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Implications of the Creditors' Influence on Corporate Decisions

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Abstract

Debt-financing potentially causes frictions in firms, as the creditors represent an additional group of stakeholders creating conflicts of interest with other stakeholders. This raises the question how corporate performance is affected by the presence of creditors. Could it be in the firms' interest to let the creditors influence corporate decisions? In order to answer these questions, three theoretical models, depicting the influence of creditors on firms in the principal-agent-context, are analyzed, compared and discussed. Based on that, a model that combines and extends their assumptions is developed. The results show that it might be preferable to let the creditors influence the firm's decisions either permanently or at least in some situations. Also, firms should establish a trustworthy relationship with the creditors in order to minimize the costs due to information asymmetries. Overall, creditors should not be seen as a source of conflict and cost factor but rather as a strategic factor that enables firms to make optimal use of their information and thus, to create a sustainable competitive advantage.

Keywords: Debt contracts; creditor influence; corporate performance; corporate governance; agency theory.

1. Introduction

The customer stands in every firm's focus, as he purchases the offered products and services,[1] generating a revenue that eventually leads to a profit for the firm.[2] With the customer being able to choose from a wide range of products and services, many firms find themselves in a fierce competition, which intensifies if new competitors enter the market. In order to sustain a strong position in the market, it is elementary for them not only to have a unique selling proposition to stand out from the others but also to optimally make use of their own resources to create competitive advantages or at least to avoid any disadvantages.[3]

As firms often represent big organizations with a high number of internal and external stakeholders, the problems they face can become complicated. In a complex environment like this, obtaining the relevant information needed to make decisions can be very costly or even impossible. Under the premise of imperfect information, the stakeholders have uncertain expectations about the future, which leads to decisions under risk. Because of diverse risk preferences, conflicts arise between them and can become even more severe if the information is distributed asymmetrically.[4] The agency theory provides the possibility for the formal depiction and analysis of such problems,[5] whereby the involved parties are generally assumed to act like the Homo Oeconomicus, being perfectly rational and maximizing their own utility.[6] Hence, for the firm it is crucial to know about its stakeholders' expected utilities that lead to the distinct preferences, so that it gains a better understanding of the conflicts' origins. Solving the conflicts and aligning the stakeholders with each other as well as with the firm's overall goal can have a significant impact on the firm's performance.[7]

Representing the legal and actual framework of the firm including all of its stakeholders, the corporate governance deals with the conflicts and the problems of imperfect infor-

[1] Note that in this thesis all acting persons are assumed to be male, which is done for reasons of simplicity and consistency only and does not represent the discrimination of other genders.

[2] Kohli and Jaworski (1990), p.3, see the customer focus as a crucial aspect for market orientated firms.

[3] For the definition of the unique selling proposition see Esch and Markgraf (2018) and for the examination of the firm's resources as potential competitive advantages see Barney (1991), pp.105-112.

[4] Cf. Holmström (1979), pp.74-75.

[5] Cf. Weber and Schäffer (2016), pp.28-29.

[6] Cf. Suchanek, Lin-Hi, Thommen, Woll, and Gillenkirch (2018).

[7] Harrison, Bosse, and Phillips (2010), pp.65-69, explain how managing for stakeholders creates an additional value for the firm.

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mation mentioned above.[8] Among the most important stakeholders, apart from the customers, are the investors and the managers, as the firm would have no capital without the investors and could not be run without the management. The firm's capital can principally be divided into equity provided by the shareholders and debt provided by the creditors, also referred to as debtholders. One of the key factors for the firm's success, dealt with in the context of the corporate governance, is to find the optimal capital structure as well as the corresponding control structure in order to mitigate conflicts that arise due to the information asymmetry.[9]

Although external financing in the form of debt represents an important part of the capital structure of firms, it might not appear to be their preferred type of financing at the first glance, because creditors embody additional stakeholders that eventually cause conflicts.[10] However, the influence of the creditors can actually be useful for the firm under certain circumstances. Among other aspects, it is possible to use the impact on the incentivization process to support the managerial compensation scheme, so that the firm value can be increased.[11] This is why it might even be in the firm's interest to voluntarily give control rights to the creditors, which raises a couple of questions: When does a firm have an incentive to do so? And in case it has, which way of letting the creditors influence its decisions is the optimal one?

The creditor-shareholder-conflict as well as the shareholder-manager-conflict are widely studied in the literature and are ordinarily resolved by setting up contracts between the parties. Nevertheless, it is important not only to solve the separate problems but also to consider their correlation.[12] This can be a crucial aspect when the creditors receive control rights through their contract with the shareholders that enable them to influence the decision about the contract between the shareholders and the manager. In addition to understanding these interdependences, the goal of the present thesis is to examine how the firm is affected by the influence of the creditors, so that the consequences for the firm's performance can be determined.

This thesis is structured as follows. Firstly, the literature overview provides an insight into the empirical and theoretical work in the field of creditor influence on the firm's actions and decisions as well as in related areas. Afterwards, three selected models that depict the influence of the creditors on the firm in specific contexts are presented and explained. Additionally, their assumptions and characteristics are compared and discussed before the implications of their results are deduced. Following this, a model that compares different options of creditor control over the firm in the context of an investment decision is derived, whereby the solutions for each option are calculated and compared. Furthermore, selected assumptions and the implications of the model's results are discussed and an approach for a possible extension is presented. Finally, the conclusion completes the thesis by reviewing and summarizing the findings as well as giving recommendations for future research.

2. Literature overview

Different aspects of the debtholders' influence on corporate decisions are widely studied in the literature.[13] While several authors examine the capital structure of the firm and its implications for the firm's performance, others focus on the design of debt contracts and the agency conflicts caused by the presence of debt. Moreover, various possibilities for the debtholders to influence the firm are depicted in the literature. The following literature overview is organized in two parts, whereby the subsection examining the empirical studies is followed by the subsection investigating the theoretical literature.

2.1. Empirical literature

With the debtholders as stakeholders of the firm, agency conflicts arise between them and the shareholders due to their opposing interests, as empirically studied by various authors. Morellec, Nikolov, and Schürhoff (2018) find that these conflicts depend on the structure of the corporate governance as well as on other characteristics of the firm, but that they are significant throughout different countries and firms. Furthermore, they argue that the agency conflicts caused by control benefits and financial frictions lead to agency costs in the form of wealth transfers and losses from the implementation of suboptimal policies.[14] Nini, Smith, and Sufi (2009) show that the conflict between the firm and the debtholders affects the firm's investment policy, as it leads to restrictions for the firm in its decisions. Although this reduces the investments, the value and performance of the firm potentially increase.[15] As the investments of the firm are generally made by the manager, Brockman, Martin, and Unlu (2010) highlight the importance of the compensation contract because it influences his risk-taking behavior significantly. The creditors understand these incentives and price the debt accordingly, which eventually leads to agency costs. However, the authors find that these costs can be reduced by issuing short-term debt.[16] Chen and Qiu (2017) also consider agency costs due to the manager's risk preferences but find another way to reduce them. They state that the costs of debt are lower in the case of relationship lending, as this implies that the creditor can intensively monitor the firm and discourage any risky behavior.[17] This result is supported by the findings of Ang, Cole, and Lin (2000), who show that agency costs can be reduced by greater monitoring through

[8] Cf. Von Werder (2018).
[9] Cf. Zender (1991), p.1661.
[10] Cf. Kroszner and Strahan (2001), p.416.
[11] Cf. Grossman and Hart (1982), pp.130-131.
[12] Cf. Douglas (2009), pp.151-152.
[13] Note that 'debtholders' and 'creditors' are used as synonyms in this thesis.
[14] Cf. Morellec et al. (2018).
[15] Cf. Nini et al. (2009).
[16] Cf. Brockman et al. (2010).
[17] Cf. Chen and Qiu (2017).

the creditors. Additionally, they find that the agency costs depend on the ownership and management structure of the firm, considering aspects like the composition of the equity and the manager's ownership share.[18]

Similar to Ang et al. (2000), several authors examine the impact of the corporate structure and governance on the firm's decisions and performance. Liao, Mukherjee, and Wang (2015) define a strong corporate governance as having a board that acts independently because it has a great number of outside directors, whereby the firm's capital structure includes large institutional shareholding. They state that such a strong corporate governance leads to a debt level that is close to the shareholders' preferred value.[19] Another approach, introduced by King and Wen (2011), is to divide the overall corporate governance into shareholder and debtholder governance. They find that the overall impact on the managerial risk-taking behavior is the result of the combination of the two. A strong governance by the debtholders leads to more low-risk investments but is usually combined with a weak shareholder governance that facilitates managerial entrenchment and therefore more high-risk investments, so that the overall effect can be ambiguous.[20] The work of Gilson and Vetsuypens (1994) also highlights the role of the debtholders in the corporate governance, particularly in financially distressed firms, as it shows that the debtholders have a direct influence on the management hiring and compensation policy. In addition to that, the debtholders have an indirect influence, as they impose restrictions on the firm that affect its policy decisions.[21]

One way for the debtholders to influence the firm's decisions is the use of debt covenants. As shown by Hong, Hung, and Zhang (2016), they are used worldwide to ensure that the creditors' claims are settled in an appropriate manner. Thereby, they function as substitutes for creditor rights, especially in countries with a strong law enforcement.[22] Christensen and Nikolaev (2012) define performance covenants as ways to transfer control to the debtholders when the debt is at risk of not being completely repaid. They state that these covenants lead to financial constraints for the firm and to restrictions for the manager's actions.[23] Generally, debt covenants should be designed with regard to the risk-taking behavior of the manager, as depicted by Chava, Kumar, and Warga (2010). They find that the use of covenants is related to managerial entrenchment and fraud as well as to the quality of the information provided by the firm.[24] Moreover, the control rights that the creditors receive through the covenants are reflected in the bond prices, as studied by Feldhütter, Hotchkiss, and Karakaş (2016). This can be seen as the bond premiums increase when the firms are situations of financial distress, e.g. when they default payments.[25]

Control rights can be allocated to the debtholders after the violation of a covenant, as Nini, Smith, and Sufi (2012) find that such violations are often followed by a number of changes for the firm. According to them, the firm experiences changes in its capital structure as well as in its hiring and investment decisions. An important aspect is that the violation of a covenant does not necessarily imply that the firm defaults payments or is bankrupt, so that Nini et al. (2012) see the debtholders as an external help for the firm to increase its value in case this is needed.[26] The related study of Roberts and Sufi (2009) shows that the firms issue much less debt after the violation of a covenant, as the creditors increase the price of the debt and reduce its availability. Also, this effect becomes even stronger if the alternative options of financing are limited and more expensive for the firm.[27] Further consequences of covenant violations, studied in the empirical literature, are employment cuts and changes in the composition of the board with most of the new directors being related to the creditors.[28]

The representation on the board of directors offers another possibility for the debtholders to influence the firm. While Kang and Kim (2017) state that creditors on the board influence the managerial compensation schemes by reducing their convexity, Güner, Malmendier, and Tate (2008) do not find strong evidence for the impact that creditors on the board might have on the compensation policy.[29] Nevertheless, Güner et al. (2008) show that the external financing increases with creditors on the board, whereas the riskiness of the investments decreases. Hence, they argue that the firms have access to sufficient external financing but can only choose among fewer and potentially poorer investment projects.[30]

2.2. Theoretical literature

The theoretical literature provides a wide range of models about the creditors' influence on the firm's decisions, yielding interesting implications for the empirical research discussed above. Thereby, the basic literature represents an important part that builds the foundation for many models in this area. The work of Modigliani and Miller (1958) deals with the capital structure of the firm, as they derive the irrelevance theorem, stating that the firm's market value does not depend on its capital structure. However, this only holds under the assumption of perfectly efficient financial markets without any taxes, transaction costs or bankruptcy costs.[31,32] As op-

[18] Cf. Ang et al. (2000).
[19] Cf. Liao et al. (2015).
[20] Cf. King and Wen (2011).
[21] Cf. Gilson and Vetsuypens (1994).
[22] Cf. Hong et al. (2016).
[23] Cf. Christensen and Nikolaev (2012).
[24] Cf. Chava et al. (2010).
[25] Cf. Feldhütter et al. (2016).
[26] Cf. Nini et al. (2012).
[27] Cf. Roberts and Sufi (2009).
[28] For the analysis of the impact of covenant violations on the employees see Falato and Liang (2016) and for the study of the impact on the board composition see Ferreira, Ferreira, and Mariano (2018).
[29] Cf. Kang and Kim (2017).
[30] Cf. Güner et al. (2008).
[31] Cf. Modigliani and Miller (1958).
[32] Dybvig and Zender (1991) show that the irrelevance theorem also holds for models with asymmetric information under the assumption of optimal compensation contracts.

posed to this, Jensen and Meckling (1976) develop a theory of the ownership structure of the firm under the assumption of imperfect markets. They define agency costs of debt due to monitoring and bankruptcy costs and agency costs of outside equity due to conflicting preferences among the shareholders and the obligation to share the residual claim. The firm's goal is to determine the optimal ownership structure that minimizes its agency costs.[33]

Apart from the generalist literature above, there exist several basic models that focus more on the issuance of debt and its impacts on the firm. Grossman and Hart (1982) show that debt can be used to incentivize the manager of the firm through the threat of the bankruptcy and therefore a punishment for him, which leads to an increasing managerial productivity. In contrast to the irrelevance theorem by Modigliani and Miller (1958), they show that the firm's production and market value depend on the financial structure if the financial markets are not assumed to be perfect.[34] Similar results are derived by Harris and Raviv (1990), who argue that the debt does not only serve to constrain the manager but also generates valuable information about the firm that can be used to monitor him and to implement optimal decisions. By weighing up these positive aspects against the default costs of the debt, the ideal capital structure can be determined.[35] Within the financial structure of the firm the composition of the debt plays an important role, as shown by Hart and Moore (1995). They explain that companies might have problems of raising additional capital due to their existing debt structure. Following their work, there exists an optimal ratio of equity to debt with a mix of different debt classes and seniorities, whereas they also find situations, in which the combination of simple equity and debt is optimal.[36] The problem of incomplete contracts between the entrepreneur and the investor is addressed by Aghion and Bolton (1992). They consider investors, who focus on their monetary payoffs, while the entrepreneur additionally receives nonmonetary rewards, so that a conflict of interest arises due to the different preferences. Their solution interprets debt financing as the possibility to implement state-contingent control rights, which serves as an important base to model debt contracts in the theoretical literature.[37]

Following the basic literature, several authors examine the capital structure as a crucial aspect of the firm. Among them is Zender (1991), who uses debt and equity as instruments to solve incentive problems due to the asymmetric distribution of information. Thereby, the ownership structure is not assumed to be fixed but is determined endogenously in combination with the cash flows. He uses debt contracts with a fixed payment and a state-contingent transfer of control to implement first-best incentives for his decision problem.[38] A different approach is presented by Berglöf and Von Thadden (1994), who develop a bargaining-based theory of the capital structure of the firm. They show that the capital structure is determined by weighing up the effects of an ex post renegotiation against the costs of the inefficient liquidation of the firm, whereby the optimal solution minimizes the costs of financial distress. Note that this happens under the assumption that the firm has the bargaining power in any renegotiation.[39] The model developed by Leland (1998) deals with the impact of the investment risk on the firm's capital structure, as both are determined jointly. Therefore, he considers imperfect financial markets, including taxes and default costs, as well as the agency costs arising due to higher risks of the investment. He derives the effects of the agency costs on the debt structure and price, while highlighting the significance of the risk management to keep the costs low.[40]

Furthermore, there exists a class of models, depicting the interrelation between the capital structure and the managerial compensation. Berkovitch, Israel, and Spiegel (2000) find that risky debt has an impact on the managerial replacement decision and on the wage paid to the manager. They derive the capital structure as a disciplining device and explain that in combination with a performance-related wage payment it can improve the managerial incentivization within the firm and can help to control him more effectively.[41] As opposed to this, Brander and Poitevin (1992) examine the impact of the managerial compensation on the capital structure of the firm, as they show that the agency costs of debt can be entirely eliminated by the right choice of the compensation contract. This means that under certain circumstances the amount of debt is irrelevant for the firm's decisions, which is similar to the irrelevance theorem by Modigliani and Miller (1958).[42] Not only the managerial compensation but also the agency conflict between the manager and the shareholders can affect the capital structure, as studied by Wang (2011). His model considers entrenched managers that prefer a lower value of debt than the shareholders, causing a conflict of interests that becomes more severe with higher levels of risk. However, Wang (2011) finds that the agency costs can be mitigated by long-term debt and renegotiations with equal bargaining power for the firm and the debtholders.[43]

The agency conflicts arising due to the chosen capital structure have a significant influence on the firm's policies, as numerous models explain. Among them is the contingent claims model of Childs, Mauer, and Ott (2005), dealing with the conflict between the shareholders and the debtholders that emerges because the shareholders' preferred investment policy distorts from the optimal one at the costs of the debtholders. Short-term debt can mitigate this conflict but is only issued by the firm if it provides enough flexibility for the future in order to reduce the liquidation risk. Ad-

[33] Cf. Jensen and Meckling (1976).
[34] Cf. Grossman and Hart (1982); cf. Modigliani and Miller (1958).
[35] Cf. Harris and Raviv (1990).
[36] Cf. Hart and Moore (1995).
[37] Cf. Aghion and Bolton (1992).
[38] Cf. Zender (1991).
[39] Cf. Berglöf and Von Thadden (1994).
[40] Cf. Leland (1998).
[41] Cf. Berkovitch et al. (2000).
[42] Cf. Brander and Poitevin (1992); cf. Modigliani and Miller (1958).
[43] Cf. Wang (2011).

ditionally, the level of debt and its maturity decrease with higher bankruptcy costs.[44] It should be noted that Childs et al. (2005) suggest to issue short-term debt, whereas Wang (2011), who focuses on a different conflict, states that long-term debt should be issued.[45] This shows that the firm's problems can become complex if various aspects are included in the models, which might lead to ambiguous results. The model of Purnanandam (2008) focuses on a similar conflict as the one of Childs et al. (2005) but highlights the consequences for the risk management of the firm. While the shareholders weigh up their risk-shifting incentives against the possibility of financial distress costs, Purnanandam (2008) shows that they optimally do ex post risk management even without pre-committing to it, which affects the optimal level of the investment risk.[46] Hirshleifer and Thakor (1992) focus on the conflict between the manager and the shareholders, as the manager prefers a more conservative investment policy in order to build his reputation. Because the manager is more closely aligned with the debtholders, the agency costs of debt decrease, so that it is beneficial for the shareholders to issue more debt.[47]

There exist several models throughout the literature that deal with different ways of issuing debt and their implications for the firm. In the work of Chang (1993), the investors obtain new information about the firm's payout level ex post, so that recontracting leads to a more efficient solution for the firm. He shows that the information can be used to transfer control to the investors if the payoff falls below a critical value, so that the optimal contract can be interpreted as a debt contract with the recontracting process as the bankruptcy of the firm.[48] The work of Gârleanu and Zwiebel (2009) focuses on the use of debt covenants as assignments of decision rights under the assumption that the manager is better informed about the future investments than the debtholders. Due to the information asymmetry, the debtholders receive more decision rights ex ante, but parts of these rights are given up by them in the course of the covenants' renegotiations.[49] As mentioned in section 2.1, the debtholders cannot only receive decision rights through debt covenants but also through representation on the board of directors. Hermalin and Weisbach (1998) understand the decision about the board's composition as a bargaining process and show that after a period of poor firm performance the board is likely to consist of a higher number of independent directors. They state that this can have a significant influence on the managerial turnover of the firm.[50] Another important aspect affecting the debt contract is the relationship between the debtholders and the firm. Chakravarty and Yilmazer (2009) show that the relationship is particularly important with regard to the application for the loan and its approval. Moreover, they find that firms being in a relationship with a creditor benefit from a lower price of the debt during an expansion, whereas this effect does not occur during a recession.[51] The timing of the debt payment also plays a key role in the design of debt contracts, as shown by Calcagno and Renneboog (2007). Their model focuses on the relative seniority of the debt compared to the manager's wage payment and shows that it significantly affects the ideal compensation scheme. One of their results is that the debt can optimally support the managerial incentivization within the firm if it is senior to the wage payment.[52]

Various models in the literature examine whether the creditors' influence on the firm can be used to implement the optimal solutions of the respective problems and if it can, how this is done. The work of Dewatripont and Tirole (1994) deals with the implementation of the ideal incentive scheme to discipline the manager, which is done by the use of the optimal financial structure. The control allocation is contingent on the income streams of the firm, whereby the debtholders have control in times of poor firm performance and the shareholders are in control in good times. Note that a crucial aspect of the model is the transition point, at which the control is transferred.[53] Chang (1992) develops a model of the firm's restructuring decision and shows that the optimal restructuring schedule can only be implemented by using the debtholders' influence. Thereby, the debtholders are given control if their short-term debt cannot be paid back, so that they initiate the restructuring process of the firm.[54] In the setting of Dessí (2001) the manager can generally be incentivized by a compensation based on the shareholder value, but this only leads to the optimal results under certain circumstances. She shows that if the reputation effects concerning the compliance with contracts are weak, it is more efficient to use an outside intervention for the incentive scheme. This is done by setting up the optimal capital structure and giving control to outside investors like the creditors in case the firm cannot repay the debt. Dessí (2001) also finds that in this context an increase in the pay-to-performance-sensitivity does not necessarily improve the solution.[55] In the model of Zwiebel (1996) the manager himself is motivated to use debt as a self-constraining device for his empire-building incentives. In order to avoid any changes in the control structure, he issues debt that constrains his personal interests by the threat of bankruptcy and is therefore used as part of the incentive scheme.[56]

The models of Douglas (2009), Berkovitch and Israel (1996) and John and John (1993) also consider different possibilities of debtholder influence and show how to implement the optimal decisions in the firm. Hence, similar to the models above, they focus on aspects of the capital and control structure and examine the agency relationships between

[44] Cf. Childs et al. (2005).
[45] Cf. Childs et al. (2005); cf. Wang (2011).
[46] Cf. Purnanandam (2008).
[47] Cf. Hirshleifer and Thakor (1992).
[48] Cf. Chang (1993).
[49] Cf. Gârleanu and Zwiebel (2009).
[50] Cf. Hermalin and Weisbach (1998).
[51] Cf. Chakravarty and Yilmazer (2009).
[52] Cf. Calcagno and Renneboog (2007).
[53] Cf. Dewatripont and Tirole (1994).
[54] Cf. Chang (1992).
[55] Cf. Dessí (2001).
[56] Cf. Zwiebel (1996).

the stakeholders of the firm.[57] All of the three models are presented in detail in the following section.

3. Selected models of creditor influence on decisions of the firm

This section presents three models that deal with different ways of the creditors, that are referred to as debtholders, influencing the decisions made in the firm. Therefore, the conflicts of interests that arise between the major stakeholders of the firm in the presence of risky debt play a key role in the following. Douglas (2009) analyzes these conflicts in the context of the investment decision of the firm, whereby he derives the stakeholders' risk preferences and explains the consequences for the control allocation of the firm.[58] Berkovitch and Israel (1996) model the managerial replacement decision of the firm's board of directors and show how the debtholders' influence can be used to implement the ideal replacement policy.[59] In contrast to the other models, John and John (1993) examine the impact of risky debt on the investment decision of the firm without any active debtholder influence.[60] All of the authors consider the debtholders as important stakeholders, having a crucial impact on the solution of the firm's respective problem. Thus, they focus on the consequences for the decision process of the firm rather than deriving the actual design of the debt contract. The selection of the models presents various possibilities of debtholder influence and considers different decisions made in the firm. Hence, the models depict solutions on how to handle the debtholders' impact under different circumstances and can be compared with regard to their respective approaches and outcomes.[61] In the following, all of the models are presented and explained in detail before comparing and discussing selected aspects of them as well as the implications of their results.

3.1. Exposition of the model from Douglas (2009)

The model from Douglas (2009) depicts the interrelations between the agency conflicts, arising when not only the shareholders but also the debtholders and the manager can influence the investment decision of the firm. The content of the complete section 3.1 is based on the work of Douglas (2009) if not stated otherwise.[62] At first, the timeline and the main characteristics of the model are introduced before solving it for the case of risk-free debt without debtholder or manager influence. Afterwards, the problem is solved with risky debt in place, incorporating the stakeholders' influences and the conflicts that emerge. Finally, the use of the influences in the context of different control structures is explained.

3.1.1. Timeline and basic setup

Below, the timing of the events as well as the main variables and functions of the model are introduced. Douglas (2009) models the firm's operations over two periods, as shown in Figure 1, and considers the shareholders, the debtholders and the manager as major stakeholders.

At the date $t = 0$ debt of the face value $F > 0$ is issued and the control structure is set up by assigning the relative strength of the influence to each group of stakeholders, determining their impact on the future decisions of the firm.[63] Note that there exists the possibility of certain stakeholders having no influence at all.

The decision about the investment risk during the first period can be influenced by each stakeholder according to the levels of influence set at t=0. For every investment, there exists a high and a low state with the respective values x^i, $i \in \{L, H\}$, and $x^H > x^L$. Thereby, the difference $\Delta x = x^H - x^L$ represents the risk level of the investment.

At the date $t = 1$ the incentive contract of the manager is negotiated.[64] The stakeholders can influence this decision just like the investment decision before. The goal of the contract is to induce the manager to correctly manage the investment made in the first period, which means that this action is contingent on the value of the investment. If the value equates to x^i, the induced action is given by a^i with $i \in \{L, H\}$.

In the second period the manager privately observes the actual value x^i of the investment before choosing his action $a \in [0, \infty]$, being neither observable nor contractible. The action a represents the manager's level of effort and leads to a disutility displayed by the function A(a) with $A'(a) > 0$ and $A''(a) > 0$. The form of this function stems from the assumption that exerting additional effort becomes costlier for the manager the higher his initial effort is.[65] Douglas (2009) works with the following disutility function for exposition:

$$A(a) = \frac{k}{2}a^2, \quad k > 0 \tag{1}$$

At the final date $t = 2$ the return of the investment is realized and the payments to the stakeholders are made. Therefore, the total value of the firm is given by:[66]

$$v\left(x^i, a\right) = x^i + a \tag{2}$$

Firstly, the wage $w(v)$, which is contingent on the total firm value, is paid to the manager. Secondly, the debtholders receive their external claim and, finally, the shareholders

[57] Cf. Douglas (2009); cf. Berkovitch and Israel (1996); cf. John and John (1993).

[58] Cf. Douglas (2009), pp.154-170.

[59] Cf. Berkovitch and Israel (1996), pp.213-227.

[60] Cf. John and John (1993), pp.954-966.

[61] Cf. Douglas (2009), pp.154-170; cf. Berkovitch and Israel (1996), pp.213-227; cf. John and John (1993), pp.954-966.

[62] Cf. Douglas (2009), pp.154-176.

[63] The bond value B that the debtholders pay to the shareholders for the external claim of F is not specifically considered. Under the assumption that the debtholders break even, B equates to their expected payoff.

[64] This contract can be seen as renegotiation-proof, as there is no possibility for any renegotiation. For a detailed derivation of renegotiation-proof contracts see Fudenberg and Tirole (1990), pp.1283-1288.

[65] This assumption is also used by other authors like Schmidt (1997), p.194.

[66] The managerial action a directly affects the monetary outcome and therefore the firm value, similar to the model of Holmström (1979), pp.75-76.

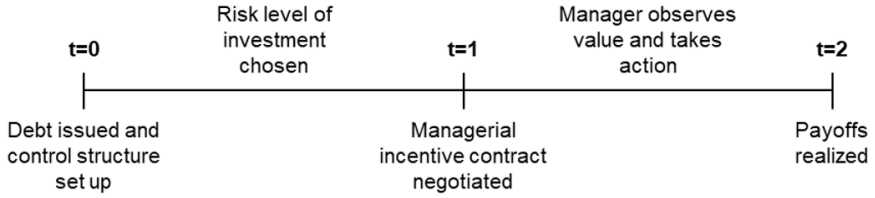

Figure 1: Timeline of the model from Douglas (2009). Own graphic made according to Douglas (2009), p.155.

receive the residual if it exists. All parties involved are risk-neutral concerning their monetary rewards. For the manager, this leads to a utility function that is linear in w but quadratic in a:

$$M(w(v),a) = w(v) - A(a) = w(v) - \frac{k}{2}a^2 \tag{3}$$

The managerial reservation utility, representing his outside options, is denoted by $u_0 > 0$.[67] In addition to that, the manager has no initial wealth, so that there is no possibility for him to buy the firm, as he is only able to borrow a restricted amount of money.

3.1.2. Case of risk-free debt without debtholder or manager influence

For the presence of risk-free debt, with $v - w \geq F$ in any case, Douglas (2009) assumes that neither the debtholders nor the manager has influence on the decisions of the firm.

In the first-best-situation, the investment value x^i is perfectly observed by all stakeholders. Hence, the only information advantage of the manager lies within his hidden action a. The shareholders face the following optimization problem for $i \in \{L,H\}$:[68]

$$\max_{a^i w^i} \left[v^i - w^i - F \right] \tag{4}$$

Subject to

$$(PC_i) \quad w^i - A\left(a^i\right) \geq u_o \tag{5}$$

$$(IC_i) \quad w^i - A\left(a^i\right) \geq w\left(v\left(x^i,a\right)\right) - A(a) \quad \forall a \neq a^i \tag{6}$$

They maximize their expected payoff with respect to the induced actions a^i and the wage payments w^i but need to make sure that the manager gains a higher utility from choosing the correct action a^i than from choosing any other action a, which is represented by the incentive compatibility constraints (IC_i). The participation constraints (PC_i) ensure that the manager is willing to complete the correct action a^i rather than realizing his outside opportunity. In the optimum, the participation constraints (PC_i) bind, leaving the manager with his reservation utility u_o. With $a^L = a^H = a^{FB}$, this leads to the optimal contract $w^{FB}(v)$ for the manager:[69]

$$w^{FB}(v) = \begin{cases} A\left(a^{FB}\right) + u_0 & , \text{ if } v = v^i, i \in \{L,H\} \\ 0 & , \text{ otherwise} \end{cases} \tag{7}$$

The shareholders implement $w^{FB}(v)$, as they observe the value x^i of the investment and deduce from the total firm value v if the manager has taken the desired action $a^i = a^{FB}$. The manager is penalized for choosing the wrong action $a \neq a^i$, as he does not receive a wage payment in this case.[70] Note that Douglas (2009) sets $A'(a^{FB}) = 1$ and assumes that $a^L \geq \Delta x$ to avoid corner solutions.[71]

In the second-best-situation, the investment value $x^i, i \in \{L,H\}$, is privately observed by the manager, leading to an additional information advantage besides his hidden action a. The extent of this advantage is contingent on the risk Δx of the investment. The shareholders only know the probability $\text{Prob}(i = H) = \sigma > 0$, so that their optimization problem becomes:

$$\max_{a^L,a^H,w^L,w^H} \left[\sigma\left(v^H - w^H\right) + (1-\sigma)\left(v^L - w^L\right) - F \right] \tag{8}$$

Subject to

$$(PC_i) \quad w^i - A\left(a^i\right) \geq u_0, \quad i \in \{L,H\} \tag{9}$$

$$(IC_i) \quad w^i - A\left(a^i\right) \geq w\left(v\left(x^i,a\right)\right) - A(a), \quad \forall a \neq a^i, i \in \{L,H\} \tag{10}$$

$$(IC_1) \quad w^L - A\left(a^L\right) \geq w^H - A\left(a^H + \Delta x\right) \tag{11}$$

$$(IC_2) \quad w^H - A\left(a^H\right) \geq w^L - A\left(a^L - \Delta x\right) \tag{12}$$

The constraints (PC_i) and (IC_i) from the first-best-scenario still need to hold and similar to the first-best-payment $w^{FB}(v)$ the manager receives the maximum penalization for choosing the wrong action a by setting $w(v(x^i,a)) = 0$ for all $a \neq a^i$. The incentive compatibility constraint (IC_1) ensures that the manager does not choose the effort $a^H + \Delta x$ to obtain the high total firm value v^H, although the value of

[67] The reservation utility represents the utility of the best alternative for the manager outside of the firm, as in Ewert and Wagenhofer (2014), p.359.

[68] Note that $v^i = v\left(x^i,a^i\right) = x^i + a^i$ and $w^i = w\left(v^i\right)$ with, $i \in \{L,H\}$.

[69] The calculation is given in Appendix A.1.

[70] A penalization in the form of $w < 0$ is not considered in the model. The expected managerial utility for $a \neq a^i$ is, $M = w\left(v\left(x^i,a\right)\right) - A(a) = 0 - A(a) \leq 0 < u_0$, so that the constraints $(IC_i), i \in \{L,H\}$, always hold.

[71] The second condition generally holds for the whole model to avoid corner solutions in the following, too.

the investment is low. Similarly, the constraint (IC_2) guarantees that the manager does not aim for a low total firm value v^L, while the value of the investment is high. For the present problem, the participation constraint (PC_L) and the incentive compatibility constraint (IC_2) bind.[72] Solving it by constructing the Lagrange function leads to the following results for the optimal managerial actions to be induced:[73]

$$a_{SB}^H = a^{FB} \tag{13}$$

$$a_{SB}^L = a^{FB} - K_1(\sigma)\Delta x, \quad K_1(\sigma) > 0 \tag{14}$$

The wage payments w_{SB}^i follow directly from the binding constraints (PC_L) and (PC_2):

$$w_{SB}^H = u_0 + A\left(a_{SB}^H\right) + A\left(a_{SB}^L\right) - A\left(a_{SB}^L - \Delta x\right) \tag{15}$$

$$w_{SB}^L = u_0 + A\left(a_{SB}^L\right) \tag{16}$$

In the high state the manager chooses the first-best-action a^{FB}, but the wage w_{SB}^H paid by the shareholders is higher than in the first-best-case. This represents the information rent the manager receives, as he is the only one to observe the value x^i of investment. Thus, the shareholders have to pay this rent, which represents their agency costs in the high state:

$$AC^H\left(a_{SB}^L\right) = A\left(a_{SB}^L\right) - A\left(a_{SB}^L - \Delta x\right) \tag{17}$$

The managerial action a_{SB}^L after the low return is lower than the first-best-action, with the difference consisting of K_1, which is contingent on the probability σ,[74] multiplied with the risk Δx of the investment. This leads to the following efficiency loss for the shareholders:

$$AC^L\left(a_{SB}^L\right) = \left(a^{FB} - A\left(a^{FB}\right)\right) - \left(a_{SB}^L - A\left(a_{SB}^L\right)\right) \tag{18}$$

All in all, the total expected agency costs of the shareholders in the second-best-case are:

$$AC = \sigma AC^H + (1-\sigma)AC^L \tag{19}$$

As $\partial AC^H / \partial a_{SB}^L > 0$ and $\partial AC^L / \partial a_{SB}^L < 0$ the key for the shareholders is to weigh up the opposing effects of a_{SB}^L on the agency costs.[75] The second-best-solution, presented in (13) to (16), includes the optimal a_{SB}^L that maximizes the shareholders' expected payoff and the firm value.

3.1.3. Case of risky debt with debtholder and manager influence

In the presence of risky debt, the influence of the debtholders is crucial for the firm, as their preferences do not align with the ones of the shareholders. Moreover, the manager can influence the firm's decisions in this case, too. Douglas (2009) assumes that $v^H - w^H > F$ and $v^L - w^L < F$, which means that the debtholders completely receive the face value F if $i = H$ but only receive $v^L - w^L$ if $i = L$, whereas the shareholders receive the residual $v^H - w^H - F$ if $i = H$ and nothing if $i = L$. As the managerial payment is assumed to be senior to the other claims, the manager always receives his complete payment, which is either w^H or w^L.[76] These payoffs lead to different preferences of the stakeholders concerning the managerial contract and the risk of the investment, as shown below. The overall problem is solved via backward induction, as the ideal managerial incentive scheme is derived before determining the preferred risk of investment.

Additional impacts on the managerial incentive problem

Risky debt combined with the influence of the debtholders and the manager leads to a new optimization problem concerning the managerial actions to be induced. The influences of the stakeholders are modelled directly, which means that their preferences are included in the overall objective function of the firm. The debtholders' level of influence is represented by β, with $0 \leq \beta < \bar{\beta}$, which is the weight of their objective within the overall objective function. Similarly, the parameter m, with $0 \leq m < \bar{m}$, models the manager's influence. This leads to the following objective function as a weighted sum of the stakeholders' objectives:

$$\max_{a^L, a^H, w^L, w^H} \Bigg\{ (1-m) \Bigg[(1-\beta) \underbrace{\sigma\left(x^H + a^H - w^H - F\right)}_{\text{shareholders' exp. payoff}} + \beta \underbrace{\left((1-\sigma)\left(x^L + a^L - w^L\right) + \sigma F\right)}_{\text{debtholders' exp. payoff}} \Bigg] + m \Bigg[\underbrace{(1-\sigma)\left(w^L - A\left(a^L\right)\right) + \sigma\left(w^H - A\left(a^H\right)\right)}_{\text{manager's exp. payoff}} \Bigg] \Bigg\} \tag{20}$$

The objective function is subject to the same constraints as in the risk-free case, given by (9) to (12). Also, under the assumption that m is small enough, the same constraints bind.[77] Solving the problem with the Lagrange function leads to the following induced managerial actions:[78]

$$a_{SB,RD}^H = a^{FB} \tag{21}$$

$$a_{SB,RD}^L = a^{FB} - K_2(\sigma, \beta, m)\Delta x, \quad K_2(\sigma, \beta, m) > 0 \tag{22}$$

While $w\left(v\left(x^i, a\right)\right) = 0$ holds for all $a \neq a^i$ for the same reasons as in the risk-free case, the wage payments $w_{SB,RD}^H$

[72] The proof is given in the Appendix A.2.

[73] The calculation is given in the Appendix A.3.

[74] This is the case if the disutility function $A(a)$, given by (1), is used.

[75] The calculation and formal analysis of the agency costs are given in the Appendix A.4.

[76] This happens under the assumption that he chooses the correct action a^i and that $v^i > w^i$ for $i \in \{L, H\}$.

[77] The managerial influence m needs to be so small that it still optimal to minimize the managerial wage payments in order to maximize the value of the overall objective function. This is similar to the assumption made by Douglas (2002) that avoids absolute manager control, see Douglas (2002), p.298.

[78] The calculation is given in the Appendix A.5.

and $w^L_{SB,RD}$ are calculated as in the equations (15) and (16) but with the above actions instead of the ones from (13) and (14). As opposed to K_1, the factor K_2, used in (22), does not only depend on the probability σ but also on the parameters β and m.[79] Thus, the value of $a^L_{SB,RD}$ depends on the relative influences set at $t = 0$.[80] As the shareholders only receive a payoff if $i = H$, they prefer to minimize the wage payment $w^H_{SB,RD}$ to the manager. Therefore, they seek to minimize the managerial information rent $AC^H\left(a^L_{SB,RD}\right)$, as in (17) with $a^L_{SB,RD}$ instead of a^L_{SB}. Because of $\partial AC^H\left(a^L_{SB,RD}\right)/\partial a^L_{SB,RD} > 0$, their goal is to minimize $a^L_{SB,RD}$, although this leads to a loss of efficiency in the low state, as these inefficiency costs are fully borne by the debtholders. The debtholders know that they receive F with certainty in the high state but only $v^L_{SB,RD} - w^L_{SB,RD}$ in the low state, so that they seek to maximize their return in the low state by maximizing the induced action $a^L_{SB,RD}$. Hence, the shareholders and the debtholders have opposing preferences concerning $a^L_{SB,RD}$. The manager seeks to maximize his information rent $AC^H\left(a^L_{SB,RD}\right)$, as in (17), by increasing $a^L_{SB,RD}$, which means that his preferences are aligned with the ones of the debtholders. Thus, a higher managerial level of influence reduces the necessary influence of the debtholders to obtain the value-maximizing $a^L_{SB,RD}$.[81]

Stakeholders' decision about the risk of the investment

Before the managerial incentive scheme is put in place at $t = 1$, the firm decides about the risk Δx of the investment, whereby all parties already predict the managerial contract, as derived in the previous section, and Δx is assumed to be mean preserving.[82] The investment decision can be influenced by all stakeholders according to the values of β and m. They consider the direct effect that Δx has on their expected payoffs as well as the indirect effect due to the changes in $a^L_{SB,RD}$. Therefore, the stakeholders anticipate $a^L_{SB,RD}$, given by (22), and its derivative with respect to Δx, which is $\partial a^L_{SB,RD}/\partial \Delta x = -K_2(\sigma, \beta, m) < 0$.

Firstly, consider the managerial utility function, given by M:

$$M(\Delta x) = \sigma\left(u_0 + AC^H\left(a^L_{SB,RD}(\Delta x)\right)\right) + (1-\sigma)u_0 \quad (23)$$

The manager receives his reservation utility u_0 in both states and the additional information rent $AC^H\left(a^L_{SB,RD}\right)$, as in (17), in the high state. Increasing Δx has a direct effect, as it increases the information advantage and therefore the information rent of the manager. On the other side, an increase in Δx also leads to a decrease in $a^L_{S,RD}$, which has an opposing effect on his information rent, as $\partial AC^H\left(a^L_{SB,RD}\right)/\partial a^L_{SB,RD} > 0$. While the first effect dominates for lower values of Δx, the second one is stronger for higher values of Δx, leading to a concave payoff function with the maximum point at Δx^M.

The debtholders' payoff function D is of the following form:

$$D(\Delta x) = \sigma \mathrm{F} + (1-\sigma)\left(x^L(\Delta x) + a^L_{SB,RD}(\Delta x) - w^L_{SB,RD}(\Delta x)\right) \quad (24)$$

They receive the complete face value F in the high state and the residual in the low state. As Δx is mean preserving, raising it decreases x^L and therefore the debtholders' payoff in the low state. Additionally, an increase in Δx leads to a decrease in $a^L_{SB,RD}$, which causes higher efficiency losses in the low state. Hence, the debtholders oppose any increase in Δx.

The expected payoff S of the firm's shareholders is calculated as follows:

$$S(\Delta x) = \sigma\left(x^H(\Delta x) + a^{FB} - w^H_{SB,RD}(\Delta x) - F\right) \quad (25)$$

The shareholders only receive the residual in the high state, as there is none left in the low state. Because Δx is mean preserving, a rising value of Δx increases x^H, leading to higher payoffs for the shareholders in the high state. At the same time, increasing Δx affects the managerial information rent AC^H and therefore $w^H_{SB,RD}$, as explained above. However, the first effect dominates and is even enhanced by the other effect for $\Delta x > \Delta x^M$, so that, overall, the shareholders' payoff strictly increases in Δx.[83]

Given the disutility function $A(a)$, depicted in (1), and thereby a specific $a^L_{SB,RD}(\Delta x)$, of the form as in (22), the payoff functions of the stakeholders can be calculated and visualized graphically, as seen in Figure 2.[84] Note that Douglas (2009) restricts attention to the interval $[\underline{\Delta x}, \overline{\Delta x}]$.[85]

Overall, the manager is aligned with the risk preferences of the shareholders below Δx^M but aligned with the debtholders above it. Under the assumption that the equilibrium risk level is below Δx^M, the manager and the shareholders prefer to raise Δx, while the debtholders represent the main force that is preventing Δx to increase. Therefore, Douglas (2009) suggests to model Δx solely as a function of β with $\partial \Delta x/\partial \beta < 0$.

Consequences for the control allocation of the firm

At the date $t = 0$ the firm's initial contracts are set up, which means issuing debt of the face value $F > 0$ and determining the control structure by choosing the combination of the

[79] This is the case if the disutility function $A(a)$, given by (1), is used.

[80] A graph that depicts $a^L_{SB,RD}$ as a function of β for different values of m is given in the Appendix A.6.

[81] This refers to the maximization of the firm value by minimizing the agency costs, as given in (19).

[82] The formal depiction is given in the Appendix A.7.

[83] This is the case for the values of $\Delta x \in [\underline{\Delta x}, \overline{\Delta x}]$ considered in the present analysis.

[84] The calculation and formal analysis of the payoff functions are given in the Appendix A.8.

[85] The calculation of the boundaries is given in the Appendix A.9.

[86] The values used to calculate the functions are: $\sigma = 0,6; \beta = 0,2; m = 0,1; k = 0,1; u_0 = 1,5; F = 1,25; \pi = 1$. Note that the factor 0,3 has been subtracted from the function D of the debtholders for illustration purposes.

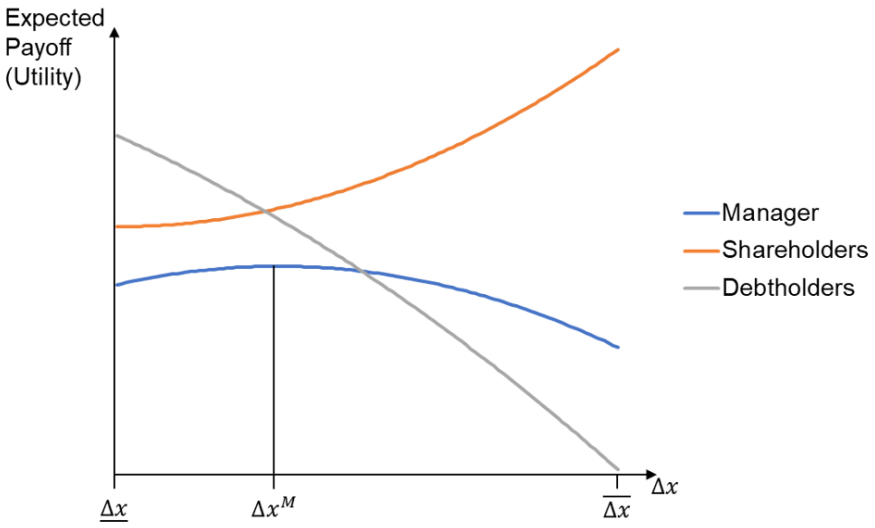

Figure 2: Payoff functions of the stakeholders over the risk choice. Own graphic made according to Douglas (2009), p.165.[86]

relative influences β and m. Thereby, Douglas (2009) distinguishes between manager- and boardcontrolled firms. The two distinct approaches are presented in the following.

In case of initial manager control over the firm, the goal is to maximize the manager's expected utility by maximizing his expected wage payment at the expense of the shareholders. However, the manager's choice of m is constrained because he can be replaced by the shareholders if he gives himself too much power.[87] The new manager would be put in place at $t = 1$ with no influence at all, thus increasing the shareholders' expected payoff.[88] At the same time, replacing the manager causes costs of R for the shareholders though. All in all, the manager faces the following optimization problem to set up β and m at $t = 0$:[89]

$$\max_{\beta,m}\Big[u_0 + \sigma\Big(A\Big(a^L_{SB,RD}(\Delta x(\beta),\beta,m)\Big) - A\Big(a^L_{SB,RD}(\Delta x(\beta),\beta,m) - \Delta x(\beta)\Big)\Big)\Big] \tag{26}$$

$$\text{Subject to} \quad S\Big(\Delta x(\beta), a^L_{SB,RD}(\Delta x(\beta),\beta,m)\Big) \geq S\Big(\Delta x(\beta), a^L_{SB,RD}(\Delta x(\beta),\beta,m=0)\Big) - R \tag{27}$$

He maximizes his expected utility subject to the constraint (27), which ensures that he chooses m, so that the shareholders have no intention of replacing him. Therefore, he sets m at the maximum level $\bar{m}$, at which the constraint (27) binds. As shown in section 3.1.3.1, the manager and the debtholders are aligned concerning the managerial action $a^L_{SB,RD}$ to be induced, but they are not necessarily aligned when it comes to the risk preferences, as derived in section 3.1.3.2. Raising β increases the information rent AC^H, given by (17), through the increase in $a^L_{SB,RD}$ and at the same time decreases AC^H, as Δx and therefore the information advantage of the manager decreases.[90] The manager weighs up these effects and chooses the value β^m that maximizes his expected utility.

Another possibility used in the literature is that an initial board or entrepreneur has control rights at $t = 0$, maximizing the expected firm value.[91] The expected value of the investment is always the same, as Δx is mean preserving, and there is no direct impact of the debt on the firm value, as the debtholders break even. Thus, the entrepreneur only focuses on the agency costs AC, given in (19), and chooses the combination of β and m that minimizes them. He faces the following optimization problem at $t = 0$:[92]

$$\min_{\beta,m}\Big[AC = \sigma AC^H\Big(a^L_{SB,RD}(\Delta x(\beta),\beta,m),\Delta x(\beta)\Big) + (1-\sigma)AC^L\Big(a^L_{SB_1RD}(\Delta x(\beta),\beta,m)\Big)\Big] \tag{28}$$

$$\text{Subject to} \quad \Delta x(\beta) \geq \underline{\Delta x} \tag{29}$$

With $\Delta x < \Delta x^M$, it follows that $\partial AC/\partial \Delta x > 0$, so that the entrepreneur aims for the minimum risk of the investment.[93] Douglas (2009) states that the risk level Δx has a greater impact on the agency costs AC than the managerial action $a^L_{S,RD}$. This is why β is set at the maximum possible level $\bar{\beta}$ with $\Delta x(\bar{\beta}) = \underline{\Delta x}$, so that the constraint (29) binds. Once β is chosen, the board sets m in order to induce the

[87] This is similar to the takeover threat in the model of Zwiebel (1996), pp.1199-1204

[88] The proof is given in the Appendix A.10.

[89] The manager considers the risk level $\Delta x(\beta)$ and the action $a^L_{SB,RD}(\Delta x(\beta),\beta,m)$, as given in (22).

[90] The second effect occurs, as the equilibrium risk is assumed to be lower than Δx^M.

[91] Cf. Berkovitch and Israel (1996), p.213; cf. Dewatripont and Tirole (1994), pp. 1035-1037.

[92] The entrepreneur considers the risk level $\Delta x(\beta)$ and the action $a^L_{SB,RD}(\Delta x(\beta),\beta,m)$, as given in (22).

[93] The proof is given in the Appendix A.11.

most efficient action $a^L_{SB,RD}$. If $a^L_{SB,RD}$ is already above the optimum, the board sets $m = 0$, because any $m > 0$ would increase $a^L_{SB,RD}$ even more and cause higher agency costs.

Overall, the shareholders and the manager are aligned concerning the risk choice in the first period due to the assumption of $\Delta x < \Delta x^M$.[94] However, this is not the case ex ante, as the manager prefers a level of risk $\Delta x > \underline{\Delta x}$ because this increases his information rent, whereas the shareholders, acting similar to the initial owner, prefer the minimum level of risk in order to minimize the agency costs. For both options, the influence of the stakeholders is used to implement the preferred level of risk as well as the preferred managerial actions.

3.2. Exposition of the model from Berkovitch and Israel (1996)

The model from Berkovitch and Israel (1996) presented in this section deals with the managerial replacement decision of the firm and highlights the effects of the stakeholders influencing the decision process. The content of the complete section 3.2 is based on the work of Berkovitch and Israel (1996) if not stated otherwise.[95] After introducing the main aspects of the model, the different preferences of the stakeholders concerning the managerial replacement decision are derived. Following this, the effort choice of the manager is examined. Subsequently, the problem that arises with the implementation of the replacement policy in an all-equity firm is explained before the last subsection shows how the capital and control structure is used to solve it.

3.2.1. Timeline and basic setup

Berkovitch and Israel (1996) model the firm's operations over two periods with the shareholders, the debtholders and the manager as stakeholders and with an initial entrepreneur setting it up. Figure 3 shows the events taking place in the model.

At the date $t = 0$ the entrepreneur hires the manager and sets up the capital structure of the firm by issuing debt and equity. Thus, there are debtholders with a fixed claim of $F > 0$ and shareholders with a residual claim.[96] Furthermore, the control is allocated among the three groups of stakeholders, which is crucial to influence the decision about the managerial replacement in the second period. Receiving control rights leads to the representation on the firm's board of directors, where the decision is made.

During the first period the incumbent manager chooses the effort level $a > 0$, which is neither observable nor noncontractible. He has the ability y that is unknown to all other parties when he chooses a. Both of the parameters a and y determine the firm's cash flow y under the incumbent manager at $t = 2$, as they induce a twice continuously differentiable cumulative distribution function $G(y \mid a)$ over R^+. Berkovitch and Israel (1996) assume that the cash flow y increases with a higher effort as well as with a higher managerial ability and that the monotone likelihood ratio property holds for the density function $g(y \mid a)$, as $g_a(y \mid a)/g(y \mid a)$ increases in y.[97] This means that the first-order stochastic dominance $G_a(y \mid a) < 0$ holds for every y, so that a higher effort level a leads to a stochastically higher cash flow y.[98] Moreover, Berkovitch and Israel (1996) assume that $G_{aa} > 0$ and $\lim_{y\to\infty} yG_a(y \mid a) = 0$.

When exerting effort of the level a, the manager experiences the disutility $\tau A(a)$ with $\tau > 0$ and the disutility function $A(a)$, which is increasing and convex in a with $A(0) = A'(0) = 0$.[99] On the other side, the manager receives nonmonetary private benefits ω when managing the operations of the firm, whereas monetary rewards are not considered.[100] The alternative wage, representing his outside options, is set at $w_0 = 0$. Furthermore, the manager is assumed to be risk-neutral. As the discount rate is set at zero and he does not have any personal funds, he cannot buy the firm or simply pay to receive the control rights.

At the date $t = 1$ the signal P is observed by all stakeholders and provides perfect information about the cash flow y under the incumbent manager at $t = 2$, so that the notation used for the cash flow in this case is $y(P)$. However, as P is not verifiable, it cannot be contracted upon.

In the second period the decision concerning the position of the manager takes place, with the different options being the continuation with the incumbent manager, the replacement by a new manager and the liquidation of the firm. As the decision is made through voting on the board of directors, all stakeholders can influence it according to the control structure set in place at $t = 0$. Each group of stakeholders can either have full control, partial control or no control at all over the board. When continuing with the incumbent manager, the cash flow $y(P)$ is assuredly realized at $t = 2$. Replacing the manager means hiring a new one, which leads to a different cash flow at $t = 2$ with the density function $h(y)$ and the cumulative distribution $H(y)$. The expected value of this cash flow is $\bar{y}$, not being dependent on the effort by the former manager in the first period. If the firm is liquidated, the terminal cash flow is $\bar{y}$ with certainty.[101] Hence, replac-

[94] Note that solving the two control allocation problems above without the assumption leads to a solution with $\Delta x < \Delta x^M$, which confirms this exact assumption. The proof is given in the Appendix A.12.

[95] Berkovitch and Israel (1996), pp.213-227 and 235-238.

[96] The model does not specifically consider the bond value B that the debtholders pay to the firm initially to receive the claim of F. However, in the background, the assumption of the debtholders setting B equal to their expected payoff holds, so that they can be assumed to break even.

[97] Note that in the following the index a refers to the first-order derivative with respect to a, and the index aa refers to the second-order derivative with respect to a. This notation is used for the functions g and G.

[98] For the formal definition of the monotone likelihood ratio and the first-order stochastic dominance as well as their causal correlation see Milgrom (1981), pp.383-384.

[99] The form of this function is chosen for the same reasons as introduced by Douglas (2009), pp.156-157.

[100] Private benefits refer to aspects like reputation or control benefits, also see Aghion and Bolton (1992), p.476.

[101] This represents the fact that outside investors can take over the firm and hire the alternative manager, which would lead to the expected cash flow of $\bar{y}$, so that the investors are willing to pay this exact price for the firm.

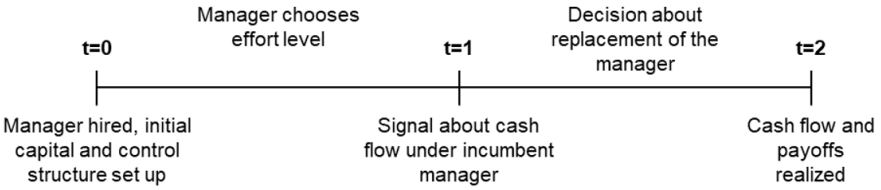

Figure 3: Timeline of the model from Berkovitch and Israel (1996). Own graphic made according to Berkovitch and Israel (1996), p.213.

ing the manager increases the risk compared to the other two options.

Finally, at the date $t = 2$ the cash flow of the firm is realized and the debtholders' claim is settled before the shareholders receive the residual, whereas the manager receives his nonmonetary private benefits ω if he is not replaced in the second period.[102]

3.2.2. Stakeholders' preferences concerning the managerial replacement decision

The preferences of the stakeholders concerning the managerial replacement are contingent on the signal P that indicates the cash flow $y(P)$ under the incumbent manager. The incumbent manager is only allowed to continue working for the firm if the signal P is greater than the critical value P^C, implying that the final cash flow $y(P)$ is greater than the respective critical value $y^C = y\left(P^C\right)$, which is denoted by the replacement policy $\left[y^C\right]$. As the critical value y^C is determined by the board of directors, its value is contingent on the composition of the board.

Only receiving the private benefits ω if staying in the firm, the manager opposes any replacement or liquidation. He seeks to maximize his expected utility:

$$\max_y [M = \omega(1 - G(y \mid a)) - \tau A(a)] \tag{30}$$

While the first term represents the expected private benefits of the manager, the second term shows his disutility when choosing the effort level a. The utility function has its optimum for $y^M = 0$,[103] meaning that he can continue working for the firm in any case.

The shareholders seek to maximize the level of risk to increase their expected payoff at the cost of the debtholders,[104] which is why they prefer the managerial replacement over the liquidation of the firm. The critical value y^s of the final income that they prefer can be determined by comparing their expected payoffs under the incumbent and under the alternative manager:

$$S_{IM}(F) = \max\{y(P) - F, 0\} = \int_F^\infty (y - F)h(y)dy = S_{AM}(F) \tag{31}$$

This leads to their preferred critical value y^S:[105]

$$y^S(\text{ F}) = \bar{y} + \int_0^F (F - y)h(y)dy \tag{32}$$

The integral represents the wealth transfer from the debtholders to the shareholders following the increasing risk with an alternative manager.[106] The critical value $y^S(F)$ is increasing in F, with $y^S(0) = \bar{y}$ and $\lim_{F\to\infty} y^S(F) = \infty$,[107] so that the shareholders become more aggressive in their replacement strategy if more debt is issued.

As mentioned before, the debtholders suffer from greater risk, which is why they prefer the liquidation of the firm if $y(P) < \bar{y}$.[108] However, as both of the other groups of stakeholders oppose the liquidation and absolute debtholder control is not an option,[109] the possibility of the debtholders having partial control is considered. In this case, they can only influence the decision whether the manager is replaced without the possibility of the firm's liquidation. Therefore, they compare their expected payoffs under the incumbent and the alternative manager to find their preferred critical value y^D of the final cash flow:

$$\begin{aligned} D_{IM}(F) = \min\{y(P), F\} &= \int_0^F yh(y)dy + \int_F^\infty Fh(y)dy \\ &= D_{AM}(F) \end{aligned} \tag{33}$$

Hence, the critical value y^D is given by the following:[110]

$$y^D(F) = \bar{y} - \int_F^\infty (y - F)h(y)dy \tag{34}$$

Note that y^D is increasing in F, with $y^D(0) = 0$ and $\lim_{F\to\infty} y^D(\text{ F}) = \bar{y}$,[111] so that the debtholders become more aggressive the more debt is issued. Note that the debtholders are still less aggressive than the shareholders for any F, as the condition $y^D(F) < y^S(F)$ holds.

[102] In case of a replacement, the alternative manager does not receive a wage payment either, as no effort is exerted in the second period anyway.
[103] The calculation is given in the Appendix A.13.
[104] This refers to the standard wealth transfer introduced by Jensen and Meckling (1976), pp.334-337.
[105] The calculation is given in the Appendix A.14.
[106] Cf. Jensen and Meckling (1976), pp.334-337.
[107] The proof is given in the Appendix A.15.
[108] The proof is given in the Appendix A.16.
[109] The debtholders do not get absolute control in order to avoid any chance of liquidation.
[110] The calculation is given in the Appendix A.17.
[111] The proof is given in the Appendix A.18.

3.2.3. Manager's choice of effort

In order to determine the optimal replacement policy $[y^C]$, the initial entrepreneur needs to consider how the managerial effort level changes with different values of y^C. When the manager exerts the effort during the first period, the capital and control structure have already been put in place, so that he can predict the critical value y^C based on the composition of the board of directors. Thus, he maximizes his utility, given y^C :

$$\max_a \left[\omega\left(1-G\left(y^C \mid a\right)\right)-\tau A(a)\right] \tag{35}$$

This function is the same as in (30), with the difference being that the manager maximizes it with respect to the effort a instead of the critical value y^C. The first-order-condition provides information about his optimal effort level a^*:

$$-\omega G_a\left(y^C \mid a^*\right)=\tau A'(a^*) \tag{36}$$

In the optimum the marginal payoff equals the marginal cost for any additional effort. The assumptions made by Berkovitch and Israel (1996) concerning the cumulative distribution function $G(y)$ and the disutility function $A(a)$ ensure that this problem has a unique interior solution.[112] However, the manager's choice of a does not only depend on the critical value y^C but also on the sensitivity of the cash flow y to the managerial effort level a, measured by the sensitivity of the density function $g(y)$ to changes in a. The model distinguishes between two cases that are shown in Figure 4.

If the density function $g(y)$ is sensitive to changes in the effort level, it is easier for the manager to achieve higher levels of y by exerting a higher level of a. This is presented graphically in Figure 4(a) with the blue and the red function and the corresponding effort levels $a_e, e \in \{1,2\}$, whereby $a_1 < a_2$. The intersection of the two density functions is to the right of y^C and $g_a\left(y^C\right)<0$, as $g\left(y^C \mid a_1\right)>g\left(y^C \mid a_2\right)$. The area I represents the increase in the probability of achieving a cash flow $y > y^C$, when exerting effort of level a_2 instead of a_1. This area grows with an increasing y^C until the intersection of the two functions is reached.[113] Hence, y^C should be set at a higher value to increase the motivation of the manager to exert the higher effort a_2.

The other case occurs when $g(y)$ is insensitive to the effort level, which makes it costlier for the manager to reach higher values of y. The blue and the red function in Figure 4(b) show this graphically for the effort levels $a_e, e \in \{1,2\}$, with $a_1 < a_2$. The intersection of the functions is to the left of y^c and $g_a(y^c) > 0$, as $g(y^c \mid a_1) < g(y^c \mid a_2)$. The higher effort level a_2 increases the probability of achieving $y > y^C$ by the area II, but at the same time decreases it by the area III. Raising y^C increases the area III, leading to a further decrease of the probability of achieving $y > y^C$ with the higher effort level. Thus, an increase in y^C decreases the motivation of the manager to exert the high effort level, because he knows that it is too costly for him to reach y^C through the higher effort. In order to induce a higher managerial effort, y^C should be decreased until the intersection of the two functions is reached.[114,115]

3.2.4. Implementation of the managerial replacement policy in an all-equity firm

This section derives the problem of the implementation of the ideal replacement policy in an all-equity firm with $F = 0$. The initial entrepreneur seeks to maximize the firm's total expected cash flow $\chi(y^c)$ by implementing the optimal replacement policy $[y^*]$. Hence, he faces the following optimization problem at $t = 0$:

$$\max_{y^C}\left[\chi\left(y^C\right)=\int_{y^C}^{\infty} y\, g\left(y \mid a^*\right) dy+\bar{y} G\left(y^C \mid a^*\right)\right] \tag{37}$$

$$\text{Subject to} \quad -\omega G_a\left(y^C \mid a^*\right)=\tau A'(a^*) \tag{38}$$

The objective function equals the firm's expected cash flow, consisting of the weighted sum of the expected cash flows under the incumbent and the alternative manager. The incentive compatibility constraint (38) is needed because the entrepreneur considers the manager's choice of a^*, as derived in section 3.2.3. Under the assumption that the manager's expected private benefits exceed his disutility from exerting the effort a^*, so that his overall expected utility, given by (35), is positive, the participation constraint always holds and does not need to be particularly considered.[116] The optimal value of y^C is contingent on the sensitivity of the density function $g(y)$ to the managerial effort a. In case of a high sensitivity at the point $\bar{y}$ and therefore $g_a(\bar{y}) < 0$, the optimal replacement policy is $[y^*]$ with $y^* > \bar{y}$, because a higher standard motivates the manager to exert a higher effort, as explained in section 3.2.3. If the sensitivity of $g(y)$ is low and $g_a(\bar{y}) > 0$, the ideal critical value is $y^* < \bar{y}$, in order not to frustrate the manager with too high standards, which is also explicated in section 3.2.3.[117]

After the determination of the ideal replacement policy $[y^*]$, the entrepreneur sets up the capital and control structure to implement it. In the present case, the capital structure is trivial, as there are only shareholders in an all-equity firm. The control structure can lead to either the shareholders or the manager having absolute control.[118] The manager always prefers $y^C = y^M = 0$, as explained in section

[112] The formal proof is given in the Appendix A.19.

[113] Increasing y^C even more leads to the case displayed in Figure 4(b).

[114] A further decrease of y^C leads to the case displayed in Figure 4(a).

[115] The formal proof concerning the managerial effort for both cases is given in the Appendix A.20.

[116] Berkovitch and Israel (1996) do not specifically mention this assumption, but it is formally needed to ensure that the manager stays in the firm rather than realizing his outside options, represented by $w_0 = 0$.

[117] The formal derivation of the optimal replacement policy is given in the Appendix A.21.

[118] The option of giving half of the votes to each group of stakeholders does not arise, as the entrepreneur generally seeks to avoid the possibility of a stalemate on the board of directors.

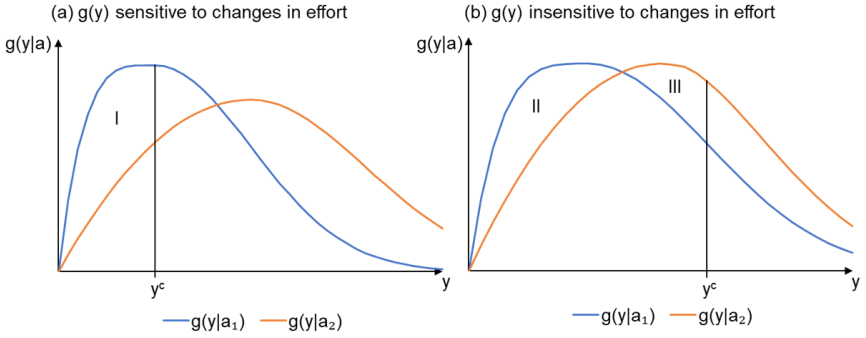

Figure 4: Sensitivity of the density function $g(y)$ to changes in the managerial effort. Own graphic made according to Berkovitch and Israel (1996), p.218-219.

3.2.2, which is not what the entrepreneur is looking for.[119] This is why he gives absolute control to the shareholders, who choose the critical value of y^C, as in equation (31) with $F = 0$:

$$S_{IM}(F=0) = \max\{y(P), 0\} = \underbrace{\int_0^{\infty} y h(y) dy}_{\bar{y}} = S_{AM}(F=0) \tag{39}$$

This leads to the critical value $y^C = y^S(F=0) = \bar{y}$ preferred by the shareholders. Hence, the entrepreneur is not able to induce any replacement policy with $y^* \neq \bar{y}$, because the shareholders cannot credibly commit to it, as they only replace the incumbent manager if the cash flow under him is lower than the expected cash flow under the alternative manager.[120]

3.2.5. Implementation of the managerial replacement policy through the capital and control structure

With the problem in an all-equity firm, as explained above, the influence of the debtholders is needed to successfully implement every possible replacement policy. Thus, in contrast to the previous section, debt of the face value $F > 0$ is issued. Section 3.2.2 shows the preferences of the stakeholders concerning the critical value y^C. The combination of them, that induces the optimal replacement policy $[y^*]$, is determined by the entrepreneur at $t = 0$, as he faces the problem in (37) and (38).[121] Thereby, he maximizes the objective function (37) by choosing the ideal capital and control structure, including the value for F, in order to induce $[y^*]$.

Firstly, note that neither giving absolute control to the manager nor giving absolute control to the debtholders is in the interest of the initial entrepreneur.[122] This leaves him with two more options for the capital and control structure that are depicted below.

One option is issuing debt of the face value $F \geq 0$ but giving the absolute control to the shareholders. In this case, the replacement policy is given by $\lceil y^S \rceil$ with $y^S(F)$, as calculated in (32). As this critical value increases in F and $y^S \geq \bar{y}$, every policy $[y^*]$ with $y^* \geq \bar{y}$ can be implemented by varying the face value $F \geq 0$. Doing so leads to an aggressive replacement policy, replacing even above average managers.

On the other side, a more conservative replacement policy keeps below average managers on the job, so that the optimal critical value is $y^* < \bar{y}$. Such a policy can be implemented by issuing debt of the face value $F > 0$ and giving partial control to each group of stakeholders. While the manager prefers $y^M = 0$ and the shareholders prefer y^S, given in (32), the debtholders' desired critical value y^D is given by (34) with $y^D < \bar{y}$ and $y^D < y^S$. If $y(P) > y^S$, all of the stakeholders prefer to continue with the incumbent manager. In case of $y^D < y(P) \leq y^S$, the shareholders would like to replace the manager, whereas the other stakeholders vote for the continuation with the incumbent manager. As the debtholders and the manager can form a coalition, they gain the absolute control over the board, so that the incumbent manager stays in the firm. If $y(P) \leq y^D$, only the manager votes against his replacement, whilst the other groups oppose his vote. This time, the shareholders and debtholders can form a coalition in order to replace the manager. All in all, the manager stays in the firm as long as $y(P) > y^D$, so that y^D, given in (34), is the overall critical value. As $0 \leq y^D < \bar{y}$ and y^D is increasing in F, every replacement policy $[y^*]$ with $y^* < \bar{y}$ can be implemented by using this control structure and varying the value of F. Note that the same result would be obtained if the shareholders were given absolute control and the debtholders had veto rights.

Overall, the entrepreneur can implement every policy $[y^*]$, using one of the two above options for the capital and

[119] With $y^C = 0$ there would be no incentive for the manager to exert any effort, because he would receive his private benefits ω anyway. This is not in the interest of the entrepreneur.

[120] The policy $y^* = \bar{y}$ would only be the optimal solution for the special case $g_a(\bar{y}) = 0$.

[121] There is no change in the objective function (37) due to the presence of debt, as the debtholders break even, so that the impacts of the bond value and the face value eliminate each other.

[122] Absolute debtholder control eventually leads to the liquidation of the firm, whereas absolute manager control means that the manager can never be replaced. It is in the interest of the entrepreneur to avoid these cases

control structure, in order to maximize the firm's expected cash flow χ. Without the debtholders, this would not be possible, following from the explanation in section 3.2.4, which highlights the significance of their influence in the present model.

3.3. Exposition of the model from John and John (1993)

This section explains the model of John and John (1993), showing the impact of risky debt on the investment decision of the firm. The content of the complete section 3.3 is based on the work of John and John (1993) if not stated otherwise.[123] After the timing and the setting of the model are presented, the optimal investment policy and its implementation within an all-equity firm are derived. Following this, debt is introduced to the problem and the new managerial incentive contract needed to implement the desired investment policy is derived.

3.3.1. Timeline and basic setup

The model of John and John (1993) focuses on a firm consisting of the shareholders, the manager and the board of directors, with a capital structure that includes equity and debt. It operates at three dates, as shown in Figure 5.

At the date $t = 0$ the managerial compensation contract μ is set up by the board of directors, which acts on behalf of the shareholders. The manager's reservation wage w_0 is given exogenously according to the forces on the labor market and represents his outside opportunities.[124] John and John (1993) only consider compensation contracts μ with the expected value of $E[\mu] \geq w_0$, so that the manager's participation constraint always holds. Furthermore, debt of the face value $F > 0$ is issued by the firm at $t = 0$. The model only allows debt in the form of a pure discount bond, maturing at $t = 2$, in order to keep it simple.[125] While F is given exogenously, the bond value B, that the firm receives from the debtholders at $t = 0$, is determined endogenously. The debtholders set B equal to their expected payoff D at $t = 2$, which is contingent on μ and F, so that they do not gain monetary advantages but instead break even.[126] They can do so because the compensation scheme μ and the investment values L, I, H are assumed to be known to the market.

The firm has an investment opportunity at $t = 1$, which is taken by the manager, who maximizes his own payoff, given the contract set up in $t = 0$. The amount of money that has to be invested equates to I and is partly paid by the bond value B, while the rest $I - B$ has to be paid by the shareholders. The manager can choose between two investment projects. The safe project yields a return of I at $t = 2$, whereas the risky project leads to a high return H with the probability q and to a low return L with the probability $1 - q$, whereby $0 < L < I < H$. The manager has an information advantage, because he privately observes the value of q and makes the investment decision, so that his contract cannot be contingent on the value of q or on his decision. The remaining stakeholders only know the values of L, I, H and that q is uniformly distributed on $[0, 1]$.

At the date $t = 2$ the return of the investment is realized and the payments to the stakeholders are made. Therefore, the manager receives the wage payment according to his contract and the claims of the debtholders are settled. Afterwards the shareholders receive the residual if it exists. John and John (1993) assume that all stakeholders within the model are risk-neutral concerning their monetary rewards.

3.3.2. Optimal investment policy and implementation in an all-equity firm

This subsection derives the optimal investment policy of the firm as the benchmark solution and shows how to implement it in an all-equity firm. The investment decision made by the manager at $t = 1$ is contingent on the value of q that he observes, with the cutoff level $\bar{q}$ representing the point, at which he is indifferent between choosing the safe or the risky project. Following the corresponding investment policy, denoted by $[\bar{q}]$, the manager chooses the risky project for all values $q > \bar{q}$ and the safe project for $q \leq \bar{q}$. Thus, the expected value of the investment is calculated as follows:[127]

$$V(\bar{q}) = -I + \bar{q}I + \frac{\left(1-\bar{q}^2\right)}{2}H + \frac{(1-\bar{q})^2}{2}L \tag{40}$$

The goal is to maximize the value of $V(\bar{q})$, so that the total monetary return stream to the firm is maximized. The first-order-condition with respect to $\bar{q}$ leads to:[128]

$$\hat{q} = \frac{I-L}{H-L} \tag{41}$$

The optimal investment policy $[\hat{q}]$ can be implemented in an all-equity firm with $F = 0$ by aligning the manager's preferences with the ones of the shareholders. In order to do so, the manager receives a constant proportion ε of the return of the investment.[129] The shareholders set ε, so that the participation constraint of the manager binds:[130]

$$E[\mu] = \varepsilon\left[\bar{q}I + \frac{\left(1-\bar{q}^2\right)}{2}H + \frac{(1-\bar{q})^2}{2}L\right] = w_0 \tag{42}$$

[123] Cf. John and John (1993), pp.954-966.

[124] This is similar to the reservation utility, defined by Ewert and Wagenhofer (2014), p.359.

[125] John and John (1993), pp.966-967, also discuss the possibility of using convertible debt, as in the model of Agliardi, Agliardi, and Spanjers (2015), pp.601-607. This option is not considered in the following though.

[126] This is consistent with the assumption of competitive financial markets, as in Brunnermeier and Oehmke (2013), p.489, and Berkovitch et al. (2000), p.563.

[127] The calculation is given in the Appendix A.22.

[128] The calculation is given in the Appendix A.23.

[129] A similar contract is used by Admati and Pfleiderer (1994), p.385-386, in the context of venture capitalists.

[130] They do so because they maximize their expected payoff by minimizing the payment to the manager.

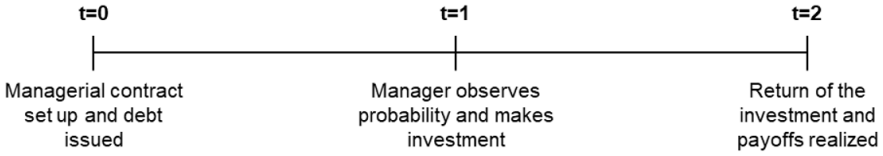

Figure 5: Timeline of the model from John and John (1993). Own graphic made according to John and John (1993), p.956.

The manager chooses the risky project if it yields a higher expected payoff than the safe one:

$$qH + (1-q)L > I \tag{43}$$

Thereby, he is indifferent at the cutoff level $\bar{q} = \hat{q}$, which leads to the optimal investment policy $[\hat{q}]$,[131] so that the shareholders receive the following payoff:

$$S(\hat{q}) = V(\hat{q}) - w_0 = -I + \hat{q}I + \frac{\left(1-\hat{q}^2\right)}{2}H + \frac{(1-\hat{q})^2}{2}L - w_0 \tag{44}$$

This solution represents the pareto-optimum of the problem, as the value of the investment and the shareholders' expected payoff are maximized, while the manager receives a payment of the present value w_0 anyway.[132] Note that any investment policy $[\bar{q}]$ with $\bar{q} \neq \hat{q}$ cannot be optimal and causes agency costs. Increasing the cutoff level $\bar{q}$ puts a stronger focus on the safe project with a safer overall expected return of the investment, whereas a decrease in the level $\bar{q}$ leads to a riskier final cash flow.[133] Thus, $S(\hat{q})$, given by (44), serves as the benchmark in the following.

3.3.3. Investment decision of the firm in the presence of debt

This section deals with the implementation of the investment policy in the firm with debt as part of the capital structure and therefore the debtholders as additional stakeholders.

Implementation of the investment policy with equity-aligned manager

In the following case, the manager is still aligned with the interests of the shareholders,[134] but in contrast to the previous section, the debt of the face value $F > 0$ changes the expected payoffs of the shareholders and the manager, because their claims are junior to the debtholders' claims. The debtholders receive the face value F if the return of the investment is high enough to pay them back completely. Otherwise they receive the return of the investment, leaving no residual, which represents the state of insolvency for the firm. The shareholders and the manager receive their respective proportions of the residual if there is one and nothing otherwise. Thus, the shareholders prefer the risky project if:

$$q\max\{H-F,0\} + (1-q)\max\{L-F,0\} > \max\{I-F,0\} \tag{45}$$

As the manager is aligned with the shareholders, the above inequation holds for him, too, which leads to the following cutoff level:[135]

$$\bar{q}(F) = \begin{cases} \hat{q} & ,F \leq L \\ \frac{I-F}{H-F} & ,L < F < I \\ 0 & ,F \geq I \end{cases} \tag{46}$$

In case of $F \leq L$, there is no risk of the debtholders not being completely paid back. F can just be eliminated from (45) which leads to the same inequation as in (43), so that the cutoff level is also the same. Hence, the optimal investment policy $[\hat{q}]$ is implemented.

With $L < F < I$, the manager chooses the cutoff level $\bar{q} = (I-F)/(H-F)$, which puts a stronger focus on the risky project than $\hat{q}$, given by (41), thus generating a riskier cash flow in $t = 2$. The value of $\bar{q}$ decreases even more in F, so that the risk of the final cash flow increases.[136] The optimum cannot be obtained in this case.

If $F \geq I$, it does not make sense for the manager to invest in the safe project because there would be no residual left. When choosing the risky project, there is the chance to receive the high return H, which possibly exceeds F, and therefore represents the only way to receive a residual payoff. The optimum cannot be obtained by always choosing the risky project.

The debtholders consider the managerial contract and the investment policy $[\bar{q}(F)]$ it induces when setting the bond value B at $t = 0$, which equates to their expected payoff in $t = 2$:

$$D(\bar{q}(F)) = \bar{q}(F)\min\{F,I\} + \frac{\left(1-\bar{q}(F)^2\right)}{2}\min\{F,H\} + \frac{(1-\bar{q}(F))^2}{2}\min\{F,L\} \tag{47}$$

The presence of debt has no direct effect on the shareholders' expected payoff, as they receive the bond value B in $t = 0$, which is equal to the amount D they expect to pay to the debtholders in $t = 2$. However, the level of the debt has an indirect effect on the final payoffs, as it affects the investment policy. The above shows that the optimal policy $[\hat{q}]$ is not implemented with risky debt of the face value $F > L$,

[131] The calculation is given in the Appendix A.24.
[132] The formal proof for the pareto-optimum is given in the Appendix A.25.
[133] The formal proof is given in the Appendix A.26.
[134] This is done by the same managerial contract as in (42).
[135] The calculation is given in the Appendix A.27.
[136] The formal analysis of the cutoff level $\bar{q} = (I-F)/(H-F)$ is given in the Appendix A.28.

causing the following agency costs:[137]

$$AC = S(\hat{q}) - S(\bar{q}(F)) = (V(\hat{q}) - w_0) - (V(\bar{q}(F)) + \underbrace{B - D}_{=0} - w_0) = V(\hat{q}) - V(\bar{q}(F)) \quad (48)$$

These agency costs of the risky debt are fully borne by the shareholders.

Implementation of the investment policy through performance-related managerial contract

This section introduces a managerial contract that avoids the agency costs of the risky debt by inducing the optimal investment policy $[\ \hat{q}\ ]$. The firm is assumed to issue debt of the face value F, with $L < F < I$, so that the debtholders receive F after the high and the safe return, whereas they receive L after the low return, leaving no residual, which implies that the firm is insolvent.

One part of the managerial contract is the fixed salary W paid to the manager regardless of the final cash flow. John and John (1993) assume that W is paid out of the gross operating cash flow of the firm, so that it does not directly decrease the return of the investment. Additionally, the manager receives the proportion α of the residual as long as the firm is solvent. This represents the performance-related part of his wage payment and can be used by the shareholders to incentivize him. In case of the firm's insolvency, the manager still receives his fixed salary, but he also experiences personal costs ϑ that reduce his overall salary to $W - \vartheta$. These personal costs can be seen as a large salary reduction or the costs that the manager has to bear when he is dismissed and needs to find a new job.[138]

Fixed salary managerial compensation contract

The simplest contract of the form described above is the contract with $\alpha = 0$, meaning that the manager only receives the fixed salary W. In this case, he prefers the risky project if:

$$qW + (1-q)(W - \vartheta) > W \quad (49)$$

Due to the personal costs ϑ the manager experiences in case of the low return L, there is no solution to (49). The manager is indifferent between the safe and the risky project for $\bar{q} = 1$, representing the investment policy $[\bar{q}] = [1]$. Hence, he only invests in the safe project, as he knows that he receives his fixed salary then with certainty, which means that the debtholders receive the complete face value F in any case and set $B = F$.[139] This causes the following agency costs:

$$AC = S(\hat{q}) - S(1) = (V(\hat{q}) - w_0) - (\underbrace{V(1)}_{=0} + \underbrace{B - F}_{=0} - w_0) = V(\hat{q})$$

[137] The detailed calculation and graphical presentation of the agency costs is given in the Appendix A.29.

[138] This assumption is consistent with the study of Gilson and Vetsuypens (1993), p.456, and also corresponds to the more recent findings of Eckbo and Thorburn (2016), p.228.

[139] They set B equal to D, as given in equation (47) with $\bar{q} = 1$ and $L < F < I$.

As the risk-averse investment policy is not optimal, the above agency costs are borne by the shareholders.

Performance-related managerial compensation contract

In order to implement the optimal investment policy through the appropriate incentivization, the managerial contract needs to include the performance-related part, which means that $\alpha \neq 0$ in the following. Hence, the manager prefers the risky project if:

$$q(W + \alpha(H - F)) + (1-q)(W - \vartheta) > W + \alpha(I - F) \quad (51)$$

The respective cutoff level is calculated as follows:[140]

$$\bar{q}_m = \frac{I - F + \frac{\vartheta}{\alpha}}{H - F + \frac{\vartheta}{\alpha}} \quad (52)$$

As the board of directors sets up the managerial contract on behalf of the shareholders, they can choose the value of α to ensure that the optimal investment policy is induced. Therefore, they set $\bar{q}_m = \hat{q}$, so that the optimal value of α is given by:[141]

$$\hat{\alpha} = \frac{\vartheta}{F - L} \quad (53)$$

Setting $\alpha = \hat{\alpha}$ implements the optimal investment policy $[\ \hat{q}]$, which eliminates the agency costs. As $\partial\hat{\alpha}/\partial F < 0, \hat{\alpha}$ needs to decrease in F in order to obtain the optimum. Note that any $\alpha < \hat{\alpha}$ leads to $\bar{q}_m > \hat{q}$, so that the final cash flow is less risky than the optimal one, whereas $\alpha > \hat{\alpha}$ yields a riskier cash flow.[142] In both cases the optimum is not obtained and agency costs occur.

The debtholders set B to break even with their expected payoff D at $t = 2$. With $\hat{\alpha}$ that induces the investment policy $[\hat{q}]$, the debtholders set the bond value as:[143]

$$B = D(\hat{q}) = \hat{q}F + \frac{\left(1 - \hat{q}^2\right)}{2}F + \frac{(1-\hat{q})^2}{2}L \quad (54)$$

Moreover, given the value of $\hat{\alpha}$, the optimal value of the manager's fixed salary W can be determined. The shareholders maximize their own payoff by choosing W, so that the participation constraint of the manager binds, similar to (42). Thus, they set $W = \widehat{W}$, using the following equation:

$$E[\mu] = \widehat{W} + \hat{\alpha}\left[\hat{q}(I - F) + \frac{\left(1 - \hat{q}^2\right)}{2}(H - F)\right] - \frac{(1-\hat{q})^2}{2}\vartheta = w_0 \quad (55)$$

The incentive contract $\mu(\hat{\alpha}, \widehat{W}, \vartheta)$ enables the shareholders to induce the optimal investment policy $[\hat{q}]$, leading to their optimal expected payoff $S(\hat{q})$, given in (44). While it is optimal to align the manager with the shareholders' preferences in an all-equity firm, the presence of risky debt demands for a different solution to avoid agency costs.

[140] The calculation is given in the Appendix A.30.

[141] The calculation is given in the Appendix A.31.

[142] The formal proof is given in the Appendix A.32.

[143] D is calculated as in (47) with $\bar{q} = \hat{q}$ and $L < F < I$.

3.4. Comparative discussion of the models and implications of their results

The sections 3.1 to 3.3 present and explain different approaches to model the debtholders' influence on the firm's decisions, whereby each model has its own setup that affects the results. The following subsections discuss selected model-specific assumptions and characteristics before comparing the main aspects of all three models. Lastly, the implications of the models' results are presented and discussed.

3.4.1. Discussion of model-specific assumptions

In the following, several aspects that are specific to the respective models depicted in sections 3.1 to 3.3 are discussed, considering various points for each model.

Discussion of selected assumptions by Douglas (2009)

Before showing the effects of the agency conflicts in the case of risky debt, Douglas (2009) models the case of risk-free debt without considering the influence of the debtholders and the manager.[144] With risk-free debt, the state-contingent transfer of control, e.g. through the use of debt covenants, does not need to be considered, as there only exists the state of the debtholders receiving their complete face value. However, if the stakeholders are represented on the board of directors, they should be able to influence each decision that is made there, regardless whether the debt is risky or not. As the debtholders receive the certain payoff F, they are indifferent about the decisions of the board, so that their influence can be ignored without the loss of generality.[145] The manager's influence cannot be so easily disregarded though, because he seeks to maximize his own utility by maximizing his wage payments, which affects the agency costs of the firm. A reason not to model this influence in the risk-free case could be to clearly show the agency costs due to the information asymmetry between the manager and the shareholders isolated from other effects.

Douglas (2009) assumes that at $t = 0$ the initial owner of control can choose the influence levels β and m freely from their domains of definition,[146] which raises the question whether this can be done so easily. The debtholders' influence β can only be chosen freely on condition of them being indifferent about their level of influence, which happens under the assumption that they break even.[147] Hence, it is reasonable to let the initial owner of control set the value of β. As the managerial influence m mainly depends on the structure and on the rules of the firm, it also seems plausible that it can be set by the owner of control over the firm because he can set up the structure to support certain values of m. Nevertheless, external factors like laws or unions might affect the domains of β and m, but in order not to include too many constraints in the model, these factors can be formally disregarded.[148]

The domains of definition of β and m are restricted by the maximum values $\bar{\beta}$ and $\bar{m}$ that are derived in section 3.1.4. The maximum value $\bar{m}$ for the managerial influence is calculated by the binding constraint, given in (27), that prevents the manager from giving himself too much control.[149] Following from (27), $\bar{m}$ increases with increasing costs R to replace the incumbent manager. Thus, as R is not formally restricted, neither is $\bar{m}$. However, it is important that m is always low enough to ensure that the manager's preferences do not dominate the overall objective function (20) in order to avoid the case that he just maximizes his wage payments at the cost of the firm. While it seems plausible that $\bar{m}$ can be assumed to be low enough to avoid the above scenario, because the shareholders would not let that happen, it is still technically possible.[150] The maximum value $\bar{\beta}$ for the debtholders' influence is given by the binding constraint (29) and therefore by the minimum level of risk $\underline{\Delta x}$.[151] Without the function $\Delta x(\beta)$ being specified, neither is the value $\bar{\beta}$ with $\Delta x(\bar{\beta}) = \underline{\Delta x}$. Hence, $\bar{\beta}$ could technically be very high, although the assumption of only considering values of $\beta < 0,5$ seems reasonable because the firm would not be interested in giving the major part of its decision power to the debtholders.[152]

Discussion of selected assumptions by Berkovitch and Israel (1996)

In contrast to the other authors, Berkovitch and Israel (1996) do not consider monetary rewards for the manager but only the private benefits he receives when staying in the firm.[153] Nevertheless, it is possible to implement wage payments in their model. They can be used by the firm to directly incentivize the manager without including debt in the capital structure. The decisive difference to the private benefits is that the wage payments have to be paid by the shareholders and affect their expected payoff. This changes their preferred replacement policy, which indirectly has an impact on the manager's expected payoff in an all-equity firm. The direct and indirect effects of the wage payments eventually oppose each other, whereas the replacement policy can be implemented through the capital and control structure without affecting the direct incentives of the manager. This is why implementing the replacement policy as depicted in section 3.2.5 provides a higher flexibility and is valuable even in the presence of a monetary compensation scheme for the

[144] Cf. Douglas (2009), pp.157-160.

[145] It could still be included to be formally correct but would not change the results.

[146] Cf. Douglas (2009), pp.167-170.

[147] Douglas (2009) states that the debtholders pay the amount B, which equals their expected payoff D, as bond value to the shareholders and therefore break even, see Douglas (2009), pp.169-170.

[148] For the effects of strong creditor rights on the firm see Acharya, Amihud, and Litov (2011), p.165, and for labor market regulations protecting the employees see Botero, Djankov, La Porta, Lopez-De-Silanes, and Shleifer (2004), p.1342.

[149] Cf. Douglas (2009), pp. 167-168.

[150] In his earlier work, Douglas (2002) restricts attention to $m < 0,5$ to avoid the case of absolute manager control, see Douglas (2002), p.298.

[151] Cf. Douglas (2009), p. 168.

[152] Cf. Galai and Wiener (2008), p.113.

[153] Cf. Berkovitch and Israel (1996), p.215.

manager.[154]

Berkovitch and Israel (1996) assume that the signal P perfectly reveals the information about the cash flow under the incumbent manager to the stakeholders,[155] which raises the question whether the model works without P being perfect and being available to all parties. There exists the possibility of the manager reporting the information to the other stakeholders, but he acts in his own favor and always reports P, ensuring that he can stay in the firm even if this is not optimal. If only the manager and the shareholders know the information and the shareholders report it to the debtholders, a similar problem arises because they report P, so that their preferred replacement policy is implemented, which does not necessarily maximize the firm value. Thus, in order to implement the optimal policy in each case, the signal P needs to reveal the information to all parties. Furthermore, it seems plausible that the cash flow under the incumbent manager is known better than the cash flow under the alternative manager, as the firm is already familiar with the incumbent manager and his abilities. Hence, if the signal P about the incumbent's cash flow is modelled as an uncertain variable, the cash flow under the alternative manager still needs to be riskier.[156] The simplest way to model this circumstance is to let the signal P be perfect, while the cash flow under the alternative manager is uncertain.

Another point worth being discussed is that the entrepreneur of the firm needs to know about the sensitivity of the density function $g(y)$ to changes in the managerial effort level ex ante to be able to implement the optimal replacement policy $[y^*]$.[157] If this sensitivity depends on the specific task that has to be completed by the manager, it seems like a fair assumption that the entrepreneur can predict it, as he knows about the tasks to be completed in his firm. However, the extent and the quality of the information that the entrepreneur has can be contingent on the size and structure of the firm as well as on the complexity of the task. Without the information, he is not be able to incentivize the manager appropriately and cannot implement the optimal policy for the firm, so that it is crucial for the solution of the problem that he knows about the sensitivity.

Discussion of selected assumptions by John and John (1993)

John and John (1993) use a managerial compensation scheme that includes the fixed salary W, which is paid out of the gross operating cash flow of the firm.[158] An alternative option is to pay W out of the return of the investment, whereby it can either be junior or senior to the debt payment. If W is junior to the debt payment, the debtholders' payoff does not change, but after the low return of the investment there is nothing left to pay the fixed salary from if $L < F < I$ holds. Hence, the manager cannot be guaranteed to receive W in each case, so that the compensation scheme with the fixed salary does not work. As opposed to this, in case of W being senior to the debt payment, the manager can be guaranteed to receive the fixed value of W. This changes the debtholders' expected payoff, but if $L - W < F < I - W$ holds, the ideal investment policy can still be implemented.[159] Thus, this possibility works with the compensation scheme of John and John (1993), but it puts stricter boundaries on the face value F. Overall, it seems reasonable to let W be paid out of the gross operating cash flow like a fixed salary from a central department of the firm and to add a proportion of the residual as a performance-related payment to the manager, similar to a bonus payment.

An interesting point is that the fixed salary $\widehat{W}$ can technically be negative, as it is used to bring the manager's expected payoff down to the reservation wage w_0.[160] This case occurs when α is so high that the expected performance-related payment to the manager exceeds the value of w_0. Although this is formally possible and needed for the model, it is not very realistic to receive negative wage payments, which is why the compensation scheme only seems plausible when considering the overall expected payment to the manager that equates to w_0.

A way to avoid $\widehat{W} < 0$ is to increase w_0, which can be seen in (55). However, increasing w_0 decreases the shareholders' expected payoff $S(\hat{q})$, given by (44), eventually leading to $S(\hat{q}) < 0$. As $S(\hat{q})$ is the optimal payoff, this would mean that all payoffs would be negative, which does not seem plausible, either, so that the value of w_0 should not be raised by too much.

Another crucial assumption by John and John (1993) is that the compensation scheme of the manager and the investment opportunities are perfectly known to the market.[161] This is an important aspect of the model, as it ensures that the debtholders can calculate their expected payoff and set the bond value B to break even. Nevertheless, it seems possible that the firm is not interested in sharing the information with the whole market, especially before the investment is even made. Without this assumption, the optimal solution cannot be implemented in the presence of risky debt though, which is why it is needed to obtain the results of section 3.3.

3.4.2. Comparison of selected aspects of the models

The following section compares and discusses selected aspects of the three models displayed in sections 3.1 to 3.3. While the debtholders take an active part within the firm in the models of Douglas (2009) and Berkovitch and Israel (1996), they stay passive in the model of John and John (1993) but still influence the decisions of the firm. The examination of the models shows that the kind of debtholder influence and its impact on the firm depend on the actual

[154] Cf. Berkovitch and Israel (1996), pp.232-233.
[155] Cf. ibidem, p.215.
[156] This could be modelled via different variances of the variables, leading to a more complicated model.
[157] Cf. Berkovitch and Israel (1996), p.218.
[158] Cf. John and John (1993), pp.960-965.
[159] The proof is given in the Appendix A.33.
[160] Cf. John and John (1993), p.964-965.
[161] Cf. ibidem, pp.955-957.

situation that is specified by the model's setup and assumptions.[162]

All of the models consider a pure discount bond of the exogenously given face value F, maturing at the final date of the respective timeline.[163] The bond value B paid by the debtholders for the external claim of F is calculated, so that they break even, which corresponds to competitive financial markets.[164] Therefore, they set B equal to their expected payoff, as modelled by John and John (1993).[165] This condition is not mentioned specifically in the other two models but still holds in the background, as there are no direct effects of the debt on the firm's objective functions (28) and (37) to be maximized in these models.[166] The debt only indirectly affects the firm value through its impact on the respective policies. Furthermore, the debtholders breaking even leads to them being indifferent about their influence and the level of the debt, so that both can be set freely and used to credibly implement the optimal policies in the models of Douglas (2009) and Berkovitch and Israel (1996). In order to calculate their expected payoff, the debtholders need to receive the relevant information concerning the actions of the firm and the managerial contracts set in place. It seems plausible that they have this information when they are represented on the board, as suggested by Douglas (2009) and Berkovitch and Israel (1996).[167] Without actively taking part in the firm's decision process, the debtholders can only obtain the relevant information if it is generally known to the market, as assumed by John and John (1993).[168]

The replacement of the manager is the central decision in the model of Berkovitch and Israel (1996) but also plays an important role in the model of Douglas (2009). While the manager is replaced by the board if his ability and effort indicate an insufficient outcome in the model of Berkovitch and Israel (1996), he is replaced by the shareholders if he gives himself too much power in the model of Douglas (2009). The decisive difference is that only Douglas (2009) includes replacement costs R, whereas they are not considered in the other model.[169] Replacing the manager causes personal costs of the human resources department, as it needs to hire a new one, and can even lead to a dismissal wage for the leaving manager, so that it seems reasonable to include these costs in the model.[170] Including the replacement costs in the model of Berkovitch and Israel (1996) decreases the expected cash flow $\bar{y}$ under the alternative manager. This does not change the general way to implement the optimal replacement policy but only lowers the critical value y^C for the incumbent manager to stay in the firm.[171] Hence, it adds another parameter and increases the complexity of the model without yielding different results, which might be the reason why the authors have refrained from including it.

Douglas (2009) and John and John (1993) consider managerial compensation schemes set in place by the board in order to incentivize the manager and compensate him for his personal costs, whereas Berkovitch and Israel (1996) use the private benefits of the manager instead.[172] A problem that can occur with only having private benefits is that they cannot be controlled by the firm so easily, which means that they might not provide the best possibility to incentivize the manager. Generally, a combination of private benefits and a monetary compensation appears to be the most plausible option to model the manager's expected rewards. In the end, a model should incorporate the incentive scheme that serves its purpose the best and at the same time keeps it as simple as possible.

An important factor of the managerial compensation is its relative seniority compared to the debtholders' payment. In general, changes in the seniority of the payments can lead to different results and are worth being discussed.[173] Douglas (2009) models the managerial wage payment senior to the debtholders' payment, whereas John and John (1993) model the performance-related part of the wage payment junior to the debtholders' payment, while the fixed salary is paid out of the gross operating cash flow and therefore is not considered in the following discussion.[174] If the managerial wage payment is modelled junior to the debt payment in the model of Douglas (2009), this causes the problem that the manager does not receive any wage payment in case of the low value of the investment because there is no residual left. With $w^L = 0$, the managerial participation constraint (9) does not hold, as the reservation utility is $u_0 > 0$ and the manager does not receive any positive reward, so that his actual utility cannot be strictly positive. Hence, the assumption of the managerial payment being senior to the debtholders' payment is needed to keep him in the firm and to obtain the results presented in section 3.1. If the performance-related payment to the manager is senior to the debt payment in the model of John and John (1993), the cutoff level induced by the managerial contract changes to $\bar{q}_{m,\text{alt}} = (I-L+\vartheta/\alpha)/(H-L+\vartheta/\alpha)$.[175] Thus, the optimal investment policy $[\hat{q}]$, with $\hat{q}$ given in (41), can be implemented by eliminating the manager's personal costs ϑ. This could be done by assuring him that he can stay in the

[162] Cf. Douglas (2009), pp.154-170; cf. Berkovitch and Israel (1996), pp.213-227; cf. John and John (1993), pp.954-966.
[163] Cf. Douglas (2009), p.156; cf. Berkovitch and Israel (1996), p.213; cf. John and John (1993), p.956.
[164] Cf. Brunnermeier and Oehmke (2013), p.489.
[165] Cf. John and John (1993), pp.956-957.
[166] The bond value paid by the debtholders and the value expected to be paid back to them eliminate each other in the objective functions, as they are equal.
[167] Cf. Douglas (2009), pp.160-168; cf. Berkovitch and Israel (1996), pp.219-224.
[168] Cf. John and John (1993), pp.955-957.
[169] Cf. Berkovitch and Israel (1996), pp.214-219; cf. Douglas (2009), pp.167-168.
[170] Cf. Andrade and Sotomayor (2011), p.80.
[171] If $\bar{y}$ was assumed to already include the replacement costs, the results of the model would not change at all.
[172] Cf. Douglas (2009), pp.156-157; cf. John and John (1993), pp.962-965; cf. Berkovitch and Israel (1996), p.215.
[173] The effects of the relative seniority of debt are examined by Calcagno and Renneboog (2007), pp.1803-1806.
[174] Cf. Douglas (2009), p.160; cf. John and John (1993), p.962.
[175] This happens if $(1-\alpha)L < F < (1-\alpha)I$. The calculation is given in the Appendix A.34.

firm even in case of the insolvency and that he does not suffer from any salary reduction. Nevertheless, as neither the face value F nor the insolvency of the firm has an impact on the investment policy $\bar{q}_{m,\text{alt}}$, the performancerelated compensation payment should be modelled junior to the debt payment to highlight the effect of the debtholders' influence on the firm's decision.

An assumption used by all of the models is that the manager is risk-neutral concerning his rewards.[176] As depicted in several models throughout the literature, another possibility is to have a risk-averse manager.[177] Douglas (2009) states that even with a risk-averse manager the results concerning the risk choice and the managerial compensation hold qualitatively. A risk-averse manager has a utility function that differs from the one shown in Figure 2, whereby the wage payments w^L and w^H need to increase, especially for high levels of risk, which causes a decrease in the shareholders' expected payoff. However, Douglas (2009) argues that these effects are dominated by the effects of the information rents, depicted in his model, so that the assumption of a risk-neutral manager is reasonable to keep the model simple.[178] As the manager only receives nonmonetary rewards in the model of Berkovitch and Israel (1996),[179] changing his risk preferences affects his choice of effort and therefore the optimal replacement policy, but it does not change the way the policy is implemented. In the model of John and John (1993), a risk-averse manager causes changes in the compensation scheme, leading to a more concave managerial contract. Thereby, the risk-aversion affects the performance-related part, which can be compensated by the fixed salary. Having the fixed salary paid out of the gross operating cash flow adds flexibility to the compensation scheme, so that the risk-aversion of the manager does not change the results qualitatively. Thus, for reasons of simplicity the risk-neutral manager represents a valid option.[180]

3.4.3. Implications of the models' results

The comparison and discussion above show that the models presented in sections 3.1 to 3.3 differ in several aspects, but they have in common that the influence of the debtholders has a crucial impact on the firm's decisions. This raises the question whether the models yield similar results and what these results imply for the debtholders' influence.

Douglas (2009) shows how the firm's objective changes due to the stakeholders' influence and highlights the significance of the conflicting preferences. Although agency costs arise due to the information advantage of the manager, the influence of the stakeholders can be used to maximize the expected payoff of the initial owner of control rights over the firm.[181] The model of Berkovitch and Israel (1996) implies that the managerial replacement decision is not only affected by the capital structure of the firm but also by the allocation of control. They explain the need of issuing debt and giving part of the control to the debtholders to be able to credibly implement the optimal replacement policy.[182] John and John (1993) have a different approach than the other authors, as they do not incorporate active debtholder influence in their model. Nevertheless, they show that even the presence of risky debt requires adaptions in the compensation scheme for the implementation of the optimal investment policy.[183]

The difference in the risk preferences evokes the conflict between the shareholders and the debtholders in each of the models, whereby it arises as soon as the debt becomes risky. While the debtholders prefer to reduce the risk, the shareholders have an incentive to increase it at the cost of the debtholders.[184] However, as the debtholders have perfect information in all of the presented models, they consider the incentives of the shareholders and price the debt accordingly.[185] The presence of an information asymmetry between the firm and the debtholders would negatively affect the conflict between the shareholders and the debtholders and therefore cause additional agency costs, which underlines the significance of the distribution of the information in the models.

While the firm minimizes its agency costs thanks to the stakeholders' influence in the model of Douglas (2009), the other authors show how to implement the ideal policy in the firm, whereby it is interesting to see that Berkovitch and Israel (1996) do so thanks to the debtholders' influence, whereas John and John (1993) implement it despite the presence of risky debt.[186] Overall, the models show that the debtholders' influence can affect the firm in various ways but does not necessarily lead to worse results. If the firm realizes this and knows about the debtholders' preferences, it can set up the capital and control structure to support the implementation of the optimal policies. An important implication is that incorporating the debtholders as an active part of the decision process can be helpful and sometimes even be necessary. Hence, it is important to understand the debtholders' influence as a chance rather than a risk.

4. Ways of debtholder control in the context of the firm's investment decision

As shown in section 3, there exist various possibilities how the debtholders can influence the firm's decisions. It

[176] Cf. Douglas (2009), p.156; Berkovitch and Israel (1996), p.215; John and John (1993), pp.955-956.

[177] The risk-aversion of the agent is the standard assumption in the positive agency theory, as stated by Pepper and Gore (2015), p.1047. Among others, Holmström and Milgrom (1991), p.29, use it in their model.

[178] Cf. Douglas (2009), p. 169.

[179] Cf. Berkovitch and Israel (1996), p.215.

[180] Cf. John and John (1993), p.956.

[181] Cf. Douglas (2009), pp.154-170.

[182] Cf. Berkovitch and Israel (1996), pp.213-227.

[183] Cf. John and John (1993), pp.954-966.

[184] This refers to the standard wealth transfer, as in Jensen and Meckling (1976), pp.334-337.

[185] Cf. Douglas (2009), pp.160-170; cf. Berkovitch and Israel (1996), pp.219-224; cf. John and John (1993), pp.964-966.

[186] Cf. Douglas (2009), p.168; cf. Berkovitch and Israel (1996), pp.222-227; cf. John and John (1993), pp.963-965.

is interesting to see that this can happen by letting them take part of the control over the firm or without them taking any actions at all. The model derived in this section compares different options of debtholder control in the context of an investment decision of the firm. It considers the investment decision modelled by John and John (1993) and can be seen as an alternative to their model.[187] The control mechanisms for the debtholders, explained in the following, incorporate ideas from all of the three models of section 3. The goal is to derive the optimal way of giving control to the debtholders. After introducing the main characteristics and the timeline of the model, it is solved for three different cases of debtholder control. The results are compared and evaluated before the model's assumptions and the implications of its results are discussed. The section ends with the presentation of an approach for a possible extension that introduces long-term aspects to the model.

4.1. Timeline and basic setup

The general setting of the model is similar to the one introduced by John and John (1993). The firm, consisting of the board of directors, the shareholders and the manager, has an investment opportunity that is taken by the manager, who is incentivized through his compensation contract. He can choose between investing I in a safe project yielding a return of I and investing I in a risky project that yields a high return H with the probability of q and a low return L with the probability of $(1-q)$, whereby $0 < L < I < H$ and q is uniformly distributed over $[0,1]$. When following the investment policy $[\bar{q}]$, the manager chooses the risky project for all values $q > \bar{q}$ and the safe project for $q \leq \bar{q}$.[188] As in (40), the expected value of the investment is:[189]

$$V(\bar{q}) = -I + \bar{q}I + \frac{\left(1-\bar{q}^2\right)}{2}H + \frac{(1-\bar{q})^2}{2}L \tag{56}$$

The investment is partly paid by risky debt, which is issued in the form of a pure discount bond of the face value $F > 0$, with $L < F < I$,[190] and matures at the final date of the model. The managerial compensation scheme $\mu(\alpha, W, \vartheta)$ consists of the proportion α of the residual payoff, the fixed salary W paid out of the gross operating cash flow and the salary reduction ϑ in case of the insolvency of the firm, similar to the payment structure derived in section 3.3.3.[191,192] Note that ϑ is defined as a salary reduction by the firm rather than as personal costs due to the dismissal of the manager. Furthermore, the reservation wage of the manager is w_0 and represents his alternative income outside of the firm. All parties involved are riskneutral concerning their monetary rewards.

The decisive difference to the model of John and John (1993) is that neither the manager's compensation contract μ nor the specific investment values L, I, H are known to the market. This information asymmetry between the debtholders and the firm can be mitigated by choosing an appropriate control structure. The firm chooses from three different options at $t = 0$ and operates over two periods from $t = 1$ to $t = 3$, as introduced below.

The first option for the firm is not to give control to the debtholders at $t = 0$, which leads to timeline I in Figure 6. Without the necessary information, the debtholders, who seek to break even, price the debt issued at $t = 1$ based on their own assumptions and not according to their expected payoff. Simultaneously, the board of directors, acting on behalf of the shareholders, sets up the managerial contract $\mu(\alpha, W, \vartheta)$. At the date $t = 2$ the manager observes the value of q and makes the investment decision. As these actions are not observable, they cannot be contracted upon. Finally, at the date $t = 3$ the return of the investment is realized and all parties receive their payoffs.[193]

Alternatively, at $t = 0$ the firm can decide to give control rights to the debtholders. The first possibility of doing so is to have representatives of the debtholders on the board of directors. This case also follows timeline I in Figure 6, but it provides the debtholders with the chance to directly influence the decisions of the firm, which is modelled via the parameter $\beta \in (0,1]$.[194] Note that the debtholders do not take any further actions than influencing the decisions on the board. As this control structure eliminates the information asymmetry between them and the shareholders, they can price the debt in an appropriate manner equal to their expected payoff. After the board, acting on behalf of the shareholders and the debtholders, has set up the managerial contract at $t = 1$, the remaining events take place at $t = 2$ and $t = 3$ as described above for the case without debtholder control.

Another possibility of debtholder control is to limit the control rights to certain circumstances, with the timing of the events as presented in timeline II in Figure 7. The noncontractible signal T, reported by the firm, provides perfect information about the debtholders' payoff before the return of the investment and the payoffs are realized.[195] If T indicates the low return $L < F$, the debtholders receive control rights that give them the chance to initiate a restructuring process within the firm.[196] This process generates an additional value, which ensures that the debtholders receive the complete face value F despite the low return $L < F$. Acting

[187] Cf. John and John (1993), pp.954-966.
[188] Cf. ibidem, p.954-957.
[189] The calculation is given in the Appendix A.22, also see John and John (1993), p.958.
[190] This happens under the assumption that the firm's cash flow is not sufficient to completely pay I and that this kind of debt is the only one available on the market.
[191] The state of the insolvency refers to the situation with no residual left to pay out to the shareholders.
[192] Cf. John and John (1993), pp.962-965.
[193] Cf. ibidem, pp.954-957.
[194] The debtholders' influence is modelled similarly to Douglas (2009), pp.160-162.
[195] This is similar to the signal P about the final cash flow modelled by Berkovitch and Israel (1996), pp.215-216.
[196] The state-contingent transfer of control to the debtholders can be achieved by the use of specific debt covenants. They are introduced as performance covenants by Christensen and Nikolaev (2012), pp. 75-77.

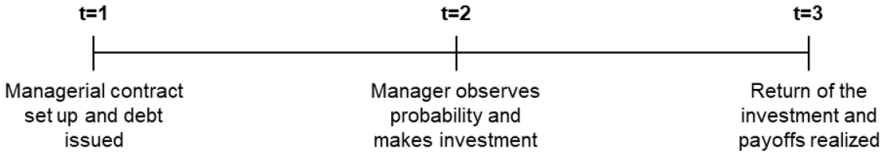

Figure 6: Timeline I for options of no debtholder control and of initial debtholder control. Own graphic made according to John and John (1993), p.956.

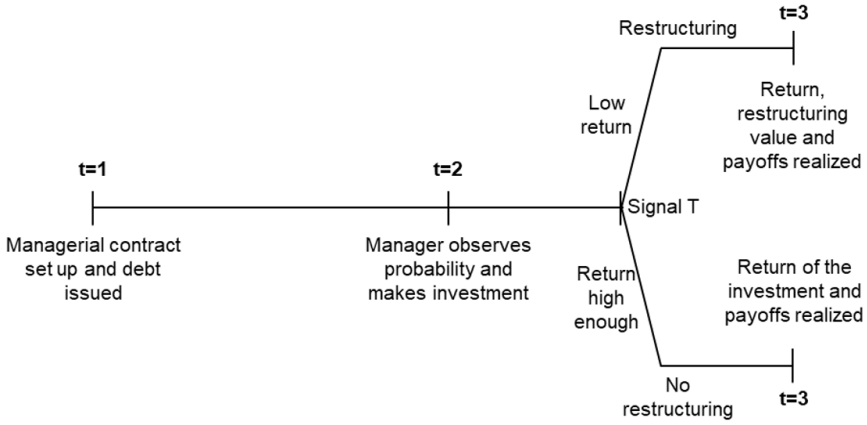

Figure 7: Timeline II for option of state-contingent debtholder control. Own graphic, $t = 1$ and $t = 2$ according to John and John (1993), p.956.

on behalf of the shareholders, the board sets up the managerial contract at $t = 1$. At the date $t = 2$ the manager privately observes q and makes the investment. Afterwards, at $t = 2,5$, the signal T reveals the debtholders' payoff and the control is eventually transferred to them. Lastly, at $t = 3$ the return of the investment and the value of the restructuring, if it has occurred, are realized and all parties receive their payoffs.

The overall goal of the model is to determine the ideal decision at the date $t = 0$ and to analyze the characteristics of the different control options for the debtholders. Therefore, the solutions for each case are derived and compared. As explained in section 3.3.2, the optimal investment policy $[\hat{q}]$, with $\hat{q}$ as in (41), maximizes the expected value of the investment, given by (56). This leads to the shareholders' optimal expected payoff $S(\hat{q}) = V(\hat{q}) - w_0$, given by (44), which serves as a benchmark in the following.[197]

4.2. Implementation of the investment policy without debtholder control

The following subsection derives the solution that is implemented when the debtholders are not granted any control at $t = 0$. John and John (1993) model a similar situation and show that the optimal investment policy $[\hat{q}]$ can be implemented through the managerial compensation scheme $\mu(\alpha, W, \vartheta)$, as explained in section 3.3.3.[198] Despite the fact that a similar compensation scheme is used in the present model, this optimum cannot be obtained due to the information asymmetry between the firm and the debtholders that leads to agency costs.

The debtholders do not know about the managerial compensation scheme or the specific investment values of the firm, as this information is not available in the market. They only know about the general structure of the investment and that they receive the complete face value F in case of the safe return I or the high return H and only $L < F$ if the return is low.[199] Additionally, it is common knowledge that q is uniformly distributed on the interval $[0, 1]$. Based on the above and on $V(\bar{q})$, given by (56), the debtholders' expected payoff is calculated as follows:[200]

$$D_1(\bar{q}) = \bar{q}F + \frac{\left(1-\bar{q}^2\right)}{2}F + \frac{(1-\bar{q})^2}{2}L \tag{57}$$

They seek to break even by pricing the bond value $B_1 = D_1(\bar{q})$ but do not have the information needed to predict $\bar{q}$, so that they cannot calculate $D_1(\bar{q})$. In order to avoid the information asymmetry, the shareholders could share the relevant information with the debtholders. However, as they could increase their own payoff by lying to the debtholders about the investment values I and H as well as the manager's

[197] Cf. John and John (1993), pp.957-959.
[198] Cf. John and John (1993), pp.962-965.
[199] The value of L is reported correctly by the shareholders, because the debtholders are assumed to be able to liquidate the firm if the return is low and the shareholders have lied about it. The shareholders avoid any risk of liquidation by reporting L correctly.
[200] This happens similarly to (54), also see John and John (1993), pp.965-966.

compensation without them noticing, the reported information cannot be trusted and the information asymmetry cannot be eliminated.[201] Thus, the debtholders make assumptions about the parameters influencing their expected payoff. These assumptions are conservative to ensure that they still break even in the worst case,[202] which occurs if the investment policy of the firm is $[\bar{q}] = [0]$, so that the manager always chooses the risky project.[203] Assuming this, the debtholders calculate the bond value:

$$B_1 = D_1(0) = \frac{1}{2}F + \frac{1}{2}L \tag{58}$$

For any $\bar{q} > 0$, the debtholders gain a profit, as their actual expected payoff $D_1(\bar{q})$ exceeds B_1, whereby the difference $\Delta B(\bar{q}) = D_1(\bar{q}) - B_1$ can also be interpreted as the agency costs for the shareholders, arising because of the information asymmetry between them and the debtholders.[204] As the debtholders do not break even, the impact of them cannot be eliminated from the shareholders' payoff function. Given the above and the expected value of the investment, as in (56), the shareholders' expected payoff is calculated as follows:[205]

$$S_1(\bar{q}) = -I + B_1 + \bar{q}(I-F) + \frac{\left(1-\bar{q}^2\right)}{2}(H-F) - E[\mu] \tag{59}$$

The term $E[\mu]$ represents the expected wage payment to the manager. By choosing the right combination of the variables α, W, ϑ, the shareholders ensure that $E[\mu] = w_0$.[206] They maximize their payoff function with respect to $\bar{q}$ in order to find their preferred investment policy:

$$\bar{q}_1 = \frac{I-F}{H-F} = \frac{I-L-(F-L)}{H-L-(F-L)} < \frac{I-L}{H-L} = \hat{q} \tag{60}$$

As $\bar{q}_1 < \hat{q}$, with $\hat{q}$ given by (41), the investment policy for this case is riskier than the policy that maximizes the expected value of the investment, which leads to agency costs.[207] Moreover, with $\partial \bar{q}_1 / \partial F < 0$, the present policy becomes even riskier in F.[208] The board sets up the managerial contract that consists of the parameters α, W, ϑ and induces the following investment policy, as calculated in (52) in section 3.3.3:[209]

$$\bar{q}_m = \frac{I-F+\frac{\vartheta}{\alpha}}{H-F+\frac{\vartheta}{\alpha}} \tag{61}$$

The goal of the shareholders is to set $\alpha = \hat{\alpha}_1$, so that $\bar{q}_m = \bar{q}_1$ and the manager follows their preferred investment policy, which leads to:

$$\frac{\vartheta}{\hat{\alpha}_1} = 0 \tag{62}$$

Thus, there should be no salary reduction ϑ in case of the insolvency of the firm, while $\hat{\alpha}_1$ can take on any possible value with $\hat{\alpha}_1 \in (0,1]$.[210] Given $\hat{\alpha}_1$ and ϑ, the fixed salary $\widehat{W}_1$ can be determined, so that the manager's participation constraint binds:[211]

$$E[\mu] = \widehat{W}_1 + \hat{\alpha}_1 \left[\bar{q}_1(I-F) + \frac{\left(1-\bar{q}_1^2\right)}{2}(H-F) \right] - \underbrace{\frac{(1-\bar{q}_1)^2}{2}\vartheta}_{0} = w_0 \tag{63}$$

With the managerial contract $\mu\left(\hat{\alpha}_1, \widehat{W}_1, \vartheta = 0\right)$ that induces the investment policy $[\bar{q}_1]$, the shareholders' expected payoff, given in (59), can be specified as follows:

$$S_1(\bar{q}_1) = -I + \bar{q}_1 I + \frac{\left(1-\bar{q}_1^2\right)}{2}H + \frac{(1-\bar{q}_1)^2}{2}L - w_o - \Delta B(\bar{q}_1) \tag{64}$$

The term $\Delta B(\bar{q}_1)$ represents the costs borne by the shareholders and at the same time the profit of the debtholders, as they price the debt too high. Figure 8 shows that the shareholders' expected payoff $S_1(\bar{q}_1)$, as a function of the face value F, with $L < F < I$, is always below the optimal payoff $S(\hat{q})$, calculated by (44), because of the agency costs due to the information asymmetry. With increasing values of F, the blue function $S_1(\bar{q}_1)$ decreases as compared to the constant $S(\hat{q})$, which means that the agency costs increase. This happens because $\bar{q}_1$ decreases in F, diverging from the optimal cutoff level $\hat{q}$, given by (41), and the conservative assumptions made by the debtholders are further off the actual values if the difference $F - L$ is greater, which increases $\Delta B(\bar{q}_1)$.

4.3. Implementation of the investment policy with initial debtholder control

As the information asymmetry between the shareholders and the debtholders causes agency costs, the shareholders seek to reduce them by giving control rights to the debtholders. This can be done by installing representatives of the debtholders on the board of directors.[213] As the managerial

[201] The proof is given in the Appendix A.35.

[202] This is similar to conservatism in accounting, which leads to an understatement of the book value in comparison to the actual market value, as defined by Beaver and Ryan (2005), p.269.

[203] The proof is given in the Appendix A.36.

[204] The calculation is given in the Appendix A.37.

[205] The calculation is given in the Appendix A.38.

[206] This means that the participation constraint binds and the expected payment to the manager is minimized, similar to section 3.3.3, also see John and John (1993), pp.964-965.

[207] As explained in section 3.3.2, a lower $\bar{q}$ leads to a riskier final cash flow. This condition holds for the complete section 4, too. The proof is given in the Appendix A.26, also see John and John (1993), p.959.

[208] The calculation and formal analysis of $\bar{q}_1$ are given in the Appendix A.39.

[209] The calculation is given in the Appendix A.30, also see John and John (1993), p.962.

[210] If $\alpha = 0$, the manager only receives the fixed salary W, so that he follows the conservative investment policy $[\bar{q}] = [1]$, as shown in section 3.3.3, also see John and John (1993), pp.960-961.

[211] This happens as in (55), also see John and John (1993), pp.964-965.

[212] The values used to calculate the functions are: $L = 0; I = 5; H = 11; w_0 = 0$.

[213] For the effects of creditors on the firm's board of directors see Sisli-Ciamarra (2012), p.697.

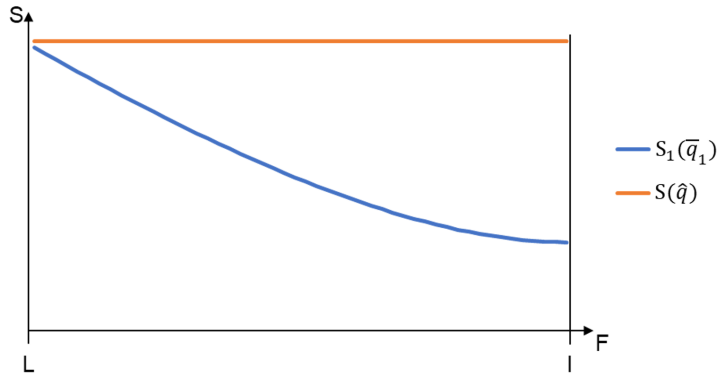

Figure 8: Shareholders' expected payoff $S_1(\bar{q}_1)$ vs. optimal expected payoff $S(\hat{q})$. Own graphic, $S(\hat{q})$ calculated according to John and John (1993), pp.957-958.[212]

compensation scheme is set up by the board, the debtholders can influence this decision and the investment policy it induces. Being involved in the decision process, they have access to the relevant information, which eliminates the information asymmetry between them and the firm as well as the agency costs that come with it. Nevertheless, the shareholders pay the price for that by letting the debtholders influence the board's decisions.

Before determining the decision made on the board, the payoff functions of the debtholders and the shareholders are derived. The debtholders' expected payoff is the same as the one in (57), so that $D_2(\bar{q}) = D_1(\bar{q})$. However, in contrast to section 4.2, they have the relevant information and can calculate their expected payoff to break even, which leads to $B_2 = D_2(\bar{q})$. Because of that, the impact of the debtholders can be eliminated from the shareholders' payoff function, as opposed to (59). Similar to the previous case, the board can set the parameters α, W, ϑ of the managerial contract, so that $E[\mu] = w_0$. With the expected value of the investment, as in (56), this leads to the following payoff function of the shareholders:[214]

$$S_2(\bar{q}) = -I + \bar{q}I + \frac{\left(1-\bar{q}^2\right)}{2}H + \frac{(1-\bar{q})^2}{2}L - w_0 \qquad (65)$$

The debtholders' influence on the decision of the board is modelled directly via $\beta \in (0,1]$,[215] similar to the model of Douglas (2009).[216] Hence, the board maximizes the objective function consisting of the weighted sum of the debtholders' and the shareholders' payoff functions:

$$\max_{\bar{q}} (1-\beta) S_2(\bar{q}) + \beta D_2(\bar{q}) \qquad (66)$$

The first-order-condition with respect to $\bar{q}$ yields:

$$\bar{q}_2 = \frac{I - L + \frac{\beta(F-L)}{(1-\beta)}}{H - L + \frac{\beta(F-L)}{(1-\beta)}} > \frac{I-L}{H-L} = \hat{q} \qquad (67)$$

Note that $[\bar{q}_2]$ is less risky than $[\hat{q}]$, with $\hat{q}$ given in (41), which represents the debtholders' influence, causing agency costs for the shareholders. Because of $\partial \bar{q}_2 / \partial \beta > 0$, the final cash flow becomes even less risky with an increasing level of debtholder influence.[217] As in the previous case, the managerial compensation contract $\mu(\alpha, W, \vartheta)$ induces the investment policy $\bar{q}_m$, given by (61), and the board can set $\bar{q}_m = \bar{q}_2$, which leads to:[218]

$$\hat{\alpha}_2 = \frac{\vartheta(1-\beta)}{(F-L)} \qquad (68)$$

In the present case, the salary reduction ϑ needs to be positive, so that $\hat{\alpha}_2 > 0$.[219] With $\hat{\alpha}_2$ and ϑ given, the board chooses the fixed salary $\widehat{W}_2$, so that the participation constraint binds and $E\left[\mu\left(\hat{\alpha}_2, \widehat{W}_2, \vartheta\right)\right] = w_0$, which happens as in (63).

While the debtholders set $B_2 = D_2(\bar{q}_2)$ and break even, the shareholders' expected payoff $S_2(\bar{q}_2)$ is given by (65) with $\bar{q} = \bar{q}_2$ and is presented graphically as a function of β on the interval $[0; 0,5]$ in Figure 9.[221] The function $S_2(\bar{q}_2)$ decreases in β because of the more conservative investment policy due to the increasing debtholder influence. While it decreases very slowly for low values of β, it decreases rapidly

[214] Note that this payoff function is similar to the one in (44). The calculation is given in the Appendix A.40.

[215] If $\beta = 0$, the debtholders are not represented on the board and do not have the information, which leads to the situation described in section 4.2 and is therefore not considered at this point.

[216] Cf. Douglas (2009), pp.160-162.

[217] The calculation and formal analysis of $\bar{q}_2$ are given in the Appendix A.41.

[218] The calculation is given in the Appendix A.42.

[219] The firm can set the salary reduction ϑ and then determine $\hat{\alpha}_2$ according to (68).

[220] The values used to calculate the functions are: $L = 0; I = 5; H = 11; w_0 = 0; F = 1$.

[221] The interval allows to focus on plausible values of β that exclude absolute debtholder control on the board. Note that the excerpt of the vertical axis is very small, so that there is actually only a marginal difference between the two functions. This can be seen by expanding the interval of β to $[0; 1]$, as shown in Appendix A.43

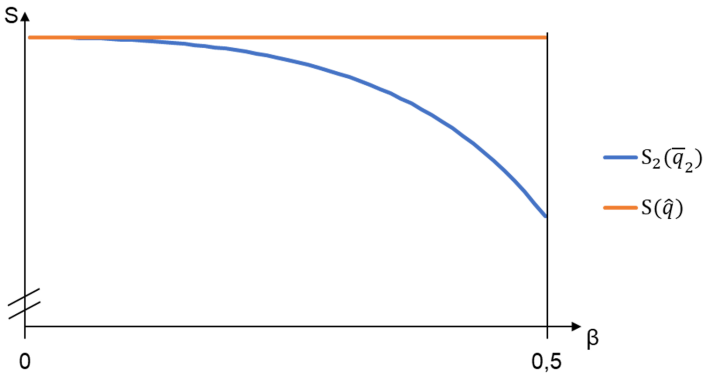

Figure 9: Shareholders' expected payoff $S_2(\bar{q}_2)$ vs. optimal expected payoff $S(\hat{q})$. Own graphic, $S(\hat{q})$ calculated according to John and John (1993), pp.957-958.[220]

for higher values of β. This represents faster growing agency costs, as the difference to the constant optimal payoff $S(\hat{q})$, calculated by (44), increases at a higher rate. Overall, Figure 9 shows that these agency costs are small for low values of β and that the payoff function approaches the optimal payoff with a decreasing β. However, it does not reach $S(\hat{q})$ unless $\beta = 0$,[222] which is excluded as per assumption.

4.4. Implementation of the investment policy with state-contingent debtholder control

Another way to let the debtholders influence the actions of the firm is to only give them control rights under certain circumstances. Therefore, at $t = 2,5$ they receive the perfect but noncontractible signal T, which reveals their final payoff. The firm is assumed to already have insider-information about the return of the investment, so that it can report to the debtholders which payoff they will receive. As per assumption, the debtholders have the right to liquidate the firm if it lies about their payoff. Because it is in the firm's interest to avoid any chance of liquidation, they report T correctly.[223] If the signal indicates the low return $L < F$, the control over the firm's operations is transferred to the debtholders, while nothing happens otherwise.[224] When being in control, the debtholders initiate a restructuring process, which can include the reorganization of the work flows or of the assets and generates an additional value that is realized at $t = 3$.[225] This additional value is assumed to equate to $F - L$, because with the low return L it adds up to the complete face value F. Hence, this leaves no residual and the firm is insolvent. The goal of the restructuring process is solely to ensure that the debtholders receive the complete face value F, although the return of the investment has been low. This means that the debtholders expect to receive the face value F in any case, leading to a certain payoff for them:[226]

$$D_3(\bar{q}) = \bar{q}F + \frac{\left(1-\bar{q}^2\right)}{2}F + \frac{(1-\bar{q})^2}{2}F = F \tag{69}$$

Even without the access to the relevant information, they know that they receive F with certainty, so that they set the bond value $B_3 = F$. With the expected value of the investment, given by (56), and the debtholders' impact being eliminated from the shareholders' payoff function, it is calculated as follows:[227]

$$S_3(\bar{q}) = -I + \bar{q}I + \frac{\left(1-\bar{q}^2\right)}{2}H + \frac{(1-\bar{q})^2}{2}F - E[\mu] \tag{70}$$

Note that, in contrast to the previous cases, the final cash flow after the low return of the investment is not L but increases because of the additional value of the restructuring process, so that it equates to $L + (F - L) = F$.

Additionally, there are adjustments in the wage payment to the manager. The general structure with the parameters α, W, ϑ remains the same, but, as opposed to the other cases, the manager experiences additional personal costs if the restructuring process occurs. These costs, denoted by C, represent the additional work load and the disutility for him because he might be put in a new position and he receives new tasks that require a higher effort from him.[228] As per assumption, the personal costs are greater than the additional value created by the restructuring process, so that $C > F - L$.[229] The firm's board knows about the personal costs C ex ante and compensates it with an additional wage payment of the same value. This leads to the following expected value of the

[222] The formal proof is given in the Appendix A.44.

[223] The firm cannot imitate the high return if the actual return is low, because it only has the amount of L available, which makes it impossible to completely pay back F. Moreover, it makes no sense to imitate the low return, as the debtholders would receive the control rights in this case, which is not in the interest of the firm.

[224] Similarly, Zender (1991), pp.1649-1654, models the state-contingent control allocation after the observation of a signal about the final cash flow.

[225] Cf. Chang (1992), p.1142.

[226] This is similar to (47) with $F < L$, meaning that F is risk-free.

[227] The calculation is given in the Appendix A.45.

[228] Cf. Chang (1992), p.1142.

[229] If $C \leq F - L$, the additional value is at least as high as the costs caused by the restructuring process, so that the firm would have already initiated it before to make optimal use of its resources.

wage payment to the manager:

$$E[\mu] = W + \alpha\left[\bar{q}(I-F) + \frac{\left(1-\bar{q}^2\right)}{2}(H-F)\right] + \frac{(1-\bar{q})^2}{2}(C-\vartheta) \tag{71}$$

While the first terms are similar to the ones in (63), the last term, that represents the variable wage payment in case of the low return, consists of the additional payment C to compensate the personal costs due to the restructuring and the salary reduction $-\vartheta$ because there is no residual left and the firm is insolvent at $t = 3$. In the present case, the expected value of the wage payment does not only equate to the reservation wage of the manager but also covers the additional personal costs multiplied with the probability that restructuring occurs:

$$E[\mu] = w_0 + \frac{(1-\bar{q})^2}{2}C \tag{72}$$

This term can be inserted for $E[\mu]$ in the shareholders' expected payoff $S_3(\bar{q})$, given in (70). The board acts on behalf of the shareholders and maximizes $S_3(\bar{q})$ with respect to $\bar{q}$, so that the ideal cutoff level is given by:

$$\bar{q}_3 = \frac{I-F+C}{H-F+C} = \frac{I-L+(C-(F-L))}{H-L+(C-(F-L))} > \frac{I-L}{H-L} = \hat{q} \tag{73}$$

For $C > F - L$, the preferred investment policy $[\bar{q}_3]$ is less risky than the optimal policy $[\hat{q}]$, with qu given by (41), which causes agency costs. Because of $\partial\bar{q}_3/\partial C > 0$, an increase in C reduces the risk even more.[230] As the cutoff level $\bar{q}_m$, induced by the contract $\mu(\alpha, W, \vartheta)$ and given in (61), is not affected by the personal costs C,[231] α can be set, so that $\bar{q}_m = \bar{q}_3$:[232]

$$\hat{\alpha}_3 = \frac{\vartheta}{C} \tag{74}$$

Now, the fixed salary $\widehat{W}_3$ is determined by the binding participation constraint:[233]

$$\begin{aligned} E[\mu] =& \widehat{W}_3 + \hat{\alpha}_3\left[\bar{q}_3(I-F) + \frac{\left(1-\bar{q}_3^2\right)}{2}(H-F)\right] \\ &+ \frac{(1-\bar{q}_3)^2}{2}(C-\vartheta) = w_0 + \frac{(1-\bar{q}_3)^2}{2}C \end{aligned} \tag{75}$$

With the contract $\mu\left(\hat{\alpha}_3, \widehat{W}_3, \vartheta\right)$, the shareholders' expected payoff in (70) becomes:

$$\begin{aligned} S_3(\bar{q}_3) =& -I + \bar{q}_3 I + \frac{\left(1-\bar{q}_3^2\right)}{2}H + \frac{(1-\bar{q}_3)^2}{2}F \\ &- \left(w_0 + \frac{(1-\bar{q}_3)^2}{2}C\right) \end{aligned} \tag{76}$$

Figure 10 shows that $S_3(\bar{q}_3)$ decreases with C on the interval $[F-L; 10(F-L)]$.[234] This leads to an increasing difference between the optimal payoff $S(\hat{q})$, calculated by (44), and the actual payoff $S_3(\bar{q}_3)$, representing rising agency costs. For lower values of C, this effect seems to be slightly stronger than for higher values. Note that for decreasing values of C the optimal payoff is approached by the function of $S_3(\bar{q}_3)$ but would only be reached for $C = F - L$,[235] which is excluded as per assumption.

4.5. Comparison of the options of debtholder control and evaluation of the results

As explained in the previous sections, the information asymmetry between the debtholders and the shareholders causes agency costs that cannot be completely eliminated. Hence, the optimum derived in the model of John and John (1993) is not obtained.[237] Giving control to the debtholders can eliminate the information asymmetry but causes agency costs due to the implementation of suboptimal investment policies. The goal of this section is to investigate whether giving control to the debtholders leads to an overall improvement of the solution. In order to do so, the shareholders' expected payoffs of the three different cases are compared, as they are the relevant results that represent the firm's success. The manager's expected payoff is not considered, because he receives just enough to stay in the firm in every case and does not gain any profit.

4.5.1. Option of no control versus option of initial control

Firstly, the results of the cases without debtholder control and with initial debtholder control on the board are compared. Therefore, the investment policies $[\bar{q}_1]$ and $[\bar{q}_2]$, with the cutoff levels given in (60) and (67), are evaluated. As $\bar{q}_1 < \bar{q}_2$, the investment policy induced without debtholder control leads to a riskier final cash flow than the one induced in the other case.[238] For any $\beta \leq 0,5$, the following condition holds:[239]

$$|\hat{q} - \bar{q}_1| > |\hat{q} - \bar{q}_2| \tag{77}$$

As the expected value of the investment, given in (56), is a downward facing parabolic function in $\bar{q}$ with the maximum point at $\hat{q}$,[240] the above condition states that the expected value is higher in case of the policy $[\bar{q}_2]$. Additionally,

[230] The calculation and formal analysis of $\bar{q}_3$ are given in the Appendix A.46.

[231] The personal costs C reduce the manager's payoff after the low return, but at the same time he receives the additional wage payment to cover exactly these costs, so that the overall effect on his payoff equals zero.

[232] The calculation is given in the Appendix A.47.

[233] This happens as in (63), also see John and John (1993), pp.964-965.

[234] The upper boundary is set at $10(F-L)$ to maintain focus on values for C that are still within a reasonable range compared to the additional value $F-L$ of the restructuring process.

[235] The formal proof is given in the Appendix A.48.

[236] The values used to calculate the functions are: $L = 0; I = 5; H = 11; w_0 = 0; F = 1$.

[237] Cf. John and John (1993), pp.957-959.

[238] The proof for the comparison of cutoff levels is given in the Appendix A. 26 and continues to hold in the following, as already mentioned in footnote 207, also see John and John (1993), p.959.

[239] The comparison of $\bar{q}_1$ and $\bar{q}_2$ and the derivation of (77) are given in the Appendix A.49.

[240] The proof is given in the Appendix A.26, also see John and John (1993), pp.957-959.

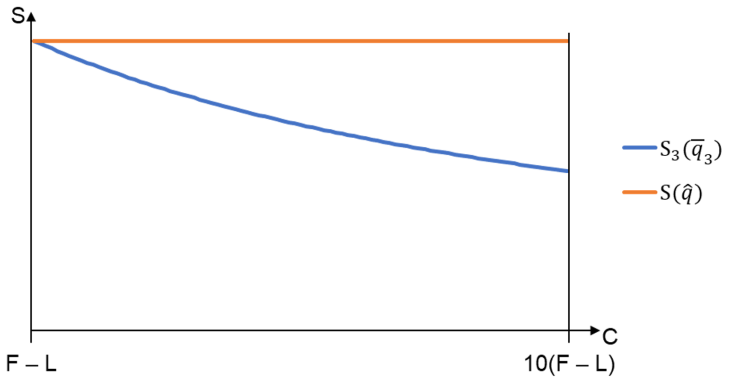

Figure 10: Shareholders' expected payoff $S_3(\bar{q}_3)$ vs. optimal expected payoff $S(\hat{q})$. Own graphic, $S(\hat{q})$ calculated according to John and John (1993), pp.957-958.[236]

the term $\Delta B(\bar{q}_1)$ is subtracted from the expected value of the investment in the shareholders payoff $S_1(\bar{q}_1)$, given by (64), while no such term exists in the payoff function $S_2(\bar{q}_2)$, as given in (65) with $\bar{q} = \bar{q}_2$. Thus, for $\beta \leq 0,5$ the option of initial debtholder control clearly dominates the option without debtholder control.

Generally, there exists a critical value β_{crit}, so that the option with debtholders on the board dominates the other one for all $\beta < \beta_{\text{crit}}$.[241] This critical value varies with the level of the face value F, but always lies above 0,5. As $\beta > 0,5$ would mean that the debtholders have the majority of the votes on the board of directors, the shareholders would not choose this option of debtholder control for any value of debtholder influence β that is so high.[242] Hence, for reasonable values of β the option of debtholder representation on the board dominates the solution without debtholder influence and reduces the overall agency costs.

4.5.2. Option of no control versus option of state-contingent control

In the following, the options of no debtholder control and of state-contingent debtholder control are compared, so that the investment policies with the cutoff levels $\bar{q}_1$, given by (60), and $\bar{q}_3$, given by (73), are examined. Because of $\bar{q}_1 < \bar{q}_3$, the investment policy induced without debtholder control creates a final return with higher risk. For $C \leq 2(F-L)$, it follows:[243]

$$|\hat{q} - \bar{q}_1| > |\hat{q} - \bar{q}_3| \tag{78}$$

Similar to (77), this implies that the expected value of the investment is higher for the option with debtholder control than for the one without. The possibility of C exceeding the value of $2(F-L)$ should be considered though. Additionally, for both options there are further casespecific terms affecting the shareholders' payoff functions, given by (64) and (76). Thus, in addition to the above analysis, the complete payoff functions are compared. By doing so, the critical value $C_{\text{crit},1}$ can be determined, so that the option with state-contingent debtholder control dominates the option without control for $C < C_{\text{crit},1}$.[244] Figure 11 shows the critical value $C_{\text{crit},1}$ as a function of the face value F.

While the option of the state-contingent debtholder control dominates for all values of C below the blue function $C_{\text{crit},1}$, the red function $C_{\text{min}} = F - L$ represents the lower boundary for C. As the difference between the two functions increases slightly progressively in F, especially for lower values of F, the value of C becomes more likely to fall in that range, so that the option with debtholder control seems likely to dominate for high values of F. However, C possibly also increases for higher values of F, as they lead to more extensive restructuring processes with L being constant, which needs to be considered in the analysis. With a decreasing F, $C_{\text{crit},1}$ approaches C_{min} and the solution mainly depends on the actual value of the personal costs C.

4.5.3. Option of initial control versus option of state-contingent control

After comparing the options with debtholder control with the one without control, now, the two different cases of debtholder control are compared. The cutoff levels of the respective investment policies $[\bar{q}_2]$ and $[\bar{q}_3]$ are given by (67) and (73). Both of the policies are less risky than the optimal policy $[\hat{q}]$, with $\hat{q}$ given by (41), but as $\partial \bar{q}_2 / \partial \beta > 0$ and $\partial \bar{q}_3 / \partial C > 0$, the values of $\bar{q}_2$ and $\bar{q}_3$ approach $\hat{q}$ for decreasing values of β and of C, as shown in sections 4.3

[241] The calculation and graphical presentation of β_{crit} are given in the Appendix A.50.

[242] Dittmann, Maug, and Schneider (2010), pp.36-37, state that bankers on the boards of German firms hold on average less than ten percent of the votes and Galai and Wiener (2008), p.113, argue that it seems unlikely for a firm to give the majority of the votes on the board to the debtholders.

[243] The comparison of $\bar{q}_1$ and $\bar{q}_3$ and the derivation of (78) are given in the Appendix A.51.

[244] The calculation is given in the Appendix A.52.

[245] The values used to calculate the functions are: $L = 0; I = 5; H = 11; w_0 = 0$.

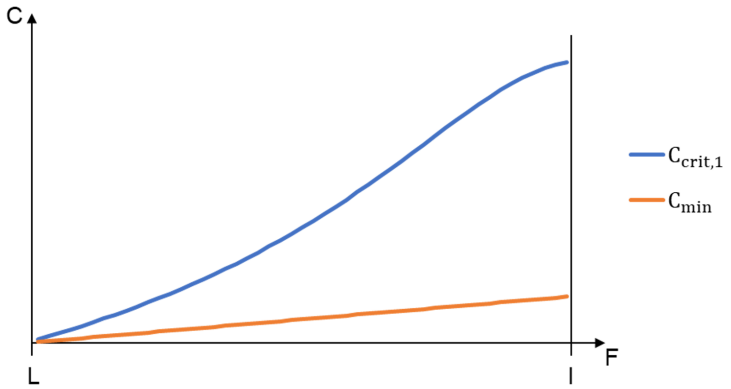

Figure 11: Critical value $C_{\text{crit},1}$ for comparison of options of no debtholder control and of statecontingent debtholder control.[245]

and 4.4. For $C > 2(F-L)$ and $\beta < 0,5$, it follows that:[246]

$$|\hat{q} - \bar{q}_2| < |\hat{q} - \bar{q}_3| \tag{79}$$

Similar to (77), the option with initial debtholder control leads to a higher expected value of the investment than the option with state-contingent control. This means that it also dominates overall, as there are no case-specific terms subtracted in $S_2(\bar{q}_2)$, as given in (65), whereas the costs of restructuring even further reduce $S_3(\bar{q}_3)$, given by (76). However, while $\beta < 0,5$ seems reasonable because the shareholders would not give the majority of the board's votes to the debtholders, the validity of the other condition is not so clear. This is why the overall payoff functions $S_2(\bar{q}_2)$ and $S_3(\bar{q}_3)$ are compared, too. The critical value $C_{\text{crit},2}$ is determined as function of β, so that the option with state-contingent debtholder control dominates for $C < C_{\text{crit},2}$.[247] The result is shown graphically in Figure 12 for $\beta \in [0;0,5]$.[248]

As the blue function of $C_{\text{crit},2}$ increases progressively in β, C becomes more likely to fall in the area between the functions of $C_{\text{crit},2}$ and $C_{\text{min}} = F - L$. This means that the option of the state-contingent debtholder control is more likely to dominate for higher values of β. However, $C_{\text{crit},2}$ approaches C_{min} for lower values of β, so that the decision between the two options is contingent on the actual value of C. Note that following from (79), the condition $C_{\text{crit},2} \leq 2(F-L)$ holds for Figure 12, as $\beta < 0,5$, meaning that only rather low values of C can be considered in this analysis. Nevertheless, both options provide the chance to approach the optimum, as shown in sections 4.3 and 4.4, enabling the shareholders to minimize the overall agency costs.

[246] The calculation is given in the Appendix A.53.
[247] The calculation is given in the Appendix A.54.
[248] The interval is chosen for the same reasons as in Figure 9. Similarly, the excerpt of the vertical axis is very small, so that there is actually only a marginal difference between the two functions. This can be seen by expanding the interval of β to $[0;1]$, as shown in Appendix A.55.
[249] The values used to calculate the functions are: $L = 0; I = 5; H = 11; w_0 = 0; F = 1$.

4.5.4. Evaluation of the results

Before the evaluation of the results, an important aspect to note is that the managerial reservation wage w_0 is set equal to zero for the calculation of the results presented in Figures 8 to 12. This has no effect on the comparison of the options, because w_0 is a constant and is subtracted in each one of the three different payoff functions of the shareholders, but it helps to ensure that the shareholders' expected payoffs are always positive. However, there exist combinations of the values L, I, H, F that lead to a negative expected payoff $S_1(\bar{q}_1)$, regardless of w_0. For these combinations, the options with debtholder control always dominate the one without.[250] The choice of the values for the Figures 8 to 12 ensures that $S_1(\bar{q}_1) > 0$ and therefore excludes such combinations from the present analysis. This is done to focus on the richer cases, in which each option of debtholder control leads to positive results and therefore needs to be considered.

Giving control to the debtholders can reduce the agency costs and particularly makes sense if the value of F is rather high. For plausible values of β, the option of initial debtholder control dominates the one without control for any F. The comparison between the options of the state-contingent control and no control is not so clear and depends on the actual value of the personal costs C, especially for low values of F. However, if the firm keeps the personal costs C low, the option of the state-contingent debtholder control dominates, too.

The decision between the two options of debtholder control depends on the actual values of the parameters β and C, as long as the personal costs C are rather low. If this is not the case, the option with initial debtholder control dominates for reasonable values of β. Nevertheless, there exist several further aspects for both options that are not considered formally in the model. Having representatives of the debtholders on the board can be helpful for the firm, as it gains additional expertise, especially in the field of finances.[251] On the other side, the debtholders have their own interests and

[250] The formal analysis of these situations is given in the Appendix A.56.
[251] Cf. Booth and Deli (1999), pp.229-230.

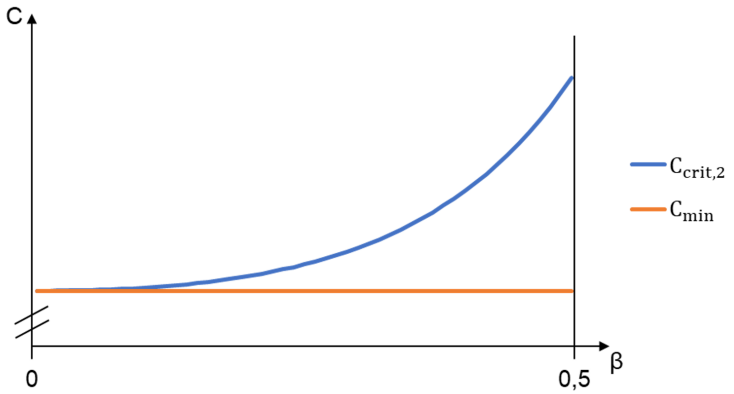

Figure 12: Critical value $C_{\text{crit, 2}}$ for comparison of options of initial debtholder control and of statecontingent debtholder control.[249]

can influence the decisions of the firm in order to maximize their own expected payoff, which could happen at the cost of the shareholders.[252] An advantage of giving control to the debtholders in case of the low return is that the agency costs can potentially be reduced by the firm. If the firm has an open-minded corporate culture and no fixed structures in the working teams, the restructuring process initiated by the debtholders is easier accepted.[253] This might lead to the manager experiencing lower personal costs, so that C and therefore the agency costs can be reduced. On the contrary, the restructuring process of the firm can affect the future operations negatively, as it is initiated by the debtholders who only seek to generate an additional short-term value but do not care about the long-term consequences. Furthermore, the shareholders completely lose control when the debtholders start the restructuring process, which possibly leads to personal costs as well as a loss in the reputation for them.[254] Overall, the decision between the two options of debtholder control mainly depends on the values of β and C but should also consider further aspects like the ones discussed above.

4.6. Discussion of the model's assumptions and implications of the results

Apart from the general setting of the model, there are several specific assumptions that hold for the respective cases of debtholder control, leading to the results explicated above. The goal of this section is to discuss selected assumptions and aspects of the model as well as to derive the implications of the results. Thereby, the focus lies on aspects that are not discussed in section 3.4 in the context of the other models.

A crucial aspect of the model is that the manager's compensation scheme and the specific investment opportunities are not known to the market, leading to the information asymmetry between the debtholders and the firm. It seems plausible that the firm is not interested in sharing the information, as this could potentially lead to a competitive disadvantage.[255] Even if the firm reported the relevant information, it would lie to the debtholders, as explained in section 4.2. This could change by expanding the model to a longer time horizon to capture the advantages of a long-lasting relationship between the debtholders and the firm with a repeated engagement of the same debtholders. In this case, the shareholders would have an incentive to provide the correct information in order to sustain that trustful relationship with the debtholders. In a short-term model like the one presented here, this option does not arise though.

Another assumption concerning the debt is that the face value F is fixed, while the bond value B is determined endogenously. At the first glance, it might seem more plausible to fix the bond value B rather than the face value F, because the firm is likely to know the exact amount of money that is missing at $t = 0$ in order to make the investment. Nevertheless, the firm has all the relevant information to predict the bond value B it receives at $t = 0$ for every face value F, as all parties act rationally.[256] Hence, debt of the face value F can be issued, so that the bond value B, set by the debtholders, equals the amount of money that is missing to make the investment at $t = 0$. In addition to that, fixing the face value F instead of the bond value B is done for expositional purposes. In case of the initial debtholder control on the board of the firm, endogenously determining F means that F becomes a function of the parameter β. While an increasing β leads to a direct decrease in $S_2(\bar{q}_2)$, as shown in Figure 9, it also decreases the value of F, which in turn increases the value of $S_2(\bar{q}_2)$,[257] Because these two effects oppose each other, the

[252] Cf. Kroszner and Strahan (2001), p.416.

[253] As the restructuring leads to changes in the firm, a well-functioning change management could help to break down potential barriers within the organization, similar to the approach in Lauer (2019), pp.4-8.

[254] This represents a loss of the private benefits of having control over the firm's actions. For a definition of private benefits see Aghion and Bolton (1992), p.476.

[255] Similarly, Dessí (2001), pp.367-368, and Harris and Raviv (1990), pp.324-327, model the information asymmetry between the manager and the investors, as the manager does not share the information in order to avoid any chance of liquidation or penalization.

[256] This also means that the firm knows the debtholders seek to break even.

[257] The formal analysis is given in the Appendix A.57.

overall effect on the function of $S_2(\bar{q}_2)$ is smaller than shown in Figure 9. This does not change the general implications of the results but adds an additional factor to be considered. In the cases of no debtholder control and of state-contingent debtholder control, fixing B instead of F does not change the results, because F can be expressed as a function of B only and is not contingent on any other variable of the model.[258] Overall, the face value F can be assumed to be fixed in all cases of the model without the loss of generality.

In the case of the state-contingent debtholder control, as in section 4.4, the restructuring process causes personal costs C for the manager of the firm. It is important that the value of C is known to the shareholders ex ante, so that they can determine their preferred investment policy and set up the managerial compensation with the additional payment to cover these costs. As the shareholders know the values of L and F ex ante and they can also be assumed to know about the characteristics of the firm and their workers, it seems plausible that they know the value of C, too.[259] If they did not know about C, they would not be able to implement the policy $[\bar{q}_3]$, which is why the above assumption is crucial for the model.[260] Moreover, the personal costs are given by the parameter C instead of expressing them through a disutility function of the actual effort taken by the manager. This is done to keep the model simple. Note that the value of C can vary due to different values of L and F, so that it can be interpreted as a function of L and F, although it is not specifically modelled as such but given exogenously.

The restructuring process initiated by the debtholders in section 4.4 is assumed to generate the additional value $F-L$ with certainty. As the restructuring serves the purpose of ensuring that F is completely paid back, the debtholders do not initiate a process that generates a lower value than $F-L$. This happens under the assumption that they are actually able to control the process that precisely. Additionally, the firm has no incentive to do any more restructuring than needed, as the costs of it exceed the additional value generated. Thus, it seems like a fair assumption that the restructuring process generates the exact value of $F-L$. An alternative is to model the additional value as a risky cash flow, assuming that the restructuring process is not guaranteed to yield exactly the results predicted ex ante. However, this means that the restructuring value can be lower than $F-L$, so that the debtholders cannot be sure to receive the complete face value F in any case. Hence, they do not receive the certain payoff depicted in (69) and the overall information asymmetry cannot be eliminated. The restructuring process needs to assuredly generate an additional value of at least $F-L$ in order to eliminate the information asymmetry and to yield the results, presented in section 4.4.

An assumption used in the case without debtholder control as well as in the case with state contingent debtholder control is that the firm avoids any chance of liquidation. The shareholders and the manager wish to be able to undertake profitable projects in the future, so that it seems plausible that the firm seeks to stay in business. This condition is used by the debtholders to threaten the firm in order to ensure that it reports the value of L in the case without debtholder control and the signal T in case of the state-contingent debtholder control correctly. Note that the threat by the debtholders is only credible if they can actually detect potential lies of the firm.[261] As the signal T provides information about their expected payoff and the value of L also represents a potential payoff of them, they are able to detect lies at the moment their payoff is realized. Without the possibility to liquidate the firm and therefore to threaten the shareholders, the debtholders could not trust the information provided by the shareholders. In the case of no debtholder control they would assume the worst case for L, being $L=0$, and calculate the bond value accordingly, which would lead to even higher agency costs than depicted in section 4.2.[262] The case of the state-contingent debtholder control would not work at all because the signal T would not credibly reveal the perfect information about the debtholders' payoff. This shows that the assumption plays a key role in the model.

All in all, the present model highlights the significance of the underlying assumptions for the decision whether the debtholders' influence can be of any help to the firm. Given its assumptions, it can predict which option of debtholder control leads to the highest payoff for the shareholders, but it is important to consider additional factors that are not displayed formally. Some of these factors are mentioned in section 4.5.4, but they can vary from firm to firm, depending on parameters like the overall structure and the corporate culture. Another important aspect is the timeline that builds the frame for the actions taking place in the model. The present model considers one investment decision and the short-term consequences on the resulting payoffs but does not incorporate any long-term aspects. One of these aspects is that the firm might prefer to have a long-lasting relationship with the same debtholders, whereby the key factor for a long and successful relationship between them is that they can trust each other. In the end, agency costs arise if this trust between the two parties is not existent. The model of John and John (1993) simulates a trustful relationship through the perfect information that is given in the market.[263] As the debtholders know that they can trust this information, they price the debt accordingly and no agency costs arise for the shareholders. In the present model, there is no trust between the debtholders and the firm and without the perfect information in the market it cannot be simulated either. Hence, agency

[258] As $B_1=(F+L)/2$ and $B_3=F$, the inverse functions for F only depend on B and the exogenously given parameter L, so that F can be seen as fixed.

[259] The information about L and F enables the shareholders to calculate the additional value that needs to be generated by the restructuring process, so that they can predict the extent of restructuring.

[260] Chang (1992), p.1144, assumes C to be noncontractible but interprets it as the loss of future monetary benefits. As opposed to that, C only represents the costs of the additional effort by the manager in the present model.

[261] This is not the case for reporting the values of I and H without debtholder control, as shown in section 4.2.

[262] The formal proof is given in the Appendix A.58.

[263] Cf. John and John (1993), pp.954-957.

costs arise and can only be reduced by finding arrangements in form of debtholder control mechanisms, that provide the debtholders with trustful information to price their debt appropriately. As opposed to the models presented in section 3, the present one uses the debtholder influence to eliminate the information asymmetry instead of using it to implement the optimal policy. In fact, the debtholder control negatively affects the implementation of the investment policy. However, this is the price the shareholders are willing to pay, as the overall agency costs can be reduced by the elimination the information asymmetry. This shows that the effect of a trustful relationship with symmetrically distributed information outweighs the impact of the debtholders' influence on the investment policy, which underlines the significance of trust between the debtholders and the firm.

4.7. Long-term approach as extension of the model

As discussed above, a long and trustful relationship between the firm and the debtholders can affect the firm's performance, which is why this subsection presents a brief approach that expands the present model by long-term aspects.

A trustful relationship between the firm and the debtholders eliminates the information asymmetry without the need of a control structure like the ones derived in sections 4.3 and 4.4. Thus, the agency costs that arise due to these aspects are abolished. This means that issuing debt to the respective debtholders leads to savings for the firm compared to issuing debt to other debtholders that do not have the trustful information. The firm expects these future savings Z for the time of the relationship. Under the assumption that the debtholders end the relationship after the low return L, the shareholders' expected payoff is given by:[264]

$$S_{LT}(\bar{q}) = -I+\bar{q}(I+Z)+\frac{\left(1-\bar{q}^2\right)}{2}(H+Z)+\frac{(1-\bar{q})^2}{2}L-w_0 \quad (80)$$

Hence, the shareholders, being in control of the board, seek to implement the investment policy with the following cutoff level in order to maximize their expected payoff:

$$\bar{q}_{LT} = \frac{I-L+Z}{H-L+Z} > \frac{I-L}{H-L} = \hat{q} \quad (81)$$

Although the information asymmetry can be eliminated, the cutoff level $\bar{q}_{LT}$ does not induce the optimal policy $[\hat{q}]$, with $\hat{q}$ given by (41), which causes agency costs for that investment project. However, it generates higher payoffs in the long term, represented by the future savings Z, so that the short-term agency costs can eventually be compensated. A positive aspect for the debtholders is that the policy $[\bar{q}_{LT}]$ leads to a safer final cash flow than the optimal policy $[\hat{q}]$,[265] whereby the risk decreases even further with an increasing Z.[266] Thus, by threatening the firm to terminate the relationship after the low return, they affect the firm's investment decision without the need of receiving control rights. This effect becomes even stronger if the shareholders expect a long and successful relationship, represented by a higher value of Z.

The key question is how the trustful relationship between the debtholders and the firm can be established and maintained, as the shareholders can technically just imitate a trustful relationship without reporting the information correctly.[267] An approach to solve this problem is to assume that, because of the close interaction between the firm and the debtholders, the lies of the shareholders are revealed with a certain probability, leading to the immediate termination of the relationship. If the expected losses of the firm due to the end of the relationship are high enough, the shareholders might not have an incentive to lie anymore, as they wish to sustain the trustful relationship with the debtholders, which leads to higher future payoffs.

A crucial point of the relationship's model is the prediction of the future savings Z. Firstly, it is difficult to forecast the future investments that will be made by the firm as well as the duration of the relationship and therefore the value of Z. Secondly, in order to predict Z precisely, the information about the debtholders' competitors in the financial market is needed, as Z represents the savings compared to issuing debt to them. Finally, it seems likely that the firm and the debtholders have different predictions for Z, which eventually leads to a conflict between them. These points imply that the uncertainty of long-term aspects is difficult to model and might require several assumptions to set up the problem.

The above discussion shows that before modelling the long-term aspects of a trustful relationship, various aspects have to be considered in order to make the appropriate assumptions for the model. Nevertheless, relationship lending represents a way of financing, that can be beneficial for the borrower, being the firm, so that it is worth being analyzed formally.[268] While the work of Boot and Thakor (1994) analyzes the effects of a long-term relationship between the firm and the creditors in a different setting,[269] it could also represent a valuable extension to the present model.

5. Conclusion and recommendations for future research

This section concludes the thesis by reviewing and interpreting the findings of sections 3 and 4 as well as pointing out possible directions for further research.

The three models presented in section 3 use different approaches to examine the influence of the creditors on the

[264] This follows with $V(\bar{q})$, given by (56), and $E[\mu] = w_0$. The calculation of the function is given in the Appendix A.59, also see John and John (1993), pp.957-958.

[265] The general proof for the comparison of cutoff levels is given in A.26, also see John and John (1993), p.959.

[266] The calculation and formal analysis of $\bar{q}_{LT}$ are given in the Appendix A.60.

[267] As shown in section 4.2 and in the Appendix A.35, the shareholders can lie without the debtholders noticing.

[268] Cf. Kysucky and Norden (2016), pp.103-104

[269] Cf. Boot and Thakor (1994), pp.904-912.

firm, whereby their settings mainly differ in the firm's decisions to be influenced and in the ways how they are influenced by the creditors referred to as debtholders in this thesis. All of them incorporate the major stakeholders of the firm and consider the complex correlations and conflicts arising between them. As each model includes the case without creditor influence, e.g. in an all-equity firm or with the debt being risk-free, before deriving the solution with creditor influence, the differences and consequences for the firm's results are shown clearly. It should be noted that a range of other models would have come into question to be presented in this thesis, too, but the three selected ones convince with their straight forward settings and their strong focus on the impact of the creditors' influence. Additionally, they generate a balanced mix of various ways to model the creditors' influence.[270]

An important implication of the models from Douglas (2009) and Berkovitch and Israel (1996) is that the influence of the creditors on the firm's decisions can be used to incentivize the manager and to implement the preferred policies. Thus, it is clearly in the firm's interest to incorporate debt in its financial structure and give part of the control to the creditors.[271] On the other hand, John and John (1993) show that the creditors' influence is not necessarily needed to implement the optimal policy within the firm. Nevertheless, an important implication of their model is that even the presence of risky debt requires changes in the managerial compensation scheme to ensure that the manager is still incentivized optimally.[272]

As the different settings of the models from section 3 exacerbate the comparison of their concrete results, the model presented in section 4 uses just one setting to compare different ways of giving control to the creditors. The setting is kept similar to the one of John and John (1993) and thereby held as simple as possible in order to focus on the creditors' impact on the firm and to allow a better classification and comparison of the results.[273] As opposed to the other three models, the one presented in section 4 considers the significance of imperfect information in the form of an information asymmetry between the firm and the creditors. In this context, the primary reason for establishing a control structure that enables the creditors to influence the firm is to eliminate the information asymmetry. Thereby, the creditors' influence cannot be used to incentivize the manager but actually causes agency costs because of the implementation of a suboptimal investment policy. Hence, the firm needs to weigh up the opposing impacts to find the optimal option of creditor control. The results show that the options of giving control to the creditors dominate the option of not letting them influence the firm's decision in almost all relevant and plausible cases, whereas the decision between the different options of creditor control is ambiguous. Overall, the model implies that the distribution of the information and the kind of relationship between the creditor and the firm are important aspects that need to be considered in order to find the optimal solution for the firm. Additionally, the model shows that the optimal option of creditor influence depends on the actual situation and can differ from firm to firm, so that no general recommendation can be given. In fact, it is crucial for the firm to know about the situation and the involved stakeholders to be able to implement the optimal mechanism of creditor control.

As explained above, there exist several reasons for the firm to voluntarily let the creditors influence its decisions. However, the creditors' influence does not necessarily lead to better results, so that the possibility of the firm deterring it needs to be taken into account, too. When giving control to the creditors, the firm can choose from several possibilities like the use of debt covenants or installing representatives of the creditors on the board of directors. The optimal solution is contingent on circumstances that are determined by the interests of the stakeholders, the distribution of the information among them and the decisions of the firm to be influenced. All of these aspects are covered by the model's setup, which emphasizes the significance of the assumptions that build the base for each model.

The findings derived and presented in the previous sections do not only have interesting implications but also build the base for further research in this field. As the way and level of the creditors' influence depend on the specific situation, it would be interesting to examine whether there exists a correlation between certain types of situations and of creditor control. Thereby, it could be helpful to distinguish between firms with different characteristics like the size and general structure. Furthermore, the models presented in sections 3 and 4 have a rather short time horizon of only one project and do not consider any long-term effects. However, combining them with approaches of modelling long-term relationships between the firm and the creditors, that already exist in the literature,[274] would possibly lead to interesting results, as discussed in section 4.7. Another aspect for further research could be to analyze the effects of different kinds of debt on the extent of the creditors' influence, as the models presented here only focus on pure discount bonds. All in all, this thesis does not only provide deep insights into the subject of the creditors' influence on the decisions of the firm but should also be seen as a starting point for future research in this field.

[270] Cf. Douglas (2009), pp.154-170; cf. Berkovitch and Israel (1996), pp.213-227; cf. John and John (1993), pp.954-966.
[271] Cf. Douglas (2009), pp.167-170; cf. Berkovitch and Israel (1996), pp.222-227.
[272] Cf. John and John (1993), pp.962-965.
[273] Cf. ibidem, pp.954-957.
[274] Among others, Boot and Thakor (1994), pp.904-912, model a long-lasting relationship between the firm and the creditors.

References

Acharya, V. V., Amihud, Y., & Litov, L. (2011). Creditor Rights and Corporate Risk-Taking. *Journal of Financial Economics*, *102*(1), 150–166.

Admati, A. R., & Pfleiderer, P. (1994). Robust Financial Contracting and the Role of Venture Capitalists. *The Journal of Finance*, *49*(2), 371–402.

Aghion, P., & Bolton, P. (1992). An Incomplete Contracts Approach to Financial Contracting. *Review of Economic Studies*, *59*(3), 473–494.

Agliardi, E., Agliardi, R., & Spanjers, W. (2015). Convertible Debt: Financing Decisions and Voluntary Conversion under Ambiguity. *International Review of Finance*, *15*(4), 599–611.

Andrade, P., & Sotomayor, A. M. (2011). Human Capital Accounting – Measurement Models. *International Journal of Economics and Management Sciences*, *1*(3), 78–89.

Ang, J. S., Cole, R. A., & Lin, J. W. (2000). Agency Costs and Ownership Structure. *The Journal of Finance*, *55*(1), 81–106.

Barney, J. (1991). Firm Resources and Sustained Competitive Advantage. *Journal of Management*, *17*(1), 99–120.

Beaver, W. H., & Ryan, S. G. (2005). Conditional and Unconditional Conservatism: Concepts and Modeling. *Review of Accounting Studies*, *10*(2-3), 269–309.

Berglöf, E., & Von Thadden, E.-L. (1994). Short-Term versus Long-Term Interests: Capital Structure with Multiple Investors. *The Quarterly Journal of Economics*, *109*(4), 1055–1084.

Berkovitch, E., & Israel, R. (1996). The Design of Internal Control and Capital Structure. *The Review of Financial Studies*, *9*(1), 209–240.

Berkovitch, E., Israel, R., & Spiegel, Y. (2000). Managerial Compensation and Capital Structure. *Journal of Economics & Management Strategy*, *9*(4), 549–584.

Boot, A. W. A., & Thakor, A. V. (1994). Moral Hazard and Secured Lending in an Infinitely Repeated Credit Market Game. *International Economic Review*, *35*(4), 899–920.

Booth, J. R., & Deli, D. N. (1999). On Executives of Financial Institutions as Outside Directors. *Journal of Corporate Finance*, *5*(3), 227–250.

Botero, J. C., Djankov, S., La Porta, R., Lopez-De-Silanes, F., & Shleifer, A. (2004). The Regulation of Labor. *The Quarterly Journal of Economics*, *119*(4), 1339–1382.

Brander, J. A., & Poitevin, M. (1992). Managerial Compensation and the Agency Costs of Debt Finance. *Managerial and Decision Economics*, *13*(1), 55–64.

Brockman, P., Martin, X., & Unlu, E. (2010). Executive Compensation and the Maturity Structure of Corporate Debt. *The Journal of Finance*, *65*(3), 1123–1161.

Brunnermeier, M. K., & Oehmke, M. (2013). The Maturity Rat Race. *The Journal of Finance*, *68*(2), 483–521.

Calcagno, R., & Renneboog, L. (2007). The Incentive to Give Incentives: On the Relative Seniority of Debt Claims and Managerial Compensation. *Journal of Banking & Finance*, *31*(6), 1795–1815.

Chakravarty, S., & Yilmazer, T. (2009). A Multistage Model of Loans and the Role of Relationships. *Financial Management*, *38*(4), 781–816.

Chang, C. (1992). Capital Structure as an Optimal Contract Between Employees and Investors. *The Journal of Finance*, *47*(3), 1141–1158.

Chang, C. (1993). Payout Policy, Capital Structure, and Compensation Contracts when Managers Value Control. *The Review of Financial Studies*, *6*(4), 911–933.

Chava, S., Kumar, P., & Warga, A. (2010). Managerial Agency and Bond Covenants. *The Review of Financial Studies*, *23*(3), 1120–1148.

Chen, L., & Qiu, J. (2017). CEO Incentives, Relationship Lending, and the Cost of Corporate Borrowing. *Financial Management*, *46*(3), 627–654.

Childs, P. D., Mauer, D. C., & Ott, S. H. (2005). Interactions of Corporate Financing and Investment Decisions: The Effects of Agency Conflicts. *Journal of Financial Economics*, *76*(3), 667–690.

Christensen, H. B., & Nikolaev, V. V. (2012). Capital Versus Performance Covenants in Debt Contracts. *Journal of Accounting Research*, *50*(1), 75–116.

Dessí, R. (2001). Implicit Contracts, Managerial Incentives, and Financial Structure. *Journal of Economics & Management Strategy*, *10*(3), 359–390.

Dewatripont, M., & Tirole, J. (1994). A Theory of Debt and Equity: Diversity of Securities and Manager-Shareholder Congruence. *The Quarterly Journal of Economics*, *109*(4), 1027–1054.

Dittmann, I., Maug, E., & Schneider, C. (2010). Bankers on the Boards of German Firms: What They Do, What They Are Worth, and Why They Are (Still) There. *Review of Finance*, *14*(1), 35–71.

Douglas, A. V. S. (2002). Capital Structure and the Control of Managerial Incentives. *Journal of Corporate Finance*, *8*(4), 287–311.

Douglas, A. V. S. (2009). Interactions between Corporate Agency Conflicts. *The Financial Review*, *44*(2), 151–178.

Dybvig, P. H., & Zender, J. F. (1991). Capital Structure and Dividend Irrelevance with Asymmetric Information. *The Review of Financial Studies*, *4*(1), 201–219.

Eckbo, B. E., & Thorburn, W., Karin S.and Wang. (2016). How Costly is Corporate Bankruptcy for the CEO? *Journal of Financial Economics*, *121*(1), 210–229.

Esch, F.-R., & Markgraf, D. (2018). *Unique Selling Proposition (USP)*. Retrieved 2019-09-13, from https://wirtschaftslexikon.gabler.de/definition/unique-selling-proposition-usp-50075/version-273300

Ewert, R., & Wagenhofer, A. (2014). *Interne Unternehmensrechnung*. Berlin, Heidelberg: Springer Gabler, Springer-Verlag.

Falato, A., & Liang, N. (2016). Do Creditor Rights Increase Employment Risk? Evidence from Loan Covenants. *The Journal of Finance*, *71*(6), 2545–2590.

Feldhütter, P., Hotchkiss, E., & Karakaş, O. (2016). The Value of Creditor Control in Corporate Bonds. *Journal of Financial Economics*, *121*(1), 1–27.

Ferreira, D., Ferreira, M. A., & Mariano, B. (2018). Creditor Control Rights and Board Independence. *The Journal of Finance*, *73*(5), 2385–2423.

Fudenberg, D., & Tirole, J. (1990). Moral Hazard and Renegotiation in Agency Contracts. *Econometrica*, *58*(6), 1279–1319.

Galai, D., & Wiener, Z. (2008). Stakeholders and the Composition of the Voting Rights of the Board of Directors. *Journal of Corporate Finance*, *14*(2), 107–117.

Gilson, S. C., & Vetsuypens, M. R. (1993). CEO Compensation in Financially Distressed Firms: An Empirical Analysis. *The Journal of Finance*, *48*(2), 425–458.

Gilson, S. C., & Vetsuypens, M. R. (1994). Creditor Control in Financially Distressed Firms: Empirical Evidence. *Washington University Law Quarterly*, *72*(3), 1005–1025.

Güner, A. B., Malmendier, U., & Tate, G. (2008). Financial Expertise of Directors. *Journal of Financial Economics*, *88*(2), 323–354.

Gârleanu, N., & Zwiebel, J. (2009). Design and Renegotiation of Debt Covenants. *The Review of Financial Studies*, *22*(2), 749–781.

Grossman, S. J., & Hart, O. D. (1982). Corporate Financial Structure and Managerial Incentives. In *The Economics of Information and Uncertainty* (pp. 107–140). University of Chicago Press.

Harris, M., & Raviv, A. (1990). Capital Structure and the Informational Role of Debt. *The Journal of Finance*, *45*(2), 321–349.

Harrison, J. S., Bosse, D. A., & Phillips, R. A. (2010). Managing for Stakeholders, Stakeholder Utility Functions, and Competitive Advantage. *Strategic Management Journal*, *31*(1), 58–74.

Hart, O., & Moore, J. (1995). Debt and Seniority: An Analysis of the Role of Hard Claims in Constraining Management. *The American Economic Review*, *85*(3), 567–585.

Hermalin, B. E., & Weisbach, M. S. (1998). Endogenously Chosen Boards of Directors and Their Monitoring of the CEO. *The American Economic Review*, *88*(1), 96–118.

Hirshleifer, D., & Thakor, A. V. (1992). Managerial Conservatism, Project Choice, and Debt. *The Review of Financial Studies*, *5*(3), 437–470.

Holmström, B. (1979). Moral Hazard and Observability. *The Bell Journal of Economics*, *10*(1), 74–91.

Holmström, B., & Milgrom, P. (1991). Multitask Principal-Agent Analyses: Incentive Contracts, Asset Ownership, and Job Design. *The Journal of Law, Economics, and Organization*, *7*(Special Issue), 24–52.

Hong, H. A., Hung, M., & Zhang, J. (2016). The Use of Debt Covenants Worldwide: Institutional Determinants and Implications on Financial Reporting. *Contemporary Accounting Research*, *33*(2), 644–681.

Jensen, M. C., & Meckling, W. H. (1976). Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure. *Journal of Financial Economics*, *3*(4), 305–360.

John, T. A., & John, K. (1993). Top-Management Compensation and Capital Structure. *The Journal of Finance*, *48*(3), 949–974.

Kang, M. J., & Kim, A. (2017). Bankers on the Board and CEO Incentives. *European Financial Management*, *23*(2), 292–324.

King, T.-H. D., & Wen, M.-M. (2011). Shareholder Governance, Bondholder Governance, and Managerial Risk-Taking. *Journal of Banking & Finance*, *35*(3), 512–531.

Kohli, A. K., & Jaworski, B. J. (1990). Market Orientation: The Construct, Research Propositions, and Managerial Implications. *Journal of Marketing*, *54*(2), 1–18.

Kroszner, R. S., & Strahan, P. E. (2001). Bankers on Boards: Monitoring, Conflicts of Interest, and Lender Liability. *Boards: Monitoring, Conflicts of Interest, and Lender Liability. Journal*, *62*(3), 415–452.

Kysucky, V., & Norden, L. (2016). The Benefits of Relationship Lending in a Cross-Country Context: A Meta-Analysis. *Management Science*, *62*(1), 90–110.

Lauer, T. (2019). *Change Management – Grundlagen und Erfolgsfaktoren* (3rd ed.). Berlin: Springer Gabler.

Leland, H. E. (1998). Agency Costs, Risk Management, and Capital Structure. *The Journal of Finance*, *53*(4), 1213–1243.

Liao, L.-K., Mukherjee, T., & Wang, W. (2015). Corporate Governance and Capital Structure Dynamics: An Empirical Study. *The Journal of Financial Research*, *38*(2), 169–191.

Milgrom, P. R. (1981). Good News and Bad News: Representation Theorems and Applications. *The Bell Journal of Economics*, *12*(2), 380–391.

Modigliani, F., & Miller, M. H. (1958). The Cost of Capital, Corporation Finance and the Theory of Investment. *The American Economic Review*, *48*(3), 261–297.

Morellec, E., Nikolov, B., & Schürhoff, N. (2018). Agency Conflicts around the World. *The Review of Financial Studies*, *31*(11), 4233–4287.

Nini, G., Smith, D. C., & Sufi, A. (2009). Creditor Control Rights and Firm Investment Policy. *Journal of Financial Economics*, *92*(3), 400–420.

Nini, G., Smith, D. C., & Sufi, A. (2012). Creditor Control Rights, Corporate Governance, and Firm Value. *The Review of Financial Studies*, *25*(6), 1713–1761.

Pepper, A., & Gore, J. (2015). Behavioral Agency Theory: New Foundations for Theorizing About Executive Compensation. *Journal of Management*, *41*(4), 1045–1068.

Purnanandam, A. (2008). Financial Distress and Corporate Risk Management: Theory and Evidence. *Journal of Financial Economics*, *87*(3), 706–739.

Roberts, M. R., & Sufi, A. (2009). Control Rights and Capital Structure: An Empirical Investigation. *The Journal of Finance*, *64*(4), 1657–1695.

Schmidt, K. M. (1997). Managerial Incentives and Product Market Competition. *Review of Economic Studies*, *64*(2), 191–213.

Sisli-Ciamarra, E. (2012). Monitoring by Affiliated Bankers on Board of Directors: Evidence from Corporate Financing Outcomes. *Financial Management*, *41*(3), 665–702.

Suchanek, A., Lin-Hi, N., Thommen, J.-P., Woll, A., & Gillenkirch, R. (2018). *Homo oeconomicus.* Retrieved 2019-09-13, from https://wirtschaftslexikon.gabler.de/definition/homo-oeconomicus-34752/version-258248

Von Werder, A. (2018). *Corporate Governance.* Retrieved 2019-09-13, from https://wirtschaftslexikon.gabler.de/definition/corporate-governance-28617/version-367554

Wang, H. (2011). Managerial Entrenchment, Equity Payout and Capital Structure. *Journal of Banking & Finance*, *35*(1), 36–50.

Weber, J., & Schäffer, U. (2016). *Einführung in das Controlling* (15th ed.). Stuttgart: Schäffer-Poeschel Verlag.

Zender, J. F. (1991). Optimal Financial Instruments. *The Journal of Finance*, *46*(5), 1645–1663.

Zwiebel, J. (1996). Dynamic Capital Structure under Managerial Entrenchment. *The American Economic Review*, *86*(5), 1197-1215.