooses a debt structure without seniority. The existence of the FI makes it more likely that the owner chooses a debt seniority structure. Thus, if k is large enough, a seniority structure increases the expected utility of the owner, the FI spends the observation costs and improves the firm‘s future policy. Combined one can say that if the FI leads to an improvement then on the junior level.

The presented model is of course extreme in its structure because we had one safe and one uncertain part. But the results could also be broadened to a more complicated cash-flow structure. If the level of the cash-flow can be split up into different parts with different probabilities of occurance choosing a seniority structure of the debt contracts is benefical because it makes it more likely that creditors spend some capital to get to know all the information they need to make the best firm‘s policy. Furthermore, a FI is the best financing source for the claims with lowest priority to make the right decision in times of financial distress and to economize on observation costs.

Our model could also be applied if the economy consists of classes of investors with different degrees of risk-aversion. In this situation it would make sense to split up the cash-flow into different parts with respective probabilities of realization. The senior creditors are the ones with the highest degree of risk-aversion whereas the investors who are best diversified respectively more risk-loving should hold the claims with the highest risk. If a firm chooses such a seniority stucture it should be not too difficult to prove that the firm will be able to lower its expected fixed payment and influence its future policy in times of financial distress. Assume for example only two classes of risk preferences, one class is risk-neutral and the other one is risk-avers, and the same cash-flows as in our model. Splitting up the cash-flow and making

the risk-neutral ones hold all the risky claims can obviously improve the firm's situation. [22]

Appendix

We start by comparing the two levels of fixed payments of each financing decision. It is shown that $I(1+\tilde{r}_{01}) < I(1+r_{01})$

$$I(1+\tilde{r}_{01}) = \frac{I \Leftrightarrow p_1 \cdot X_1^s + (I \Leftrightarrow X_1^s)p_1(1 \Leftrightarrow p_L) \cdot c_1 \Leftrightarrow p_1 \cdot (1 \Leftrightarrow p_L) \cdot p_Y \cdot L^h \Leftrightarrow p_1 \cdot p_L \cdot (1 \Leftrightarrow p_2) \cdot X_2^h \Leftrightarrow}{1 \Leftrightarrow p_1}$$

$$\frac{\Leftrightarrow p_1 \cdot (1 \Leftrightarrow p_L) \cdot (1 \Leftrightarrow p_Y) \cdot (1 \Leftrightarrow \alpha) \cdot Y^h \Leftrightarrow p_1 \cdot (1 \Leftrightarrow p_L) \cdot (1 \Leftrightarrow p_Y) \cdot (1 \Leftrightarrow p_2) \cdot X_2^h}{1 \Leftrightarrow p_1}.$$

and

$$I(1+r_{01}) = \frac{I \Leftrightarrow p_1 X_1^s \Leftrightarrow p_1(1 \Leftrightarrow p_L)L^h \Leftrightarrow p_1 p_L(1 \Leftrightarrow p_2)X_2^h}{1 \Leftrightarrow p_1}.$$

Several terms cancel out at the beginning, $(1 \Leftrightarrow p_1), I, p_1 X_1^s$, afterwards p_1 can be eliminated.

Thus, we get

$$(I \Leftrightarrow X_1^s)(1 \Leftrightarrow p_L) \cdot c_1 \Leftrightarrow (1 \Leftrightarrow p_L)(1 \Leftrightarrow p_Y)(1 \Leftrightarrow p_2)X_2^h \Leftrightarrow (1 \Leftrightarrow p_L)p_Y \cdot L^h \Leftrightarrow (1 \Leftrightarrow p_L)(1 \Leftrightarrow p_Y)(1 \Leftrightarrow \alpha)Y^h < \Leftrightarrow (1 \Leftrightarrow p_L)L^h$$

$$\Leftrightarrow (I \Leftrightarrow X_1^s) \cdot c_1 + (1 \Leftrightarrow p_Y) \cdot L^h \Leftrightarrow (1 \Leftrightarrow p_Y)(1 \Leftrightarrow \alpha)Y^h \Leftrightarrow (1 \Leftrightarrow p_Y)(1 \Leftrightarrow p_2)X_2^h < 0$$

With $(1 \Leftrightarrow p_Y)L^h = (1 \Leftrightarrow p_Y)(1 \Leftrightarrow \alpha)Y^h + (1 \Leftrightarrow p_Y)(1 \Leftrightarrow p_2)X_2^h \Leftrightarrow (I \Leftrightarrow X_1^s) \cdot c_1 \Leftrightarrow \epsilon$ and $\epsilon > 0$ very small we get

$$\Rightarrow \Leftrightarrow \epsilon < 0$$

[22] See for example Winton (1995), who mentiones different degrees of risk-aversion.

Now, we compare the expected utilities under asymmetric information. The expected utility without seniority structure is,

$$E[U^1(i)] = p_1 \cdot p_L \cdot k + (1 \Leftrightarrow p_Y) \cdot Y^h + (1 \Leftrightarrow p_1) \cdot [(X_1^s + X_1^j) \Leftrightarrow I(1 + r_{01}) + k] + (1 \Leftrightarrow p_1) \cdot (1 \Leftrightarrow p_2) X_2^h.$$

The individual rationality constraint for the determination of $I(1 + r_{01})$ gives us

$$(1 \Leftrightarrow p_1) I(1 + r_{01}) = I \Leftrightarrow p_1 X_1^s \Leftrightarrow p_1 (1 \Leftrightarrow p_L) L^h \Leftrightarrow p_1 p_L (1 \Leftrightarrow p_2) X_2^h$$

$$\Rightarrow E[U^1(i)] = p_1 \cdot p_L \cdot k + (1 \Leftrightarrow p_Y) \cdot Y^h + (1 \Leftrightarrow p_1) \cdot [(X_1^s + X_1^j) + k] + (1 \Leftrightarrow p_1) \cdot (1 \Leftrightarrow p_2) X_2^h +$$

$$+ p_1 (1 \Leftrightarrow p_L) L^h + p_1 p_L (1 \Leftrightarrow p_2) X_2^h + p_1 X_1^s \Leftrightarrow I.$$

The expected utility with a seniority structure has the following form,

$$E[U^2(i)] = p_1 \cdot p_L \cdot k + p_1 \cdot (1 \Leftrightarrow p_L) \cdot (1 \Leftrightarrow p_Y) k + p_1 p_L (1 \Leftrightarrow p_Y) Y^h + p_1 \cdot (1 \Leftrightarrow p_L) \cdot (1 \Leftrightarrow p_Y) \cdot \alpha \cdot Y^h$$

$$+ (1 \Leftrightarrow p_1)[(X_1^s + X_1^j) \Leftrightarrow I(1 + \tilde{r}_{01}) + k] + (1 \Leftrightarrow p_1) \cdot (1 \Leftrightarrow p_2) X_2^h + (1 \Leftrightarrow p_1) \cdot (1 \Leftrightarrow p_Y) Y^h.$$

We know that

$$I(1 + \tilde{r}_{01}) = X_1^s + (I \Leftrightarrow X_1^s)(1 + r_{01}^j).$$

$$\Rightarrow E[U^2(i)] = p_1 p_L k + p_1 (1 \Leftrightarrow p_L)(1 \Leftrightarrow p_Y) k + p_1 p_L (1 \Leftrightarrow p_Y) Y^h + p_1 (1 \Leftrightarrow p_L)(1 \Leftrightarrow p_Y) \alpha Y^h$$

$$+ (1 \Leftrightarrow p_1)[(X_1^s + X_1^j) + k] \Leftrightarrow (1 \Leftrightarrow p_1) X_1^s \Leftrightarrow (1 \Leftrightarrow p_1)(I \Leftrightarrow X_1^s)(1 + r_{01}^j) + (1 \Leftrightarrow p_1) \cdot (1 \Leftrightarrow p_2) X_2^h + (1 \Leftrightarrow p_1) \cdot (1 \Leftrightarrow p_Y) Y^h.$$

Moreover, equilibrium condition for $(I \Leftrightarrow X_1^s)(1 + r_{01}^j)$ is

$$(1 \Leftrightarrow p_1)(I \Leftrightarrow X_1^s)(1 + r_{01}^j) = I \Leftrightarrow X_1^s + (I \Leftrightarrow X_1^s)p_1(1 \Leftrightarrow p_L) \cdot c_1 \Leftrightarrow p_1 \cdot p_L \cdot (1 \Leftrightarrow p_2) \cdot X_2^h$$

$$\Leftrightarrow p_1 \cdot (1 \Leftrightarrow p_L) \cdot p_Y \cdot L^h \Leftrightarrow p_1 \cdot (1 \Leftrightarrow p_L) \cdot (1 \Leftrightarrow p_Y) \cdot (1 \Leftrightarrow \alpha) \cdot Y^h \Leftrightarrow p_1 \cdot (1 \Leftrightarrow p_L) \cdot (1 \Leftrightarrow p_Y) \cdot (1 \Leftrightarrow p_2) \cdot X_2^h.$$

$$\Rightarrow E[U^2(i)] = p_1 \cdot p_L \cdot k + p_1 \cdot (1 \Leftrightarrow p_L) \cdot (1 \Leftrightarrow p_Y)k + p_1 p_L (1 \Leftrightarrow p_Y)Y^h$$

$$+(1 \Leftrightarrow p_1)[(X_1^s + X_1^j) + k] + (1 \Leftrightarrow p_1) \cdot (1 \Leftrightarrow p_2)X_2^h + p_1(1 \Leftrightarrow p_L)(1 \Leftrightarrow p_Y)\alpha Y^h +$$

$$+(1 \Leftrightarrow p_1) \cdot (1 \Leftrightarrow p_Y)Y^h \Leftrightarrow X_1^s + p_1 X_1^s \Leftrightarrow (I \Leftrightarrow X_1^s)p_1(1 \Leftrightarrow p_L)c_1 \Leftrightarrow I + X_1^s + p_1 \cdot p_L \cdot (1 \Leftrightarrow p_2) \cdot X_2^h$$

$$+p_1 \cdot (1 \Leftrightarrow p_L) \cdot p_Y \cdot L^h + p_1 \cdot (1 \Leftrightarrow p_L) \cdot (1 \Leftrightarrow p_Y) \cdot (1 \Leftrightarrow \alpha)Y^h + p_1 \cdot (1 \Leftrightarrow p_L) \cdot (1 \Leftrightarrow p_Y) \cdot (1 \Leftrightarrow p_2) \cdot X_2^h.$$

Now, we equate the two expected utilities,

$$E[U^1(i)] = p_1 \cdot p_L \cdot k + (1 \Leftrightarrow p_Y) \cdot Y^h + (1 \Leftrightarrow p_1) \cdot [(X_1^s + X_1^j) + k] + (1 \Leftrightarrow p_1) \cdot (1 \Leftrightarrow p_2)X_2^h +$$

$$p_1(1 \Leftrightarrow p_L)L^h + p_1 p_L (1 \Leftrightarrow p_2)X_2^h + p_1 X_1^s \Leftrightarrow I = p_1 \cdot p_L \cdot k + p_1 \cdot (1 \Leftrightarrow p_L) \cdot (1 \Leftrightarrow p_Y)k + p_1(1 \Leftrightarrow p_Y)Y^h$$

$$\Leftrightarrow (I \Leftrightarrow X_1^s)p_1(1 \Leftrightarrow p_L)c_1 + (1 \Leftrightarrow p_1)[(X_1^s + X_1^j) + k] + (1 \Leftrightarrow p_1) \cdot (1 \Leftrightarrow p_2)X_2^h + (1 \Leftrightarrow p_1) \cdot (1 \Leftrightarrow p_Y)Y^h$$

$$\Leftrightarrow I + p_1 X_1^s + p_1(1 \Leftrightarrow p_L)p_Y L^h + p_1 p_L (1 \Leftrightarrow p_2)X_2^h + p_1(1 \Leftrightarrow p_L)(1 \Leftrightarrow p_Y)(1 \Leftrightarrow p_2)X_2^h = E[U^2(i)] \quad \Leftrightarrow$$

After deleting serveral terms, we get

$$(1 \Leftrightarrow p_L)L^h = (1 \Leftrightarrow p_L)p_Y L^h + (1 \Leftrightarrow p_L)(1 \Leftrightarrow p_Y)k \Leftrightarrow (I \Leftrightarrow X_1^s)(1 \Leftrightarrow p_L)c_1 + (1 \Leftrightarrow p_L)(1 \Leftrightarrow p_Y)(1 \Leftrightarrow p_2)X_2^h$$

Thus, the final result is that if

$$k > k^* = L^h \Leftrightarrow (1 \Leftrightarrow p_2) \cdot X_2^h + \frac{(I \Leftrightarrow X_1^s) \cdot c_1}{1 \Leftrightarrow p_Y}$$

the owner increases his expected utility by choosing a seniority structure.

To derive the inequation for the FI we substitute $p_1 \cdot (1 \Leftrightarrow p_L) \cdot c_1 + (I \Leftrightarrow X_1^s) \cdot c_2$ for $(I \Leftrightarrow X_1^s)p_1 \cdot (1 \Leftrightarrow p_L) \cdot c_1$. This leads to the following inequation,

$$k^{*\text{`}} > L^h \Leftrightarrow (1 \Leftrightarrow p_2) \cdot X_2^h + \frac{c_1}{1 \Leftrightarrow p_Y} + \frac{(I \Leftrightarrow X_1^s) \cdot c_2}{p_1(1 \Leftrightarrow p_L)(1 \Leftrightarrow p_Y)}.$$

Finally, we compare the two thresholds k^* and $k^{*\text{`}}$, Threshold $k^*$ is larger than $k^{*\text{`}}$ if

$$L^h \Leftrightarrow (1 \Leftrightarrow p_2) \cdot X_2^h + \frac{(I \Leftrightarrow X_1^s) \cdot c_1}{1 \Leftrightarrow p_Y} >$$

$$L^h \Leftrightarrow (1 \Leftrightarrow p_2) \cdot X_2^h + \frac{c_1}{1 \Leftrightarrow p_Y} + \frac{(I \Leftrightarrow X_1^s) \cdot c_2}{p_1(1 \Leftrightarrow p_L)(1 \Leftrightarrow p_Y)}$$

$$\Leftrightarrow \frac{(I \Leftrightarrow X_1^s) \cdot c_1}{1 \Leftrightarrow p_Y} > \frac{c_1}{1 \Leftrightarrow p_Y} + \frac{(I \Leftrightarrow X_1^s) \cdot c_2}{p_1(1 \Leftrightarrow p_L)(1 \Leftrightarrow p_Y)}$$

$$\Leftrightarrow p_1(1 \Leftrightarrow p_L)c_1(I \Leftrightarrow X_1^s \Leftrightarrow 1) > (I \Leftrightarrow X_1^s)c_2$$

If $I \Leftrightarrow X_1^s$ is large one can neglect $\Leftrightarrow 1$ so that $I \Leftrightarrow X_1^s \Leftrightarrow 1 \approx I \Leftrightarrow X_1^s$. Thus, the relationship between $p_1(1 \Leftrightarrow p_L)c_1$ and c_2 deserves the main attention.

$$\Rightarrow p_1(1 \Leftrightarrow p_L)c_1 > c_2 \quad \Rightarrow k^* > k^{*\text{`}}$$

References

Allen, Franklin and Douglas Gale (1988), Optimal Security Design, *Review of Financial Studies*, 1(3),pp. 229-263.

Altman, Edward I. and Allan C. Eberhart (1994), Do Seniority Provisions Protect Bondholders' Investments?, *Journal of Portfolio Management*, 20(4), pp. 67-75.

Barclay Michael J. and Clifford W. Smith, Jr. (1995), The Priority Structure of Corporate Liabilities, *Journal of Finance*, 50(3), pp. 899-917.

Berglf, Erik and Ernst-Ludwig von Thadden (1994), Short-Term Versus Long-Term Interests: Capital Structure With Multiple Investors, *Quarterly Journal of Economics*, 109(4), pp. 1055-1084.

Berkovitch, Elazar and Han E. Kim (1990), Financial Contracting and Leverage Induced Over- and Under-Investment Incentives, *Journal of Finance*, 45(3), pp. 765-794.

Boot, Arnould W.A. and Anjan V. Thakor (1993), Security Design, *Journal of Finance*, 48(4), pp. 1349-78.

Diamond, Douglas (1984), Financial Intermediation and Delegated Monitoring, *Review of Economic Studies*, 51(3), pp. 393-414.

Diamond, Douglas (1993), Seniority and Maturity of Debt Contracts, *Journal of Financial Economics*, 33(3), pp. 341-368.

Eberhart, Allan C., William Moore and Rodney Roenfeldt (1990), Security Pricing and Deviations from the Absolute Priority Rule in Bankruptcy Porceedings, *Journal of Finance*, 45(5), pp. 1457-1469.

Fama, Eugene F. (1985), What's different about Banks?, *Journal of Monetary Economics*, 15(1), pp. 29-39.

Franks, Julian and Walter Torous (1989), An Empirical Investigation of U.S. Firms in Reorganization, *Journal of Finance*, 44(3), pp. 747-769.

Gertner, Robert and David S. Scharfstein (1991), A Theory of Workouts and the Effects of Reorganization Law, *Journal of Finance*, 46(4), pp. 1189-1222.

Gilson, Stuart, John Kose and Larry Lang (1990), Troubled Debt Restructuring: An Empirical Study of Private Reorganization of Firms in Default, *Journal of Financial Economics*, 27(2), pp. 315-353.

Gilson, Stuart (1991), Managing Default: Some Evidence on how Firms choose between Workouts and Chapter 11, *Journal of Applied Corporate Finance*, 4(2), pp. 62-70.

Harris, Milton and Artur Raviv (1990), Capital Structure and the Informational Role of Debt, *Journal of Finance*, 45(2), pp. 321-350.

Hart, Oliver and John Moore (1995), Debt and Seniority: An Analysis of the Role of Hard Claims in Constraining Management, *American Economic Review*, 85(3), pp. 567-585.

Haugen, Robert A. and Lemma W. Senbet (1978), The Insignificance of Bankruptcy Costs to the Theory of Optimal Capital Structure, *Journal of Finance*, 33(2), pp. 383-393.

Hoshi, Takeo, Anil K. Kashyap and David S. Scharfstein (1990), Bank Monitoring and INvestment: Evidence from the Changing Structure of Japanes Corporate Banking Relationships, in: *Asymmetric Information, Corporate Finance, and Investment*, (Glenn R. Hubbard ed.), pp. 105-126.

Madan, Dilip and Badih Soubra (1991), Design and Marketing of Financial Products, *Review of Financial Studies*, 4(2), pp. 361-84.

Modigliani, Franco and Merton H. Miller (1958), The Cost of Capital, Corporation Finance, and the Theory of Investment, *American Economic Review*, 48(3), pp. 261-297.

Ross, Stephen A. (1989), Institutional Markets, Financial Marketing, and Financial Innovation, *Journal of Finance*, 44(3), pp. 541-556.

Stiglitz, Joseph E. (1985), Credit Markets and the Control of Capital, *Journal of Money, Credit and Banking*, 17(2), pp. 133-152.

Welch, Ivo (1997), Why is Bank Debt Senior? A Theory of Asymmetry and Claim Priority Based on Influence Costs, *Review of Financial Studies*, 10(4), pp. 1203 - 1236.

Weiss, Lawrence (1990), Bankruptcy resolution: Direct Costs and Violation of Priority of Claims, *Journal of Financial Economics*, 27(2), pp. 285-314.

Winton, Andrew (1995), Costly State Verification and Multiple Investors: The Role of Seniority, *Review of Financial Studies*, 8(1), pp. 91-123.