universität wien

MASTERARBEIT / MASTER'S THESIS

Titel der Masterarbeit / Title of the Master's Thesis

„Debt Covenants and Waivers"

verfasst von / submitted by

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angestrebter akademischer Grad / in partial fulfilment of the requirements for the degree of

Master of Science (MSc)

Wien, 2022 / Vienna 2022

Studienkennzahl lt. Studienblatt / degree programme code as it appears on the student record sheet:	UA 066 915
Studienrichtung lt. Studienblatt / degree programme as it appears on the student record sheet:	Masterstudium Betriebswirtschaft
Betreut von / Supervisor:	Uni.-Prof. Dr. Thomas Pfeiffer

Table of Contents

Abstract

Relationships between lenders and borrowers that emerge from debt contracts, hold potential for conflicts among the involved parties. Debt covenants are agreements in the debt contract that offer a mechanism to mitigate these conflicts which originate in agency problems and informational asymmetries. They aim to restrict managerial behaviour by setting accounting thresholds and imposing limits on certain actions. Empirical studies show that in the majority of cases, violations of debt covenants are followed by either a waiver or renegotiations regarding the contract terms rather than contract termination. Hence, covenants additionally serve as monitoring tools allowing to dynamically complete contracts through incorporation of new information. This master's thesis examines incentives for a firm's manager to give up control through restrictive debt covenants and the implications that the prospect of renegotiations after a covenant breach provides in this process. An introduction to the topic and the perception within relevant literature is given in the first part. Followed by a model that analyses the manager's expected utility when given the choice between a contract without covenant regulations, a strict covenant contract and a covenant contract with the option to renegotiate after covenant violation, using comparative statics. The model shows that implementing covenants in a debt contract can be beneficial for the manager particularly in prospect of a waiver or renegotiations.

Abstract – Deutsch

Die durch Schuldverträge entstandene Beziehung zwischen Kreditnehmer und Kreditgeber birgt Konfliktpotenzial zwischen den involvierten Parteien. Klauseln (Covenants) sind Vereinbarungen in Schuldverträgen, die einen Mechanismus zur Bewältigung dieser Konflikte bieten, welche ihren Ursprung in Agency Konflikten und Informationsasymmetrien haben. Durch das Festlegen von Grenzwerten für Kennzahlen sowie die Limitierung bestimmter Handlungen soll das Verhalten des Managers beeinflusst werden. Empirische Studien zeigen, dass in den meisten Fällen bei einem Verstoß gegen Covenants ein Verzicht auf Durchsetzung (Waiver) bzw. Nachverhandlungen des Vertrags (Renegotiations) gegenüber der Durchsetzung der Klauseln oder einer Kündigung des Vertrags bevorzugt werden. Covenants dienen daher zusätzlich als Überwachungswerkzeug, das eine dynamische Vervollständigung des Vertrags durch Informationsaustausch ermöglicht. Diese Masterarbeit untersucht welche Anreize für

Manager bestehen, Kontrolle durch restriktive Covenants abzugeben und welche Auswirkungen die Aussicht auf Nachverhandlungen im Fall von Verstößen gegen Covenants auf diesen Prozess hat. Im Ersten Teil der Arbeit wird eine Einführung in das Thema gegeben sowie auf Erkenntnisse aus der Fachliteratur näher eingegangen. Danach wird der erwartete Nutzen des Managers mit Hilfe komparativ-statischer Effekte anhand eines Modells, welches den Manager vor die Wahl zwischen einem Schuldvertrag ohne Covenant-Regelung, einem strikten Covenant Vertrag sowie einem Covenant Vertrag mit Option auf Nachverhandlung nach Verstoß gegen Klauseln stellt, analysiert. Das Modell veranschaulicht, dass die Verwendung von Covenants in Schuldverträgen durchaus vorteilhaft für den Manager sein kann, insbesondere wenn die Möglichkeit auf Nachverhandlungen besteht.

1. Introduction

This master's thesis discusses covenants within debt contracts and their effects on the involved parties. A debt contract is a contractual agreement between a lender and a borrower. The borrower requires funds, that are provided by the lender, and commits to repay the debt, usually with interest. Conditions surrounding the amount of debt, interest rates or debt maturity are set within a debt contract. Debt contracts include the borrower's promise, in the form of covenants, to repay interest and principal payments. Furthermore, covenants may include promises regarding the borrower's behaviour, such as refraining from paying excessive dividends to shareholders or promises regarding performance like maintaining a minimum firm value (Chava and Roberts 2006, p.6). In case these contractually agreed promises are broken, the lender has the option to sanction the borrower. Alternatively, the lender can decide to sustain the existing contract through a waiver or adapt certain aspects of the contract via renegotiations.

The thesis is divided into two main parts. In the first part I give an overview on how covenants in debt contracts are described in the relevant literature. First an introduction to the topic is provided, explaining the initial situation surrounding the implementation of debt covenants. Debt contracts create relationships between lenders and borrowers leading to possible conflicts. Such conflicts can stem from agency problems and asymmetric information with debt covenants presenting a mechanism to mitigate these issues. To increase the understanding of how covenants work, a summary on the classification and characterization of debt covenants is presented followed by a depiction of the consequences of a covenant breach and the option lenders have to deal with it. One of the main objectives of this thesis is to analyse in which cases it can be beneficial for the firm's manager to transfer decision rights over an investment project to the debtholder. The thesis aims to elaborate on the managers' preferences regarding debt covenants and why they might favour their implementation in debt contracts. Managers are willing to accept more restrictive covenant contracts in prospect of a waiver or renegotiations. Empirical studies indeed show that covenant violations are frequently waived or renegotiated following a technical default (see Beneish and Press 1993; Gopalakrishnan and Parkash 1995; Chava and Roberts 2006; Garleanu and Zwiebel 2009). This, inter alia, shall be illustrated in the second part of the thesis, using an analytical model.

The model is based on the working paper by Laux and Laux (2020) and designed around various parameters which are then analysed by comparative statics. Three different types of contracts

are offered to the firm's manager. One without covenants a second with a strict covenant and the third also including strict covenants but with the prospect of renegotiations following a covenant violation. In order to analyse the contract with the option to renegotiate, a second signal providing further information about the project's quality is implemented. For each contract the effects of a change in parameters regarding the face value of debt and the manager's expected utility are explored. Debt covenants in the model are contingent on accounting-based information represented by a report published by the firm. Covenant violation leads to loss of control for the manager, in the model simplified as the right to decide whether the investment project is continued or liquidated. The manager has to weigh up the costs and benefits of each contract, a trade-off between a potential loss of the decision right over the project continuation and lower debt repayment due to reduced risk for the lender.

The model shows that a debt contract including covenants, reduces the debt repayment and makes financing less expensive for the firm. Additionally, creating a trustworthy environment, in the case of this model by enhancing the reliability of the reporting system, further reduces the demanded repayment. Hence, the implementation of covenants in debt contracts – besides offering advantages to the lender by providing the opportunity to intervene in the project execution – can be beneficial for the manager as well particularly in presence of the option to renegotiate the debt contract after a covenant violation. Finally, a table containing the effects of each parameter is attached at the end of the thesis.

2. Literature Review

2.1 Debt Covenants

When a firm decides to acquire debt, e.g., to implement an investment opportunity, a suitable lender needs to be found. This future relationship between the lender and the firm holds potential conflicts which are regulated within a debt contract. A debt contract as described by Sridhar and Magee (1997, p.225) determines the allocation of decision and property rights between the involved parties, contingent on future actions and events. Naturally, lenders are aware that the firm's actions can be detrimental to them and thus, in an efficient market, unbiased forecasts of the effects of such future actions are already priced within the debt contract (Smith 1993, p. 289).

Conflicts between lenders and firms arise through information asymmetries and agency problems. This includes devaluation of the existing debt by the firm issuing more debt of equal or higher priority (claim dilution) or transferring wealth from debtholders to stockholders by switching from safer to riskier investments (asset substitution) as well as other forms of opportunistic behaviour (c.f. Nash, Netter and Poulsen 2001, pp.203). In order to minimize agency costs and negative effects of information asymmetries, covenants can be imposed in debt contracts restricting firms to engage in certain activities or obliging them to satisfy a variety of financial constraints. Debt covenants can be linked to accounting information restricting the firm's leverage ratio, excessive dividend payments or maintaining a certain level of net worth among other restrictions and obligations (Gopalakrishnan and Parkash 1995, pp.13; Chava and Roberts 2006, p.6). Hence, debt covenants serve primarily to protect debtholders from possible activities on the firm's side that could transfer wealth from them to shareholders or other debtholders (c.f. Garleanu and Zwiebel 2009, p.749).

Nikolaev (2010, p.138) points out that in order for debt covenants to be able to mitigate conflicts between lenders and borrowers, a functioning accounting system is essential to recognize deteriorations in the firm's economic performance and subsequently detect possible covenant violations. This is affirmed by Bozanic (2016, pp.823) who finds that unwanted actions are reduced when accounting-based covenants are used in combination with reliable financial reporting systems, creating a trustworthy environment. Accounting systems contribute to increasing debt covenants' contractibility, i.e., their observability and verifiability, thus, helping them to provide an effective monitoring tool.

Dependent on the covenant contract design, even financially healthy companies can find themselves faced with a covenant violation. This can lead to a shift in decision rights, restraining the usually better-informed manager from making decisions that increase the firm value and resulting in manager's inability to follow up on promising investment opportunities or in failure to abandon unproductive assets. Hence, the firm's manager faces a trade-off between the costs and benefits of debt covenants, namely reduced costs of debt, by giving the lender the option to intervene in case of opportunistic behaviour, and reduced flexibility, regarding potential future investment projects and their financing (Nikolaev 2010, p.142; Smith 1993, p.289).

The perception of debt covenants in analytical literature has slightly changed over time as Christensen and Nikolaev (2012, p.76) annotate. While classic literature describes covenants as mechanisms addressing agency problems by restricting managerial behaviour, more recent papers view them as tools that allow lenders to renegotiate the terms of a debt contract by threatening contract termination after an accounting-based covenant violation.

2.2 Classification of Debt Covenants

In the relevant literature debt covenants are classified in various ways. Smith (1993, p.290) divides debt covenants that rely on accounting numbers in two groups: affirmative or positive covenants and negative covenants. Positive covenants aim for the firm's observance of particular levels of accounting-based ratios, such as a minimum net worth or working capital. Negative covenants, on the other hand, rely on limitations of specified investment and financing activities which can include restrictions on dividend payments or the issuance of additional debt. Hence, positive covenants are setting thresholds that need to be maintained while negative covenants restrict certain actions.

Nikolaev (2010, p.139) and Reisel (2014, pp. 254) follow a different approach in categorizing debt covenants. They organize debt covenants in three groups based on their functional role: restrictions on investment activities and asset sales, financing-related restrictions, and payout-related restrictions. Restrictions on investment activities include asset sales covenants and merger covenants, both of which aim to mitigate the asset substitution problem. Asset sales covenants usually demand that assets are sold at fair market value and often additionally limit leverage by requiring that earnings made from those sales are used to repay outstanding debt. Merger Covenants, on the other hand, restrict merger with another entity. Financing-related restrictions often involve covenants that limit the issuance of future debt or sale-leaseback transactions. The latter is a way to raise capital by selling a certain asset and leasing it afterwards for an agreed rate. Both of these types of covenants target to mitigate claim dilution as well as agency problems that may arise from suboptimal investment decisions (Reisel 2014, p.224). Finally, payout-related restrictions are assigned to two subcategories. The first one includes covenants which restrict dividend payments to shareholders and thus make the transfer of wealth from debtholders to shareholders more difficult. The other, contains covenants that restrict payments other than dividends, such as repurchasing shares or repayment of subordinated debt. Reisel (2014, p.255) finds in a large sample of bond contracts that almost all of them contain financing-related restrictions followed by a slightly smaller number of

restrictions on investment activities and asset sales. About half of the bond contracts use payout-related restrictions.

Christensen and Nikolaev (2012, pp.76) proceed in a similar way to Smith (1993) by organizing debt covenants in capital covenants and performance covenants. Capital covenants rely on balance sheet information about the sources and use of capital. They aim to mitigate agency problems by aligning borrower and lender interests through restrictions on the company's capital structure. Performance covenants, conversely, serve as a warning system which is activated in case the company's performance declines and conflicts between shareholders and debtholders become urgent (p.106). After a performance covenant breach the lender attains control and has the option to restrict managerial actions. They rely on income statement information but can use additional balance sheet data to assess the company's performance. Christensen and Nikolaev (2012, p.77) predict that performance covenants are related to an increasing number of renegotiations and waivers after a covenants violation due to their warning system characteristics. Further they find that financially constrained firms prefer the use of performance covenants over capital covenants since restrictions on their capital structure are more costly for them. However, capital covenants are preferred as debt covenants become less contractible, because costly control transfers are expected to increase with performance covenants (p.106).

When negotiating debt contracts which include covenants, determining the right tightness is essential in order to enable covenants to work efficiently. Covenant tightness or strictness refers to how close covenant thresholds are set to the company's current accounting values (Chava and Roberts 2006, p.6). Tight covenants increase the probability of a covenant violation since they leave less room for performance fluctuations. Chava and Roberts (2006, pp.13) document that the average covenant threshold is initially set remarkably tight and thus covenant violation occurs in a significant number of instances. Garleanu and Zwiebel (2009, p.750) emphasize that the firm's consent to implement tight covenants can be seen as signal of their intention to avoid asset substitutions and that frequent renegotiations are a direct consequence of covenant tightness. They argue that, during most renegotiations, conditions which the covenants rely on are relaxed and seldomly tightened. This is supported by Smith (1993, p.302) who states that strict covenants encourage a dynamic interaction between the borrower and the lender. Thus, enabling the lender to monitor and receive access to new information, e.g., regarding performance forecasts, provided by the borrower after a covenant breach.

2.3 Debt Covenant Violations and Technical Default

While covenant violation describes any form of covenant breach, technical default covers covenant violations other than missing out on interest or principal payment (Chava and Roberts 2006, p.1). Hence, the term technical default covers covenant breaches caused by firms' not maintaining the agreed performance standards and ratio thresholds or performing actions that might not be tolerated such as dividend payments. Smith (1993, p.292) finds that affirmative covenants like net worth, working capital or leverage ratios are more frequently violated than negative covenants. Furthermore, technical default is often related to multiple covenant violations. This is because accounting numbers, which debt covenants are based on, are interconnected, such that a lower company performance results in multiple accounting measures deteriorating.

Covenant violations are associated with costs. Beneish and Press (1993, pp.234) observe refinancing costs, resulting from lenders raising interest rates or shortening maturities, restructuring costs, arising from lenders' demand to repay the debt fully or partially, as well as costs arising during the process of renegotiating; all of them following technical defaults. However, those costs vary dependent on the lender's response to accounting-based covenant violations. Basically, lenders have three different options following a covenant breach: they can waive the breach, initiate renegotiations to continue the debt contract under new terms or terminate the debt agreement and demand repayment of the outstanding debt (Chava and Roberts 2006, p.7). Contract termination and full repayment of the outstanding debt are rare, lenders in most cases prefer to waive or renegotiate the debt contract in order to minimize costs and keep the debt relationship intact (Gopalakrishnan and Parkash 1995, p.20). Expectations over the lender's reaction towards a technical default, also influence the borrower's actions before and after signing the debt contract. Dependent on whether the firm can expect a waiver/renegotiations or not, the firm's manager has an incentive to alter accounting methods to a avoid covenant violation. The prospect of a waiver or renegotiations can thus influence managerial behaviour (Chen and Wei 1993, p.231). Jha (2013, p.381) finds that managers tend to manipulate earnings upwards before violation, when the firm is in a good financial position and thus expecting a waiver and downwards for a financially distressed firm as a waiver is unlikely. This process of altering accounting methods to avoid technical violation is called debt covenant hypothesis (p.370). A negative side-effect of this is that lenders might not be able to distinguish between truthful reporting and overreporting, in the sense of a manipulation of the firm's performance, which could lead to mutually beneficial projects not being implemented.

However, reporting methods that diminish these uncertainties can mitigate this problem and besides that, further reduce debt rates (Sridhar and Magee 1997, p.241). Concerning the ex-ante managerial behaviour, the prospect of renegotiations can influence the debt contract's design as borrowers might be more willing to accept tighter covenants, since a violation is not necessarily followed by contract termination and high costs (Roberts 2015, p.77).

2.4 Waivers and Renegotiations

As mentioned above a major reason for implementing covenants in a debt contract is to overcome informational asymmetries. Often these asymmetries are related to wealth transfers from debtholders to shareholders or to the outcome of investments and enhanced by lack of transparency within the firm (Garleanu and Zwiebel 2009, pp.772). Even though the firm is regarded to be the better-informed party, empirical studies show that firms' managers often relinquish control contingent on debt covenants in order to signal congruency of interests (Dessein 2005, p.2513). The firm is inclined to give up control rights given the prospect of a waiver or renegotiations, supplying the lender with information in the process and, thus, mitigating informational asymmetries. Roberts (2015, pp.61) shows that a typical bank loan is renegotiated five times on average during its contractual period. He emphasizes that renegotiations facilitate the monitoring process ex-post and thereby enable to dynamically complete the initially incomplete debt contract, giving both parties the incentive to engage in renegotiations. It is for this possibility to renegotiate contract terms, that borrowers are willing to accept tighter covenants in the first place. Garleanu and Zwiebel (2009, p.771) confirm this by showing in their model that covenant tightness increases with lower renegotiation costs.

Renegotiation costs, which consist of costs for rewriting the contract such as lawyer fees and managers' time, differ significantly for private, e.g., bank loans, and public debt, e.g., bonds (Beneish and Press 1993, p.235; Nikolaev 2010, p.138). Due to diffuse ownership complicating coordination between the parties and public lenders entirely relying on publicly available information, public debt tends to be related to higher renegotiation costs as compared to private debt. Thus, in order to reduce the frequency of renegotiations, public debt loans often contain more covenants restricting actions rather than the firm's performance, while private debt loans rely on more tight covenants (Nikolaev 2010, p.139). Bozanic (2016, p.824) points out that, while private debt is renegotiated after a covenant breach, public debt is often renegotiated before a technical default through consent solicitation. In this process public lenders are

informed about the changes that the borrower intends to implement in the debt contract, in exchange for a consent payment.

Violation of accounting-based covenants can further result in losses in market value and shareholder wealth. Beneish and Press (1993, p.234) estimate the average decline in market value of the firm's equity to range between 1 - 2% immediately after the announcement of a technical default. This loss as well as other costs related to technical default can be mitigated for firms that obtain a covenant waiver.

3. Model

3.1 Overview

The model in this master's thesis is grounded on the working paper by Laux and Laux (2020), *Accounting Conservatism and Managerial Information Acquisition*. Some pivotal adaptions and simplifications have been made in order to correspond to the main questions addressed in this thesis.

We consider a bilateral relationship of two risk-neutral parties: a manager who acts in the interest of the firm's owners and a lender. A new investment opportunity for the firm arises in the form of a project that needs to be financed. The project is fully financed by debt. A debt contract stipulates the terms and decision rights related to the project. Since the lending market is competitive, the lender is willing to finance the project if she is expected to break-even in equilibrium. After settling on a financing contract, the manager initiates the project. In a second stage the firm's accounting report is published. The report is supposed to provide some information on the project's quality but can vary in accuracy. The party in charge of the decision right makes the decision on whether the project should be continued or liquidated based on the accounting report. Whether this party is the manager, or the lender depends on the financing contract, initially chosen by the manager. Continuing the project leaves the opportunity to yield cash flows in case of a successful outcome. It further creates a non-monetary private benefit for the manager for concluding the project, irrespective of its success. Nevertheless, continuation also maintains the risk of resulting in a low-quality project which generates no cash flows at all. In contrast, liquidation of the project assures the lender gets parts of her investment refunded but leaves the manager empty-handed. The manager will therefore always prefer continuing the project, while for the lender, the efficient decision is dependent on the accounting report.

The first two debt contracts we will be looking at are the no covenant contract and the strict covenant contract. Later on, a modified version of the strict covenant contract will be introduced. This modified version gives the lender the option to initiate renegotiations in case the accounting report implies that the project is of low quality. Further soft information might indicate that continuing the project is the better option for the lender, rather than liquidating it.

The following schematic representation gives a simplified depiction of the model.

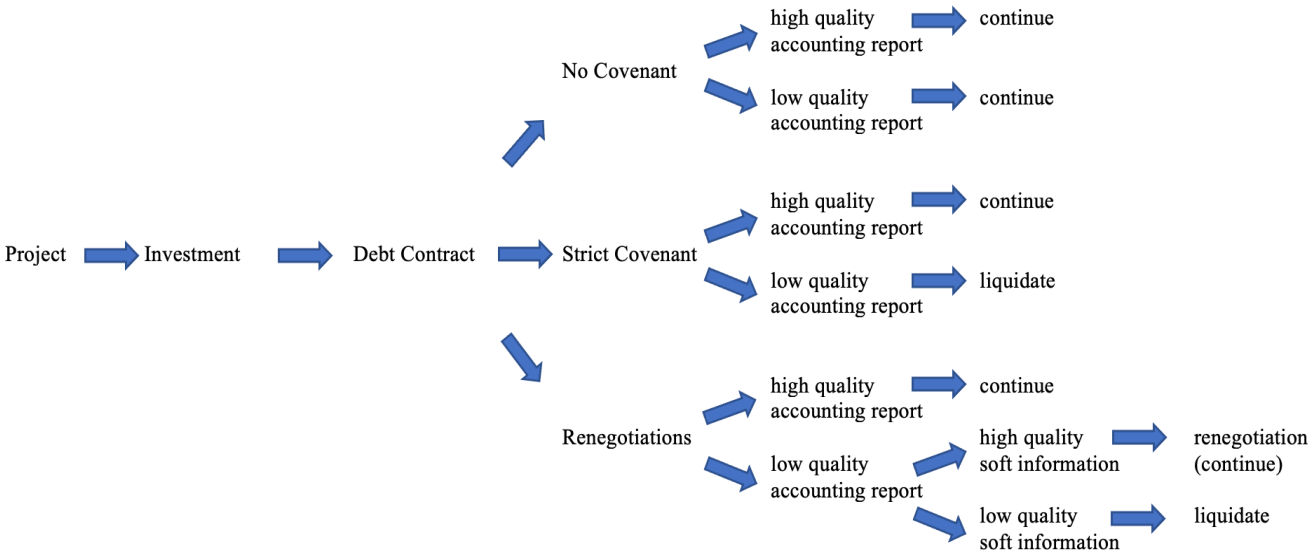

Figure 1: Schematic depiction of the model.

3.2 Setup

We have already established that the manager needs financing for a new investment project. An initial investment outlay of $I > 0$ is therefore required. The two parties, i.e., the manager and the lender, agree on a debt contract with face value D. The face value of debt D characterizes the amount that the lender gets repaid after the completion of a successful project. Therefore, D acts as a compensation for the initial investment I with the risk of failure considered. Ex-ante there is incomplete information about the efficiency of the project. The outcome, in case the project is continued rather than liquidated after receiving the accounting report, is dependent on the project's quality $\theta \in \{\theta_l, \theta_h\}$. The ex-ante probability that the project is successful and has high quality, i.e., $\theta = \theta_h$, is common knowledge and given by the probability $q \in (0, 1)$.

3.2.1 Accounting Report

The accounting report $R \in \{R_l, R_h\}$ provides information about the quality of the project θ. This information consists of the following conditional probability

$$\Pr(R_h|\theta_h) = \Pr(R_l|\theta_l) = \lambda, \text{ where } \lambda > 0.5. \quad (1)$$

$\Pr(R_h|\theta_h)$ describes the probability of receiving an accounting report that indicates a successful project given the project actually has high quality. By analogy $\Pr(R_l|\theta_l)$ characterizes the probability to obtain a low accounting report given the project has low quality. Therefore, λ is a unit of measurement for the accounting report's accuracy and exogenously given in our model. In order to make sure that λ has validity and a high report R_h is viewed as positive news while a low report R_l has a negative connotation, λ is set to be higher than 0.5. By applying Bayes' theorem, the current probability that the project has high quality conditional on a report R is

$$\Pr(\theta_h|R) = \frac{q\Pr(R|\theta_h)}{q\Pr(R|\theta_h) + (1-q)\Pr(R|\theta_l)}, \quad (2)$$

where the denominator marks the unconditional probability to receive a report. The conditional probability of high quality can change after observing possible additional soft information, which will be introduced later in the model. After applying λ and $R \in \{R_l, R_h\}$ to the formula above we get

$$\Pr(\theta_h|R_h) = \frac{q\lambda}{q\lambda + (1-q)(1-\lambda)} \quad \text{and} \quad \Pr(\theta_h|R_l) = \frac{q(1-\lambda)}{q(1-\lambda) + (1-q)\lambda} \quad (3)$$

respectively.

3.2.2 Cash Flows

A successful project, i.e., a project with high quality θ_h, generates cash flows of $X > I$. In order to make the project a reasonable investment we set the cash flows X to be exogenously given and larger than the initial investment I. Those cash flows can then (partially) be utilized to repay the debt. If the decision is made to continue the project and it fails, i.e., it turns out to have low quality θ_l, the cash flows are equal to zero. In addition to possible cash flows X the manager

derives private benefit $B > 0$ for managing the project in case it is completed. Manager's private benefits of continuing the project can originate from gains in reputation and psychic benefits of empire building (Scharfstein and Stein 2000, p.2541). The private benefit B in this model is non-monetary and attained regardless of the project's quality θ. In consequence the manager always prefers continuation over liquidation. Liquidating the project after the accounting report is published, yields cash flows of $L < I$ which is insufficient to fully repay the debt. The liquidation value L is therefore passed over entirely to the lender, leaving the manager with no returns from the project – neither in the form of a portion of L nor the private benefit B. All above mentioned cash flows are common knowledge.

For the purpose of making it more intelligible why the lender would want to continue the project after observing a positive accounting report R_h and liquidate after a negative report R_l, we put up the Assumption 1.

Assumption 1:

$$\Pr(\theta_h|R_l)\, X \;<\; L \;<\Pr(\theta_h|R_h)X \tag{4}$$

Assumption 1 implies that in case the accounting report indicates high quality, i.e., $R = R_h$, no party has interest in interrupting the project. On the other hand, if the report suggests that the project has low quality, i.e., $R = R_l$, the lender prefers to liquidate the project in order to achieve higher expected cash flows. Since the accounting report is the only source of information for the lender, it is reasonable to base the decision of whether the project should be continued or liquidated, on the report.

3.2.3 Timeline

The order of events unfolds as follows. At stage 0, the manager detects an investment opportunity, i.e., the project, and initiates the financing process. In the following stage 1, the manager and the lender agree on a debt contract with face value of debt D. Immediately after the agreement, the lender provides capital I and the project is put into action. At stage 2, the accounting report R is published, disclosing imperfect information about the quality of the project θ. Based on the accounting report the party in control of the decision right, chooses whether the project is continued or liquidated. The party entitled to make this decision is determined by the debt contract. In case the project is liquidated the lender receives the entire

liquidation value L and the manager comes out empty-handed. Finally at stage 3, it becomes evident whether the project is of high quality θ_h or low quality θ_l, yielding cash flows X or zero respectively. In both case the manager obtains the private benefit B for managing the project.

3.2.4 Debt Contracts

The contract on which the two parties must agree on is a zero-coupon debt contract with face value D. We assume the lender finds herself on a competitive lending market and therefore accepts financing the project if she breaks-even in equilibrium. At first, we consider two types of debt contracts: the no covenant contract and the strict covenant contract.

When the no covenant contract is chosen in stage 1, the manager keeps the decision right on the continuation decision over the investment project, independent of the accounting report's quality. The manager stays in control of the project and favours continuation over liquidation in any case in order to achieve the private benefit B.

If, on the other hand, the two parties agree on a strict covenant contract the decision right shifts towards the lender when the covenant is violated. Violation occurs if in stage 2 a low-quality accounting report R_l is published. In this case the decision right is transferred from the manager to the lender, who receives control over the project, giving her the right to abandon it. Following Assumption 1 the lender will decide to liquidate the project, in order to maximize her total expected cash flows. In absence of a covenant violation, i.e., the accounting report indicates high quality R_h, the manager remains in control and proceeds equivalently to the no covenant contract scenario. Hence, the covenant is based solely on the accounting report R.

Both parties, the manager as well as the lender, rely their beliefs based on Bayes' Theorem. Accordingly, the solution of the analysis is a subgame-perfect Bayesian Equilibrium. Optimal decisions are made given the information the manager and the lender have at their disposal. If new information occurs beliefs are updated, and decisions adjusted correspondingly.

3.2.5 Differentiation to Laux and Laux (2020)

As mentioned above the model in this thesis has similarities to the model in Laux and Laux (2020). Nevertheless, differences are evident in some crucial respects. Regarding the model

structure, and especially the accounting report, Laux and Laux (2020) differ by defining an additional parameter c which reflects the degree of accounting conservatism (p. 9). Since they put an emphasis on analysing accounting system conservatism, which involves a "*trade-off between timeliness and precision*" (p. 2), the parameter c is needed to examine the effects of conservatism. Laux and Laux (2020) discuss whether it is optimal for an accounting system to be more conservative – it detects projects with low quality more often, but also increases the probability of a false alarm, meaning that actual high-quality projects are sometimes marked as low-quality projects by the report – or more liberal and only reports low-quality when the system is sufficiently accurate (p. 2). Therefore, their analysis focuses on the optimal choice of c. Another major aspect of their analysis, which is discussed differently in our model, is the additional information concerning the project's quality. In Laux and Laux (2020) the manager can exert effort to increase the probability of obtaining this additional information (p. 10). However, in our model the additional information is represented by a signal which is not related to the manager's effort nor do further costs for acquiring the signal incur. The information from the signal in this model can be provided by the manager as well as being inferred from the environment. We assume such a signal is received in any case provided a renegotiation option is included in the covenant contract. The informational value of this signal is given exogenously in our model. The additional information will be discussed in detail later when renegotiations are introduced. Finally, Laux and Laux (2020) do not examine no covenant contracts at all while strict covenant contracts are not discussed separately but as an initial position for waivers and further renegotiations. Conversely, those two types of contracts and the expected utilities derived from them, play a significant part in this thesis.

4. Analysis of the Benchmarks

4.1 Benchmark 1: No Covenant Contract

Without covenant regulation the manager remains in control of the project, regardless of the accounting report's quality. The optimal decision for the manager will always be to continue in order to attain the private benefit B. The lender's expected payoff in the no covenant contract scenario equals $qD - I$. On the return side, this translates to receiving a repayment with the face value of debt D given the belief q of carrying out a successful project. In order to finance the project, the lender initially provides the investment I. Due to the competitive lending market, the lender is satisfied with breaking-even in expectations over the payoff.

The corresponding face value of debt therefore is

$$D_N = \frac{I}{q}. \tag{5}$$

Given the two parties have agreed on a no covenant contract the lender is willing to accept financing the project if the manager promises a repayment in the amount of D_N in return. The face value of debt D_N equals the initial Investment I over the probability q that the project has high quality.

Per definition the manager stays in charge of the decision right over the project when the parties have initially agreed on the no covenant contract. As stated above he remains in control regardless of the accounting reports assessment of the project and will favour continuation in any case in order to secure private benefit B. The manager's expected payoff in this scenario is therefore crucially dependent on the ex-ante probability q while being unaffected by the accounting report. Hence, the manager's ex-ante expected utility is

$$U_N = q(X - D_N) + B\,.$$

In case the project turns out to be of high quality, the manager yields cash flows in the amount of X. A part of these cash flows is then used to settle the outstanding debt towards the lender. As mentioned earlier the two parties agree upon the repayment D_N in stage 1 when the contract is negotiated. Since the manager will always select to continue the project, private benefit B is attained irrespective of the project's quality θ. After applying the face value of debt D_N to the formula above, we get

$$U_N = qX + B - I \tag{6}$$

as the manager's expected utility in case a no covenant contract is signed. Since the lender breaks even in expectation this utility equals social welfare. Again, it is evident that the manager yields the non-monetary private benefit B in any state of the world. An initial investment I must be carried out in order to finance the project, while the cash flows X depend on the ex-ante probability q that the project will be successful. We further anticipate the manager to decline signing the contract unless $qX > D$ is fulfilled. Otherwise, his expected payoff is too low to

even reimburse the lender for the negotiated repayment, let alone make a profit from carrying out the project. Therefore, the manager would not be willing to agree on those terms in the first place and no contract conclusion occurs.

4.2 Benchmark 2: Strict Covenant Contract

Under a strict covenant contract the party entitled to decide over the project is dependent on the accounting report. Given a high-quality report R_h, the decision right stays with the manager. His optimal action does not differ from the no covenant contract scenario. Hence, the manager will decide to continue the project to achieve private benefit B and possibly cash flows X in case the project has high quality indeed. The difference between the contracts becomes evident when the covenant is violated. A low-quality report R_l at stage 2 implies a covenant violation and leads to the lender seizing control over the project. The lender's expected payoff in this case is

$$q\lambda D + q(1-\lambda)L + (1-q)\lambda L - I.$$

The optimal decision for the lender is to liquidate the project after observing a low-quality accounting report in order to secure the liquidation value L. Assumption 1 makes sure that the lender's expected payoff after a low-quality report is less than the liquidation value L. Therefore, liquidating the project is her optimal equilibrium decision. Again, the lender breaks even in expectation. Hence, the value of debt is

$$D_S = \frac{I - (q+\lambda)L + 2q\lambda L}{q\lambda}\ . \tag{7}$$

Compared to the face value of debt in the no covenant contract scenario D_N it is apparent that D_S is also affected by the initial investment I and the project's quality q. Additionally, the liquidation value L and the informative value of the accounting system λ feature in the computation of the repayment D_S. This is due to the shift in control right, enabling the lender to liquidate the project in case of a covenant violation. Thus, with a strict covenant contract the outcome varies with the accounting report.

Proposition 1. *Given assumption 1 is fulfilled, the face value of debt with a no covenant contract D_N is always higher than the face value of debt with a strict covenant contract D_S.*

Proof for Proposition 1 is provided in the appendix. The lender is willing to accept a lower repayment when the two parties agree to implement strict covenants in the debt contract as opposed to a debt contract without covenants, regardless of the other parameters. Hence, a strict covenant contract makes financing less expensive for the manager.

The deviation in the face values of debt between the two contracts affects the manager's expected utility as well. In the strict covenant contract scenario, the manager's expected utility, therefore, differs from the manager's expected utility in the no covenant contract scenario. When the manager and the lender agree on a strict covenant debt contract, the accounting report must be taken into account, since it legitimizes a possible shift in control. When a positive accounting report R_h, which indicates a high-quality project, is observed, the manager retains control over the continuation decision. His decision will be to continue the project, identical to the no covenant contract scenario. The motivation for this decision is again to attain private benefit B and is additionally encouraged by the high-quality accounting report R_h.

If on the other hand a low-quality report R_l is published, the lender is granted the decision right. R_l implies a violation of the strict covenant contract and therefore qualifies the lender to take over control. As stated above the lender's decision will be to liquidate the project, contrasting the manager's preference to continue in any case. The reason for this is that the lender at least wants to secure the liquidation value L to avoid coming away empty-handed. The manager's expected payoff is therefore dependent on whether the strict covenant contract is violated or not, i.e., whether the manager stays in charge of the decision right over the project continuation or has to pass it on to the lender. Accordingly, the manager's ex-ante expected utility in the strict covenant contract scenario is

$$U_S = q\lambda(X - D_S + B) + (1 - q)(1 - \lambda)B \, .$$

It is evident that in case the project is continued, i.e., the manager stays in control of the decision right, he receives a return or benefit from it at stage 3. If the project is successful, i.e., it has high quality θ_h, he collects cash flows in the amount of X as well as the private benefit B. The repayment D_S, codified in the strict covenant debt contract, must be submitted to the lender. A project with low-quality θ_l is still continued if the accounting report is not accurate enough and mispredicts its quality, i.e., a high-quality report R_h is published. In this case the manager

keeps the decision right. Since the project is in fact of low-quality it yields no cash flows, but the manager attains the private benefit for carrying it out.

By contrast, when the lender takes over control due to a covenant violation and liquidates the project, the manager is left without any return, neither in the monetary form of cash flows X nor in the non-monetary form of the private benefit B, regardless of the project's actual quality. After substituting the face value of debt from the strict covenant contract D_S in the formula we get

$$U_S = q\lambda X + [q\lambda + (1-q)(1-\lambda)]B + (q + \lambda - 2q\lambda)L - I \tag{8}$$

as the manager's expected utility in the strict covenant contract scenario. Again, this equals the social welfare given the lender breaks-even in expectation. In this case the utility is split into four parts. The project only yields cash flows X in case it has high quality, and the decision is made to continue, i.e., a high-quality accounting report R_h is published in stage 2 and the manager stays in control over the continuation decision. The second part is the manager's private benefit B. As opposed to the no covenant contract, the achievement of B is dependent on the probability q of having a successful project with quality θ_h and the accuracy of the accounting report λ. An additional parameter which plays a role in calculating the manager's utility in the strict covenant contract scenario is the liquidation value L. Even though L is awarded to the lender, it still affects the manager's utility by influencing the face value of debt D_S. This will be discussed later in further detail. Similar to the private benefit B, the expression of the liquidation value L is dependent on the probability q and the accounting report's informative value λ. Once more an initial investment I needs to be conducted in order to finance the project.

4.3 Comparison of the Debt Contracts

No Covenant Contract Scenario

Considering the face value of debt D_N in (5) in the no covenant contract scenario it is evident that the only two parameters which have an influence on D_N, namely I and q, work in opposite directions. An increased initial investment I leads to a constant increase in the face value of debt D_N. This translates to a higher repayment for the lender as a response to the higher initial investment needed for the project to be implemented. Conversely, an increased ex-ante probability q that the project has high quality reduces the risk of failure and increases the belief

in the project leading to the lender demanding a lower repayment D_N from the manager in order to break-even in her expectation.

Strict Covenant Contract Scenario

Analysing the effects of a change in parameters becomes more demanding when the two parties agree on a strict covenant contract. A higher number of parameters influence the face value of debt D_S (7) as well as the outcome of the continuation decision, since the decision right can now shift dependent on the accounting report. On the terms of the strict covenant contract this decision might differ to the one made in the no covenant contract scenario under the same conditions, uncovering new parameters to take into consideration.

Accuracy of the Reporting System λ

To examine the effect that a change in the accuracy of the reporting system would have on the face value of debt, we take the first derivative of D_S (7) with respect to λ and get $\frac{\partial D_S}{\partial \lambda} = \frac{Lq-I}{q\lambda^2} < 0$. This term is negative since $0 < q,\ \lambda < 1$ and $L < I$.

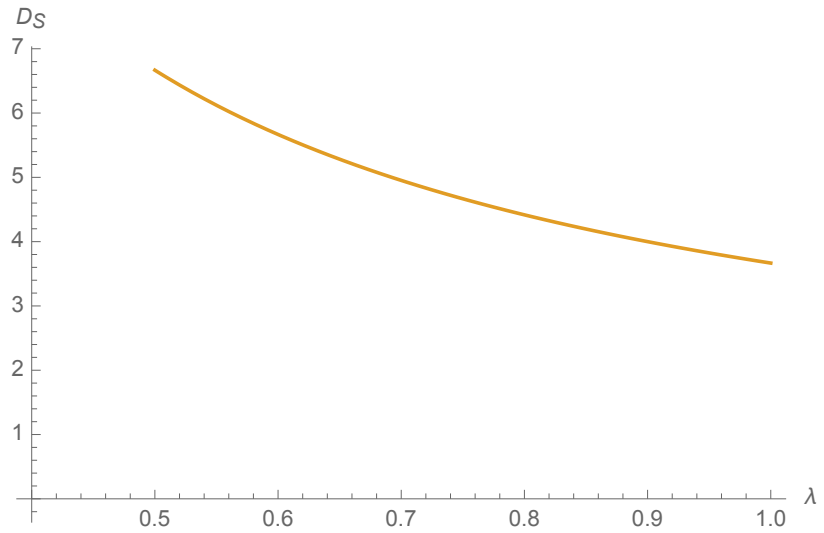

Figure 2: Repayment D_S decreases with reliability of the reporting system λ.
D_S=Face value of debt with a covenant contract, λ=Accuracy of the reporting system
I=3, L=2, q=0.6

The more reliable a reporting system is the less risk is imposed on a continuation decision. If the report indicates a high-quality project, the manager remains in charge of the decision right. He will continue the project, which, in case the project has high quality indeed, would also be the preferred decision for the lender. In case the report indicates low-quality, and the

covenant is violated, the lender takes over control and decides to liquidate the project. A highly reliable reporting system increases the chance for those decisions to be optimal. With a more accurate reporting system, and thus less risk, the lender is more likely to agree to a lower repayment D_S. This is shown in *Figure 2*.

The effect that an accurate reporting system λ has on the face value of debt D_S is enhanced by a lower ex-ante probability q that the project will be successful and a lower liquidation value L. Technically, we see that by taking the first derivative of the marginal impact of the face value of debt, i.e., $\frac{\partial \frac{\partial D_S}{\partial \lambda}}{\partial q} = \frac{I}{q^2\lambda^2} > 0$ and $\frac{\partial \frac{\partial D_S}{\partial \lambda}}{\partial L} = \frac{1}{\lambda^2} > 0$. If the chance of having a successful project q is decreased, it is of even greater importance for the lender to have a reliable reporting system. Otherwise, the risk of a false positive report, i.e., the accounting report R_h falsely predicting the project to be of high quality, is increased. In this case the manager would stay in charge of the decision right and continue the project, while liquidation would be the optimal decision for the lender. A low liquidation value L on the other hand increases the opportunity cost of forgoing the project for the lender in case there is a false alarm, i.e., the accounting report R_l wrongly predicts the project to be of low quality. In this case the lender would be in charge of the decision right and liquidate the project. Since the liquidation value is low, the difference between D_S, i.e., the amount the lender would receive if she continued the project, and the liquidation value L is even greater. A more accurate accounting report decreases the probability of both a false positive report and a false alarm and therefore increases the chance of making the optimal decision regarding the project continuation.

Liquidation Value L

How the liquidation value L affects the face value of debt D_S on its own can be explored analogously to λ from above. Taking the first derivative of D_S (7) with respect to L results in $\frac{\partial D_S}{\partial L} = 2 - \frac{1}{q} - \frac{1}{\lambda} < 0$. This is again negative due to $\frac{1}{q}, \frac{1}{\lambda} > 1$.

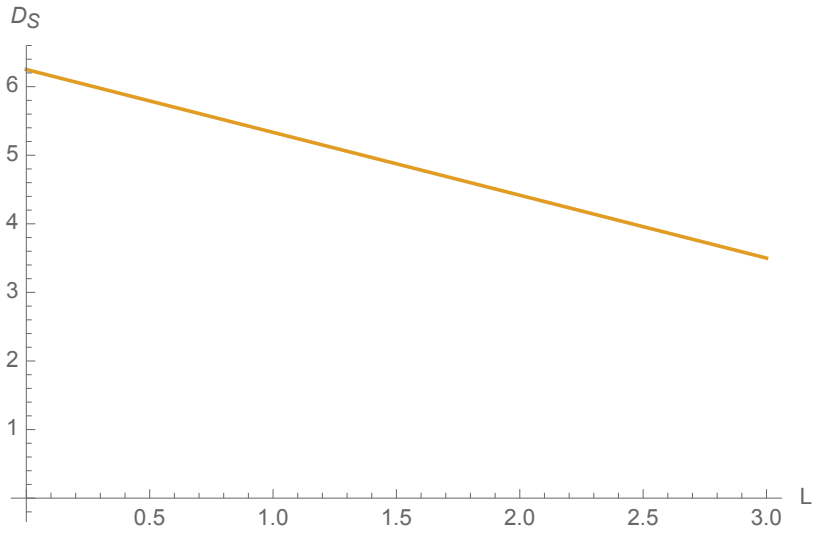

Figure 3: Repayment D_S decreases with liquidation value L.
D_S=Face value of debt with a covenant contract, L=Liquidation value of the project
I=3, q=0.6, λ=0.8

The value of the repayment D_S that the lender is asking for diminishes with increasing liquidation value L. Since a higher amount of L equals a more acceptable compensation value for a low-quality project, provided that the project is recognized as such by the accounting report, the lender is willing to accept a reduced D_S, as shown in *Figure 3*. The same applies for a high-quality project wrongfully accused of low-quality by an accounting report R_l. In this case the decision right shifts towards the lender and the project is liquidated. This may not seem as the optimal decision, nevertheless, given the knowledge available to the lender, it is. A higher liquidation value L decreases the opportunity costs arisen by liquidating a high-quality project instead of continuing it. Like above, the effect that the liquidation value L has on the face value of debt D_S can be amplified by a less accurate reporting system λ or a lower probability of a high-quality project q. Consequently, in a situation with increased risk due to a less reliable reporting system or a low initial probability of success, the value of the compensation in case the project is liquidated becomes even more important.

Ex-ante Probability of Success q

For the sake of completeness, the effect that the ex-ante probability of success q has on the face value of debt D_S shall also be briefly discussed. Taking the derivative of D_S (7) with respect to q gives $\frac{\partial D_S}{\partial q} = \frac{L\lambda - I}{q^2\lambda} < 0$, since $L < I$ and $\lambda \leq 1$.

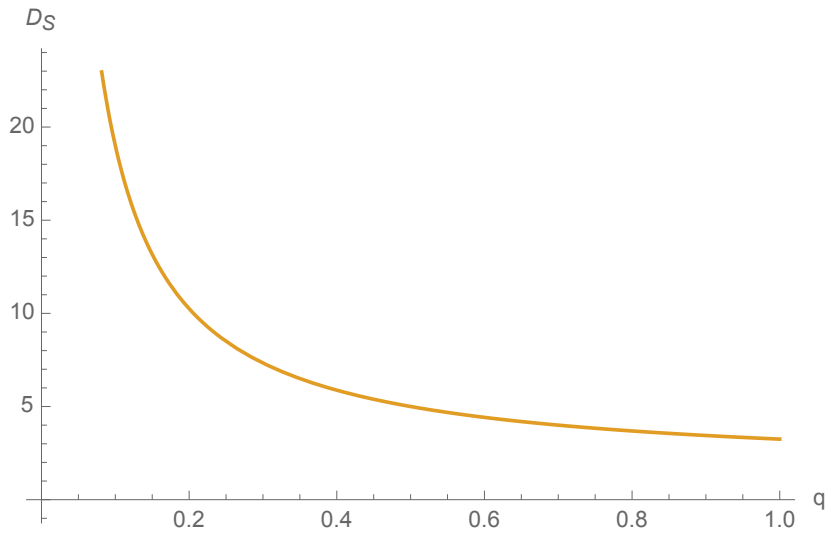

Figure 4: Repayment D_S decreases with probability of success q.
D_S=Face value of debt with a covenant contract, q=Ex-ante probability of a high-quality project
I=3, L=2, λ=0.8

Figure 4 shows that with increasing ex-ante probability of high quality q, the lender is willing to accept a lower face value of debt D_S in order to break-even in expectation, due to a higher chance of carrying out the project successfully. This effect is again positively affected by lower accuracy of the accounting report λ as well as a reduced liquidation value L. Consequently, scenarios with low λ or low L are putting more weight on the ex-ante probability of success q, increasing its effect on the face value of debt D_S.

All the effects of the above discussed parameters are amplified by an increasing initial investment I. The higher the amount at stake the more risk mitigating parameters, such as a reliable reporting system λ or a higher liquidation value L, are appreciated.

Face Values of Debt – Comparison

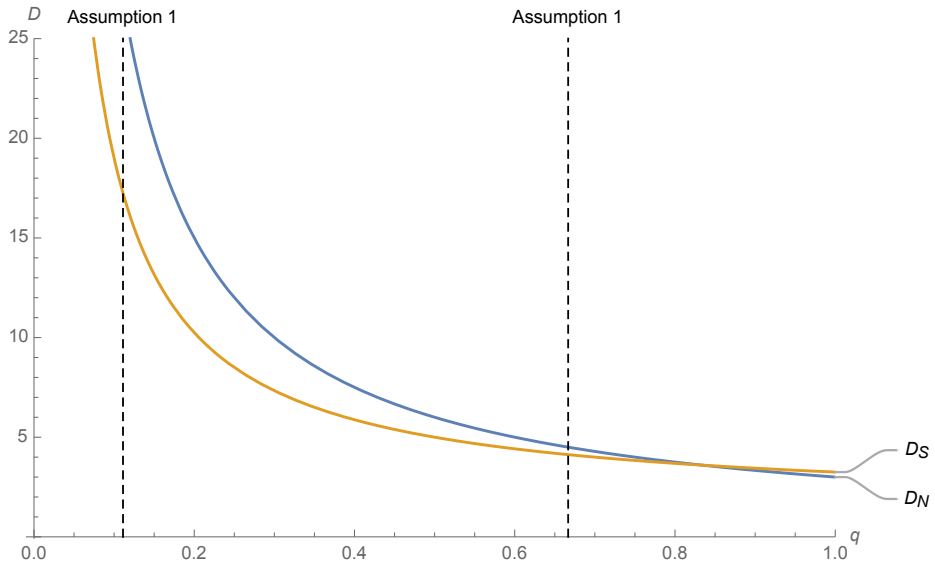

Figure 5: D_N and D_S both decrease with q, but D_N is always higher than D_S.
Assumption 1 is fulfilled in the area between the dashed lines.
D_N=Face value of debt with no covenant contract, D_S=Face value of debt with a covenant contract, q=Ex-ante probability of a high-quality project
I=3, L=2, λ=0.8

Finally, we take a look at how the two above-mentioned face values of debt compare next to each other. *Figure 5* depicts a comparison between the face value of debt D_N if the no covenant contract is signed and the face value of debt D_S when the strict covenant contract is agreed upon under the same conditions with changing ex-ante probability of success q. The area between the dashed lines marks the region where assumption 1 is fulfilled. It is evident that with increasing chance q of a high-quality project θ_h the face value of debt D is decreasing regardless which contract the parties agreed upon. Higher probability of success equals less risk for the investment and therefore the lender is willing to accept a lower repayment. The repayment that the lender is demanding is even lower in case of the strict covenant contract, since the lender obtains the option to make the continuation decision herself in case the accounting report is of low quality R_l and the covenant is violated. This option is not available to the lender with the no covenant contract. As a result, she wants to be compensated with a higher face value of debt. Consistent with Proposition 1 we see that D_N is always higher than D_S where assumption 1 applies. The lender is content with a lower compensation D_S in exchange for the option to liquidate the project in order to reduce the risk of losing out on both the repayment D and the liquidation value L in case a low-quality project θ_l is carried out to completion.

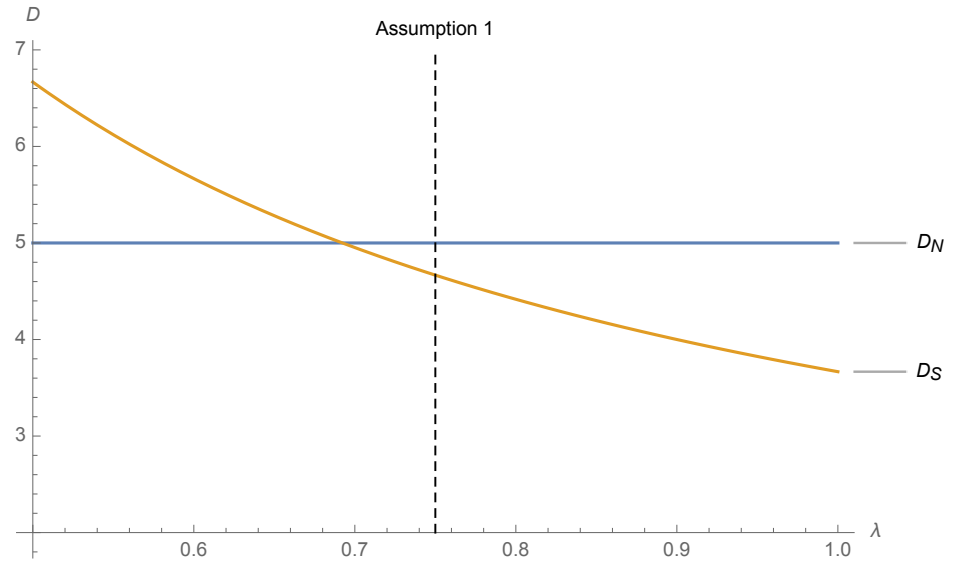

Figure 6: Higher λ increases the gap between D_N and D_S.
Assumption 1 is fulfilled on the right side of the dashed line.
D_N=Face value of debt with no covenant contract, D_S=Face value of debt with a covenant contract,
λ=Accuracy of the reporting system
I=3, L=2, q=0.6

Figure 6 shows a comparison of the two face values of debt D_N and D_S under equal conditions with changing accuracy of the reporting system λ. To the right side of the dashed line λ is high enough for assumption 1 to be fulfilled. It is evident that the face value of debt D_N in case a no covenant contract is signed, is not affected by a changing reliability of the reporting system. Unlike D_N, the face value of debt D_S does change with increasing accuracy of the reporting system. In line with Proposition 1, D_N is always higher than D_S when Assumption 1 is fulfilled. As D_S is diminishing with a more reliable reporting system, the gap between the to face values is expanding. To the right side of the dashed line, the accuracy λ of the reporting system R is high enough – and hence the risk of a false positive report, which leads to unfavourably continuing a low-quality project θ_l, low enough – for the manager to face a lower repayment D_S by agreeing on a strict covenant contract as opposed to the repayment D_N with a no covenant contract. The lender accepts a lower compensation in return for the option to receive the decision right over the project continuation in case a covenant violation occurs. It is therefore beneficial for the manager to invest in a more reliable reporting system and negotiate a strict covenant contract in order to achieve a lower repayment on which the lender is willing to agree upon.

4.4 Implications on the Manager's Expected Utility

No Covenant Contract

Similar to the comparative statics analysis of the face value of debt D_N in the no covenant contract scenario from above, the analysis of the manager's expected utility U_N (6) with the no covenant contract is straightforward. Even though compared to the face value of debt more parameters must be taken into account, the results are relatively obvious. As expected, the utility increases with an enhancing ex-ante probability q of a high-quality project θ_h. The manager profits from a higher prospect of success, which increases his chance of yielding the cash flows X at stage 3. Additionally, as discussed above, q decreases the obligatory repayment D_N which again benefits the manager and therefore inflates his utility. It is apparent that the ex-ante probability of success q and the cash flows X are directly connected to each other. The cash flows, which the manager receives in case the project is continued and of high quality, increase the expected utility by the constant factor q. Higher cash flows therefore affect the manager's expected utility dependent on the probability of receiving those cash flows and vice versa.

The manager's expected utility is of course further influenced by his non-monetary private benefit B, derived from completing the project θ. An increased private benefit, such as higher reputation or the possibility to engage in further projects, has a positive effect on the utility. This increases the likelihood of the manager's willingness to accept the contract. Unlike the other discussed parameters, the initial investment I negatively affects the manager's utility. As mentioned above, the face value of debt D_N is increased with the needed investment I for implementing the project. The higher repayment D_N decreases the expected utility since less is left for the manager, respectively the firm in which interest he acts, to consume.

Strict Covenant Contract

Analysing the manager's expected utility in the strict covenant contract scenario turns out to be a more complex task compared to the no covenant contract scenario. This is again due to the possible shift in the decision right in case the covenant contract is violated. Therefore, additionally to the other parameters previously mentioned with the no covenant contract, the accuracy of the reporting system λ must be taken into account as well as the liquidation value L. Both parameters occur in the formula for the face value of debt D_S in the strict covenant contract situation and thus play a significant role in the manager's expected utility calculation. As for the accuracy of the accounting report λ, it is substantial for the formula of the expected

utility in the strict covenant contract scenario U_S itself, not just the repayment D_S. The accuracy λ affects the decision right over the continuation decision and therefore whether the project is continued or liquidated. Other parameters, such as the private benefit B and the liquidation value L directly depend on this decision. Hence, they are heavily influenced by the characteristics of the reporting system.

Accuracy of the Reporting System λ

The effect that the accuracy of the accounting system λ has on the expected utility U_S in case the strict covenant contract is signed, is analysed analogously to the face value of debt D_S by taking the first derivate of U_S (8) with respect to λ, i.e., $\frac{\partial U_S}{\partial \lambda} = qX + (1-2q)(L-B)$. This term can be positive or negative. Both scenarios will be examined in the following.

Whether the accuracy of the reporting system has an increasing or decreasing effect on the manager's expected utility primarily depends on the ex-ante probability q.

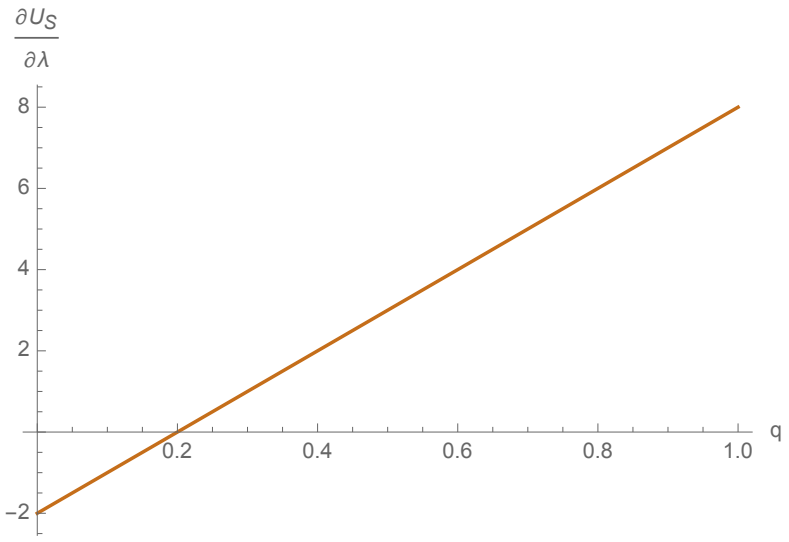

Figure 7: Dependent on q, λ has an increasing or decreasing effect on U_S.
$\frac{\partial U_S}{\partial \lambda}$=Marginal impact of the accuracy of the reporting system λ on the manager's expected utility with a strict covenant contract U_S,
q=Ex-ante probability of a high-quality project
L=2, X=6, B=4

Figure 7 shows how the sign of the first derivative of the manager's expected utility U_S with respect to λ changes with increasing ex-ante probability q. It is evident that at some point the effect shifts from negatively to positively influencing the expected utility U_S. By investigating the first derivative of U_S with respect to λ it can be shown that there are three different scenarios

where this shift occurs: 1) for the case with an underlying ex-ante probability $q \geq \frac{1}{2}$ the effect of λ is always positive. A relatively high ex-ante probability q increases the chance of completing the project successfully. Combined with an increasing reliability of the reporting system λ this raises the likelihood of a scenario where the decision right in stage 2 stays with the manager and the project is continued. In this situation the manager yields the private benefit B and additionally with higher probability the payoff X, hence his expected utility increases. 2) if $X > B$ applies, an ex-ante probability of $q \geq \frac{1}{3}$ is sufficient in order for λ to have an increasing effect on the manager's expected utility U_S. By adding the restriction that the private benefit B does not exceed the project's payoff X, the shift from negative to positive effect emerges at an even lower probability q. This is due to lower opportunity costs resulting from missing out on a smaller private benefit B in case the project is liquidated at stage 2. It is more important for the manager to be able to accurately predict the project's quality and continue carrying out a successful project to yield the payoff X than it is to risk publishing a false positive report R_h where he would receive the private benefit B while missing out on X. Hence, an even smaller probability of the project being high-quality is enough for the manager to increase his expected utility with higher λ. Therefore, a more reliable reporting system λ is desired by the manager. Finally, 3) in case the ex-ante probability is $q < \frac{1}{2}$ and $B > L + \frac{q}{1-2q} X$ applies, a more accurate reporting system λ has a negative effect on the manager's expected utility U_S. Above this threshold for the private benefit B the manager cares more about his private benefit than the project's payoff. In this scenario, i.e., with low ex-ante probability of success q and high private benefit B, it is beneficial for the manager that the reporting system is inaccurate. A reliable reporting system means the chance of detecting a low-quality project is increased, leading to a shift in the decision right and project liquidation. Since in this case the manager misses out on the valuable private benefit B, he is more inclined to a lower λ with increased probability of publishing a false positive report R_h.

Additionally, the effect that a more reliable reporting system has on the manager's expected utility U_S is always positive in case of $L > B$. This is independent of the ex-ante probability q. As mentioned above, a high liquidation value L decreases the face value of debt D_S. Combined with a lower a private benefit B, and hence, lower opportunity costs in case the manager is missing out on B, it is favourable for him to have a more accurate accounting system since it enables to negotiate a contract with better conditions.

Proposition 2. *Higher accuracy of the reporting system λ increases the manager's expected utility U_S if*

(i) $L > B$ *or*

(ii) $q \geq \frac{1}{2}$ *or*

(iii) $q \geq \frac{1}{3}$ *and* $X > B$ *apply*

and decreases the manager's expected utility if

(iv) $q < \frac{1}{2}$ *and* $B > L + \frac{q}{1-2q} X$ *are fulfilled.*

Proposition 2 summarizes the effect of higher accuracy of the reporting system on the manager's expected utility under a strict covenant contract. I discuss the positive and negative effect of λ on U_S in further detail in the appendix.

Liquidation Value L

How the liquidation value L, which is obtained in case the lender liquidates the project in stage 2, affects the manager's expected utility U_S will be examined in the following. We proceed by taking the first derivative of the expected utility U_S with respect to L and get $\frac{\partial U_S}{\partial L} = \lambda + q(1 - 2\lambda) > 0$. This is always positive since $0 < q < 1$ and $0.5 < \lambda < 1$ are assumed to apply.

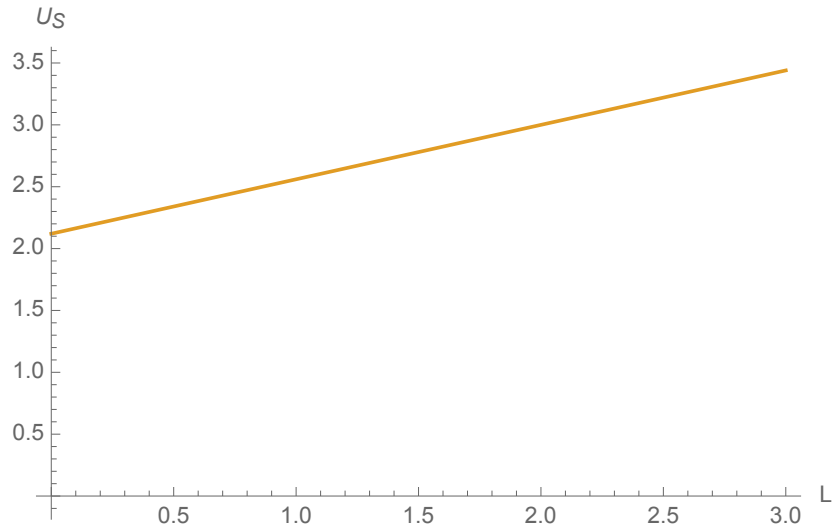

Figure 8: Expected utility U_S increases with liquidation value L.
U_S=Manager's expected utility with a strict covenant contract, L=Liquidation value
I=3, q=0.6, λ=0.8, X=6, B=4

The manager's expected utility U_S is positively affected by an increasing liquidation value L, as shown in *Figure 8*. As discussed above a higher liquidation value allows the manager to negotiate a lower repayment D_S due to a more acceptable compensation value in case the lender seeks charge of the decision right and forgoes to continue the project. Reduced D_S consequently increases the manager's expected utility since more of the cashflow X remains with the manager. Additionally, the lower face value of debt D_S further increases the chance that the manager is willing to agree upon a strict covenant contract as a result of more profitable conditions for him.

This effect is diminished by increasing probability of success q. With an increased ex-ante probability q the value of continuation increases too, while at the same time the value of the real option for the lender to stop and liquidate to project decreases. This means that the increase of q is more influential in the reduction of the repayment D_S than a higher liquidation value L. Hence, the impact of L on the manager's expected utility U_S is decreased.

The influence that the accuracy of the reporting system λ has on this effect is again dependent on the ex-ante probability q. When $q > \frac{1}{2}$ applies, then the effect of the liquidation value L is decreased by a more reliable reporting system. If, on the other hand, $q < \frac{1}{2}$ then the liquidation value is more important, and its impact is increased. Carrying on the thought from above, an increasing accuracy of the accounting system λ in case of high probability of success q only adds further value to the project continuation, hence reducing the effect that the liquidation value L has on the expected utility U_S. However, if the ex-ante probability q is low, a more reliable accounting report enhances the significance of the liquidation value L and increases its effect on the manager's expected utility U_S.

Private Benefit B

The private benefit B, which is received by the manager in case the project is continued, is also affecting the manager's expected utility U_S. Taking the first derivative of U_S with respect to B we get $\frac{\partial U_S}{\partial B} = 1 - \lambda - q(1 - 2\lambda) > 0$. The similarity to the first derivative of U_S with respect to L is evident, suggesting that the other parameter's influence is reversed as compared to the analysis of the effect of the liquidation value L.

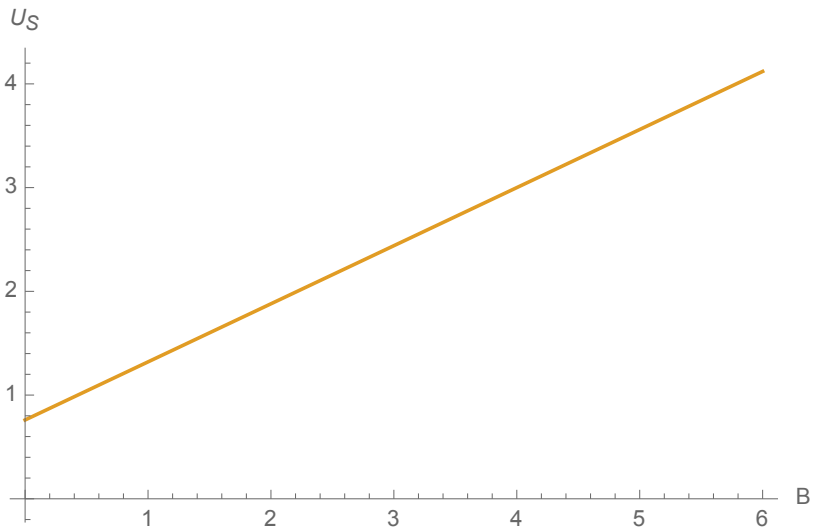

Figure 9: Expected utility U_S increases with private benefit B.
U_S=Manager's expected utility with a strict covenant contract, B=Manager's private benefit
I=3, L=2, q=0.6, λ=0.8, X=6

The effect that an increasing private benefit B has on the manager's expected utility U_S is depicted in *Figure 9*. Naturally, a higher private benefit constantly enhances the manager's expected utility, since more private benefit is obviously desired by the manager. As opposed to the analysis with respect to L, an increasing ex-ante probability q can even amplify the effect that B has on the expected utility U_S. Higher probability of success q operates in two ways. On the one hand it decreases the repayment D_S and on the other it increases the chance for the manager to receive the private benefit B. Both processes increase the positive effect that the private benefit has on the manager's expected utility.

A change in the accuracy of the reporting system λ can again influence this effect positively or negatively dependent on the ex-ante probability q. Compared to the effect of the liquidation value L on the manager's expected utility U_S this dependency is reversed. So, if $q > \frac{1}{2}$ applies, the effect of the private benefit is further enhanced. Higher probability of success increases the chance for the project being of high quality θ_h. The manager, therefore, prefers a more reliable reporting system in order detect this high-quality project and subsequently receive the private benefit for carrying out the project. However, given that $q < \frac{1}{2}$ applies, the manager prefers a less accurate reporting system, hence a lower λ. In this case a more reliable reporting system diminishes the effect that the private benefit has on the expected utility. With a lower ex-ante probability q, it is more likely to have an unsuccessful project θ_l. A more accurate reporting system increases the chance of a low-quality report R_l in this situation. This equals a covenant

violation and consequently the manager missing out on the private benefit B due to project liquidation.

Ex-ante Probability of Success q

In the interest of continuity, we will briefly discuss the effect that the ex-ante probability q has on the manager's expected utility U_S. Taking the first derivative of U_S with respect to q gives $\frac{\partial U_S}{\partial q} = (1 - 2\lambda)(L - B) + X\lambda > 0$. This is positive since $0.5 < \lambda < 1$ and $X > L$ is given in the assumptions.

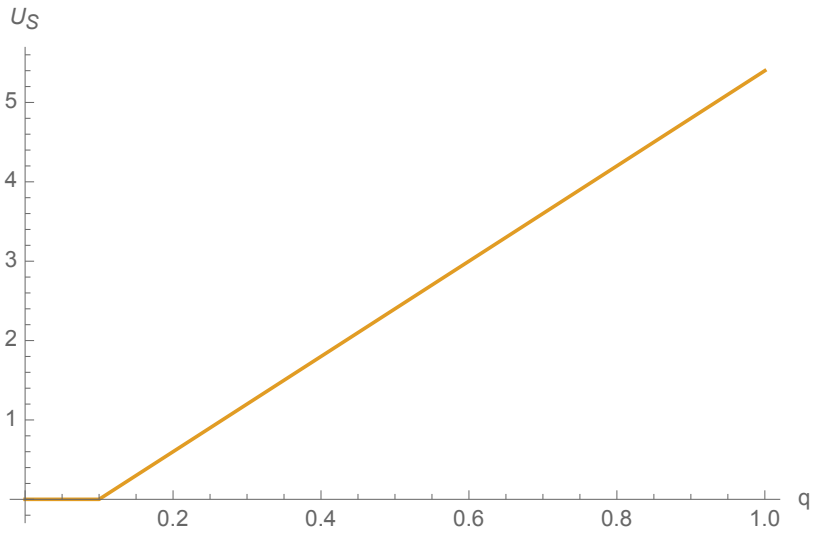

Figure 10: Expected utility U_S increases with probability q.
U_S=Manager's expected utility with a strict covenant contract, q=Ex-ante probability of a high-quality project
I=3, L=2, λ=0.8, X=6, B=4

Figure 10 shows that the manager's expected utility U_S is increasing with the probability of success q. An enhanced chance of having a high-quality project θ_h, naturally increases the expected utility since it is more likely that the manager yields the cashflow X when the project is continued in stage 2. For the area where $U_S = 0$, there is no agreement on the strict covenant contract and the project does not get initiated at all. The positive effect that q has on U_S is further amplified by increasing private benefit B and, of course, increasing cashflow X since there is more for the manager to profit from. Higher liquidation L value on the other hand, decreases the impact that the ex-ante probability q has on the manager's expected utility U_S. A more reliable reporting system λ will enhance this effect under usual circumstances. Only in less common situations, i.e., if $B < L - \frac{X}{2}$ applies, a reduction of this effect is possible.

The effects of the cashflow X and the initial investment I will not be discussed in further detail since it is evident from the formula of the manager's expected utility U_S (8) that the expected utility is increasing and decreasing, respectively.

Manager's Expected Utility – Comparison

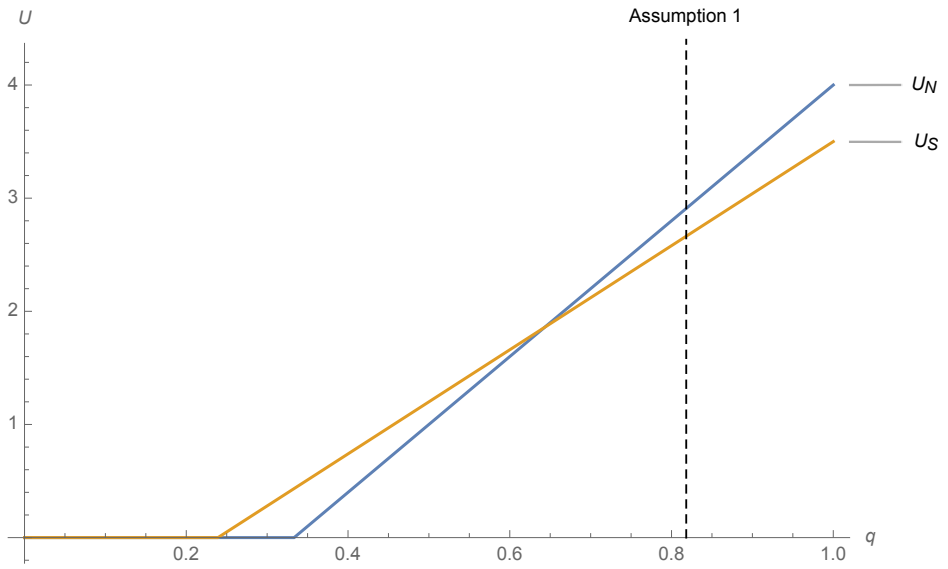

Figure 11: With increasing q, the manager's preference switches from a strict covenant to a no covenant contract. Assumption 1 is fulfilled on the left side of the dashed line.
U_N=Manager's expected utility with a no covenant contract, U_S=Manager's expected utility with a strict covenant contract, q=Ex-ante probability of a high-quality project
I=3, L=2, λ=0.9, X=6, B=1

A comparison between the manager's expected utility U_N after the two parties agree upon a no covenant contract and the manager's expected utility U_S in case they sign a strict covenant contract is depicted in *Figure 11*. This comparison is made under the same circumstances for both contracts with changing ex-ante probability of success q. The area where Assumption 1 is fulfilled is located to the left of the dashed line. As already mentioned above, both expected utilities are increasing with higher ex-ante probability q due to a higher chance of yielding the cash flows X if the project is carried out to completion. While at the lower regions of the probability of success q, the strict covenant contract is beneficial to the manager, i.e., U_S is higher than U_N, this shifts at $q > \frac{\lambda(L-B)}{(1-\lambda)X-(1-2\lambda)(L-B)}$ in favour of the no covenant contract. For lower ex-ante probability q, the manager prefers the strict covenant contract since the repayment D_S for the strict covenant contract is lower than the repayment D_N for the no covenant contract (see section *Face Value of Debt – Direct Comparison)*. However, when the probability of success q increases, the risk of a false alarm increases too. A false alarm leads to

the manager missing out on both the cashflow X and the private benefit B due to a shift in the decision right and the subsequent liquidation of the project. The manager naturally wants to prevent that; therefore, his preference shifts towards the no covenant contract. In the area in *Figure 11* where the expected utility is equal to zero, the bad prospect of success forces the manager to avoid initiating the project at all.

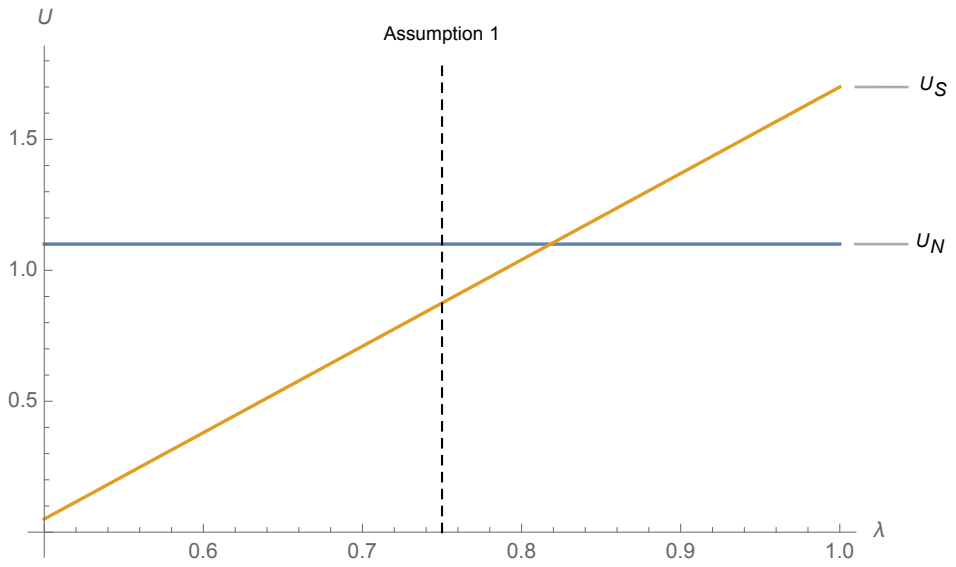

Figure 12: λ does not affect U_N but increases U_S.
Assumption 1 is fulfilled to the right side of the dashed line.
U_N=Manager's expected utility with a no covenant contract, U_S=Manager's expected utility with a strict covenant contract,
λ=Accuracy of the reporting system
I=3, L=2, q=0.6, X=6, B=0.5

Comparing the manager's expected utility U_N in the no covenant contract scenario with the manager's expected utility U_S in a strict covenant contract situation under equal circumstances and with changing accuracy λ of the accounting report R reveals further insightful details. *Figure 12* shows that an increase in the accounting report's reliability has a positive effect on the expected utility U_S, while having no impact on the expected utility U_N. Once more the dashed line signals the area where Assumption 1 is fulfilled. To the right of it, λ meets the requirements of Assumption1. In the no covenant contract scenario, the continuation decision is independent of the accounting report R – and hence, also independent of its ability λ to correctly predict the project's quality – because the manager always stays in charge of the decision right. His expected utility U_N is, therefore, not influenced by λ. This is different in the strict covenant contract scenario. With the strict covenant contract, the decision right can shift towards the lender in case a covenant violation occurs. This happens if the accounting report R_l predicts a low-quality project θ_l. The lender receives the decision right and liquidates the project. A more accurate accounting report lowers the face value of debt D_S as it creates a more

secure investment environment for the lender. It further increases the chance for the manager to stay in charge of the decision right in case the project is of high quality, since the report is more likely to predict a high-quality project θ_h. Hence, for a less accurate reporting system the manager prefers the no covenant contract while higher λ makes leaning towards the strict covenant contract more beneficial for the manager. This shift in preference takes place at $\lambda > \frac{q(X+B-L)}{qX+(1-2q)(L-B)}$. Investing in a more reliable reporting system allows the manager to improve his expected utility and makes the strict covenant contract more appealing.

Proposition 3. *If* $\lambda > \frac{q(X+B-L)}{qX+(1-2q)(L-B)}$ *is fulfilled, then* $U_S > U_N$ *applies.*

The manager prefers the strict covenant contract over the no covenant contract when the accuracy of the reporting system λ surpasses the above-mentioned threshold. This is due to the lender's willingness to accept a lower repayment in a less risky environment provided by a reliable reporting system and the enhanced probability for the manager to stay in charge of the decision right in case the project if of high quality.

5. Additional Soft Information and Renegotiations

5.1 Model with Renegotiations

Until now we had two different options in the model regarding the continuation decision over the project θ. The decision can be to either continue or liquidate the project at stage 2. Dependent on the contract that the manager and the lender agree upon, one of the two parties is in charge of the decision right. As already mentioned before, the decision right stays with the manager if they sign a no covenant contract. The manager will always continue the project in order to receive the private benefit B and possibly the cashflow X, in case the project is of high quality. However, if they agree on a strict covenant contract, the lender obtains the option to decide about the project continuation. The decision right shifts towards the lender if the covenant is violated, i.e., a low-quality accounting report R_l is published, predicting an unsuccessful project θ_l. When the lender is in charge of the continuation decision, she will always decide to liquidate the project, since her decision is based solely on the information that the accounting report R provides. Liquidating the project allows the lender to at least yield the liquidation value L and minimize the loss of a project that is believed to be of low quality.

Introducing another contract which enables renegotiations in case of a covenant violation offers the two parties another option to possibly increase their payoff. If the accounting report reveals a bad signal, i.e., a low-quality report R_l is published, the lender gets the option to initiate renegotiations of the contract.

After the accounting report has been published, the manager receives additional soft information $S \in \{S_l, S_h\}$ with

$$\Pr(S_h|\theta_h) = \Pr(S_l|\theta_l) = \tau, \text{ where } \tau > 0.5. \quad (9)$$

$\Pr(S_h|\theta_h)$ labels the probability that the soft information S indicates a successful project, given the project is indeed of high quality. By analogy $\Pr(S_l|\theta_l)$ characterizes the probability of attaining negative soft information given the project has low quality. The parameter τ reflects the expressiveness of the soft signal S and is, hence, in accordance to λ reflecting the accuracy of the accounting system. Soft information refers to information that is not contractible in stage 1. It is of different quality than the information provided by the accounting report R. Soft information can be provided by the manager as well as being inferred by the environment and enables the lender to make a more informed decision regarding the project continuation. We assume that the acquisition of the soft information S does not incur any additional costs for neither the manager nor the lender. In order to give τ validity and to make sure that S_h and S_l are perceived as positive and negative news, respectively, it is set to be higher than 0.5

If the accounting report indicates a successful project, i.e., $R = R_h$, no party has interest in liquidating the project. On the other hand, if the accounting report predicts low-quality, i.e., $R = R_l$, the lender has the real option to initiate renegotiations. This can be beneficial as the additional soft information might indicate a high-quality project.

In order to characterize when the lender is willing to renegotiate the contract after the accounting report R is published and the soft information S is made available we put up the assumption that

Assumption 2:

$$\Pr(\theta_h|R_l, S_l)\, X < L < \Pr(\theta_h|R_l, S_h)\, X \quad (10)$$

must be fulfilled. Following from Assumption 2, the lender will not necessarily liquidate the project after gaining the decision right in case the soft information S indicates a high-quality project. High-quality soft information S_h increases the expected payoff to such an extent that it exceeds the liquidation value L. Meanwhile a low-quality soft signal S_l reduces the expected payoff below L. The liquidation value L is, hence, the threshold upon which the lender evaluates whether to initiate renegotiations or not. The exact prerequisites for when renegotiations occur, will be discussed below.

Since the lender has higher interest in the repayment D than in the expected payoff, she will liquidate the project even after obtaining high-quality soft information S_h if $\Pr(\theta_h|R_l, S_h)\, D < L$ applies. In this case the expected repayment is lower than the liquidation value L and she will decide to terminate the project in order to secure L. Otherwise, i.e., if the two parties can agree on a face value of debt D which fulfils $\Pr(\theta_h|R_l, S_h)\, D > L$, the lender initiates renegotiations about the potential residual of continuing the project. This potential residual equals $\Pr(\theta_h|R_l, S_h)\, X - L$. It represents the amount that the lender is willing to negotiate about, thus, the expected payoff after deducting the liquidation value L. The lender's bargaining power $\delta \in [0, 1]$ determines the share that the lender can secure during renegotiations. The new face value of debt D_R, which the lender will now ask for, is such that the expected value of continuing equals the value without continuation, i.e., the liquidation value L, plus a bargaining premium. This corresponds to

$$\Pr(\theta_h|R_l, S_h)\, D_R = L + \delta(\Pr(\theta_h|R_l, S_h)\, X - L). \tag{11}$$

The lender does not want to give up the liquidation value L but she is willing to continue the project in return for a premium. Assumption 2 makes sure that this bargaining premium is positive. Hence, the new face value of debt is

$$D_R = \frac{(1-\delta)L}{\Pr\,(\theta_h|R_l, S_h)} + \delta X\,. \tag{12}$$

Given the lender is in charge of the decision right, she will decide to continue the project if the manager agrees on a repayment in the amount of D_R in return. In contrast to the face values of debt D_N and D_S, the cashflow X is influencing the repayment in the renegotiation scenario D_R as it is a decisive component of the potential residual which the two parties are bargaining

about. Additionally, the liquidation value L and the lender's bargaining power δ feature in the computation of D_R. It is further evident from the formula that the higher the probability $\Pr(\theta_h|R_l, S_h)$ the lower the repayment the lender is willing to accept in order to continue the project.

5.1.1 Existence of Renegotiations

Renegotiations occur if $\Pr(\theta_h|R_l, S_h)\, D > L$ is fulfilled. $\Pr(\theta_h|R_l, S_h)$ describes the probability that the project is successful, i.e., $\theta = \theta_h$, given the accounting report R predicted a low-quality project followed by additional soft information S indicating high-quality, nevertheless. By applying Bayes' Theorem, we get

$$\Pr(\theta_h|R_l, S_h) = \frac{q(1-\lambda)\tau}{q(1-\lambda)\tau + (1-q)\lambda(1-\tau)}\ , \tag{13}$$

where the denominator marks the unconditional probability to receive a low-quality report R_l and a high-quality soft information S_h. The probability in such a situation for the project to actually be of high quality is increasing with the ex-ante probability q and the accuracy of the soft information τ. This is obvious since higher probability of success q per definition increases the chance of a high-quality project while higher τ increases the credibility of the soft information. An increasing accuracy of the reporting system, on the other hand, decreases this probability. In such a situation the higher λ makes it more likely for the accounting report to correctly detect the project as a low-quality project and hence lower the incentive for the lender to renegotiate. Therefore, renegotiations occur more frequently with increasing q, τ and D and less frequently with increasing λ.

5.1.2 Manager's Expected Utility in the Renegotiation Scenario

The expected utility in case the manager and the lender agree on a contract with the option to renegotiate in stage 2 after receiving the accounting report R has similarities with the expected utility in the strict covenant contract scenario. When an accounting report R_h is published, indicating a successful project, the expected utility is equal to the one with the strict covenant contract. The manager stays in charge of the decision right and continues the project. Differences arise when the accounting report R_l predicts a low-quality project. The decision right still shifts towards the lender, but now she has the option to wait for additional soft information and renegotiate the initial contract. Whereas with the strict covenant contract, the

lender would have simply liquidated the project, leaving the manager empty-handed. If the soft information S indicates the project to be successful, the lender might initiate renegotiations. In this case the two parties can bargain about a potential residual. If they manage to agree on a new face value of debt D_R the lender is willing to decide in favour of the project continuation. Hence, the manager's expected utility in the renegotiation is

$$U_R = q\lambda(X - D_S + B) + (1-q)(1-\lambda)B$$
$$+\Pr(\theta_h|R_l, S_h)\Pr(R_l, S_h)(X - D_R + B) + \Pr(\theta_l|R_l, S_h)\Pr(R_l, S_h)B\ .$$

From this formula it is evident that the first part behaves the same as in the strict covenant contract scenario. If the project is successful and the manager stays in control of the decision right, he yields cash flows X and the private benefit B while compensating the lender with a repayment equal to D_S. In case the project turns out to be of low-quality, though, it yields no cash flows, but the manager still receives the private benefit B for carrying out the project. Contrary to the expected utility in the strict covenant contract scenario U_S, where the manager gains no cash flows or benefit after a shift in the decision right towards the lender, now there is the option to renegotiate in such an instance. When a low-quality report R_l is published in stage 2, the lender can decide to initiate renegotiations. If she does so and the project is successful, the manager yields the cash flows X and the private benefit B. He has to refund the lender with the recently negotiated face value of debt D_R. However, in case the project turns out to be low-quality, the manager does not yield cash flows X nor repay the lender but he still receives the private benefit B. Should the soft information S indicate a low-quality project θ_l or the expected face value of debt be less than the liquidation value L – as discussed above – then the lender decides to forgo the option to renegotiate and liquidates, regardless of the project's actual success, leaving the manager with no return at all. After applying the face values of debt D_S and D_R to the formula, we get

$$\begin{aligned} U_R = {} & q\lambda X + [q\lambda + (1-q)(1-\lambda)]B + (q + \lambda - 2q\lambda)L - I \\ & +q(1-\lambda)\tau[(1-\delta)X + B] + (1-q)\lambda(1-\tau)B \\ & -[q(1-\lambda)\tau + (1-q)\lambda(1-\tau)](1-\delta)L \end{aligned} \tag{14}$$

as the manager's expected utility with a contract including the option to renegotiate. The expected utility U_R is divided into three parts. The first line describes the situation where the manager stays in charge of the decision right and equals the expected utility with the strict

covenant contract U_S, which was already discussed above. The other two lines characterize the events where the lender gains the right to decide over the project continuation upon contract violation. In the second line of the formula the return for the manager from renegotiating the contract is expressed. If the two parties renegotiate and the lender decides to continue the project, the manager yields cash flows X and the private benefit B in case the project is successful. The manager still receives the private benefit B for implementation if the project turns out to be of low quality. For the case that the lender still decides to liquidate the project, even after the acquisition of additional soft in formation S, the manager again comes away empty-handed. Finally, the manager needs to compensate the lender for waiving the covenant and losing out on the liquidation value L, which is expressed in the third line of the formula.

5.2 Comparative Statics

Face Value of Debt – Renegotiations Scenario

The face value of debt D_R is negotiated in case the lender pulls the option to renegotiate after gaining the decision right. In order to analyse D_R more parameters need to be taken into account, since new additional soft information S is available, possibly changing the lender's mind to continue the project instead of liquidating it. Dependent on the bargaining power δ the lender might be in a better position for renegotiations. Besides that, the accuracy λ of the accounting report R plays a significant role as it influences the probability of success in a renegotiation scenario $\Pr(\theta_h|R_l, S_h)$. Furthermore, the liquidation value L has an impact on D_R as it is the parameter which the lender must renounce in order to continue the project.

Accuracy of the Reporting System λ

First, we examine the effect that the accuracy of the accounting system λ has on the face value of debt D_R. Taking the first derivative of D_R with respect to λ results in $\frac{\partial D_R}{\partial \lambda} = \frac{(1-q)(1-\delta)(1-\tau)L}{q(1-\lambda)^2\tau} > 0$.

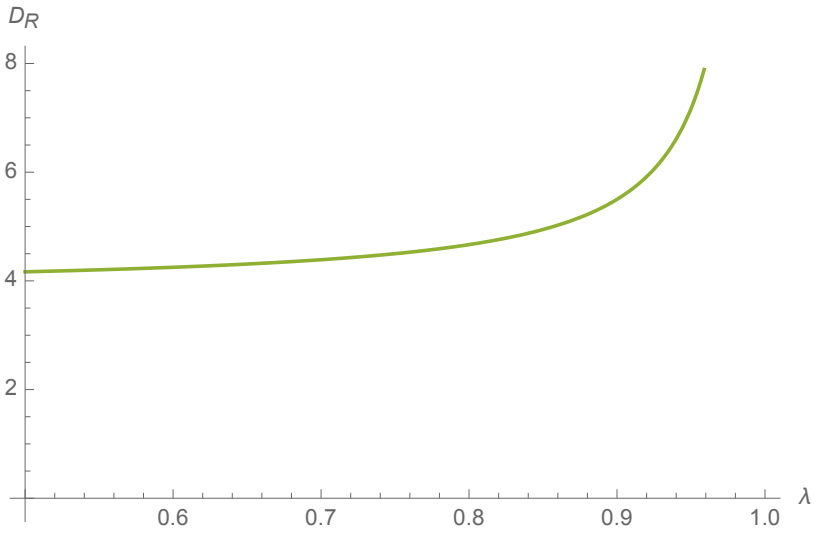

Figure 13: Repayment D_R increases with λ.
D_R=Renegotiated face value of debt, λ=Accuracy of the reporting system
L=2, q=0.6, X=6, δ=0.5, τ=0.8

A more reliable accounting system increases the repayment D_R as displayed in *Figure 13*. The prerequisite for renegotiations is that the lender gains the decision right, i.e., the accounting report R_l indicates a low-quality project leading to covenant violation. An increase in the accuracy of the accounting system λ, thus, leads to a higher D_R due to the enhanced chance of an unsuccessful project in such a situation. The lender wants to be compensated with a higher repayment for the increased risk. The closer λ gets to being perfectly representative of the project's quality θ, i.e., $\lambda = 1$,the steeper the increase in D_R. This effect is further enhanced with increasing liquidation value L since a higher amount is at stake. If the report is more likely to have correctly predicted a low-quality project, a higher repayment D_R is needed to convince the lender to take the risk and continue the project. On the other hand, q, τ and δ are reducing the impact of λ. For the ex-ante probability of success q and the accuracy of the soft information τ this is straight forward, as both indicate a successful project, hence, reducing the risk imposed on continuing the project. The bargaining power δ makes renegotiating more appealing, thus, lowering the enhancing effect that λ has on D_R.

Liquidation Value L

In order to analyse the effect that an increasing liquidation value L has on the face value of debt D_R we take the first derivative of D_R with respect to L. Calculation yields $\frac{\partial D_R}{\partial L} = \frac{(1-\delta)[q\tau+\lambda(1-q-\tau)]}{q(1-\lambda)\tau} > 0$.

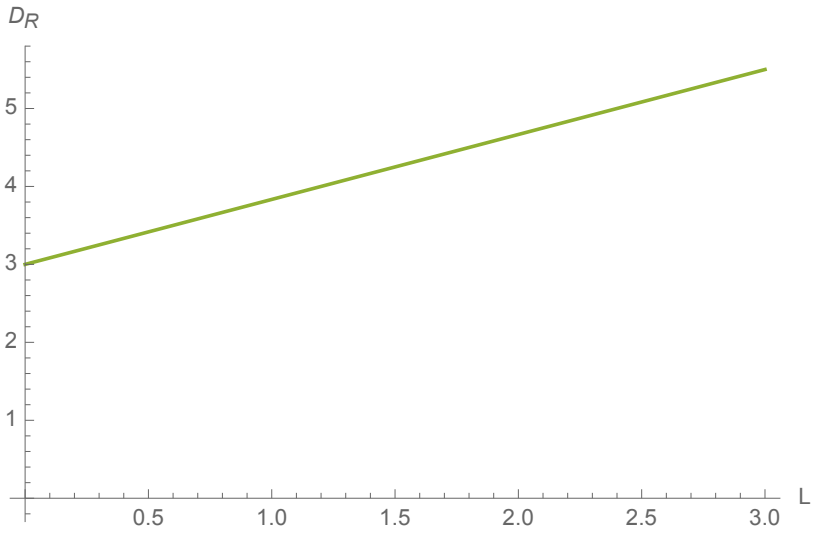

Figure 14: Repayment D_R increases with L.
D_R=Renegotiated face value of debt, L=Liquidation value
q=0.6, λ=0.8, X=6, δ=0.5, τ=0.8

The liquidation value L is only attained by the lender in case the decision is made to liquidate the project. If renegotiations are initiated and the lender subsequently decides to continue, she must relinquish L. Higher liquation value L means a larger sum which has to be renounced is at stake. The lender is, thus, only willing to continue if she is compensated with a higher repayment D_R for missing out on L. Hence, D_R is constantly increasing with the liquidation value, which is shown in *Figure 14*. This effect is even enhanced with increasing λ. A more reliable reporting system, indicating a low-quality project, further decreases the chance of a successful project. Therefore, it takes an even higher repayment D_R to convince the lender to continue the project. High ex-ante probability q, accuracy of the soft information τ and lender's bargaining power δ, on the other hand, reduce this effect. Increased q and τ create a less risky continuation scenario, thus, diminishing the effect of L. While L and increased δ work in opposite directions, since a high L attributes higher value to the liquidation decision and a high δ implies a higher value for the option to continue. This contrasting effect lowers the impact that L has on D_R.

Lender's Bargaining Power δ

How the lender's bargaining power δ affects the face value of debt D_R is explored analogously to above. We take the first order condition of D_R with respect to δ and get $\frac{\partial D_R}{\partial \delta} = X - L\frac{q(1-\lambda)\tau+(1-q)\lambda(1-\tau)}{q(1-\lambda)\tau} > 0$, which equals $X - \frac{L}{\Pr(\theta_h|R_l,S_h)}$. Assumption 2 in (10) makes sure that this is positive.

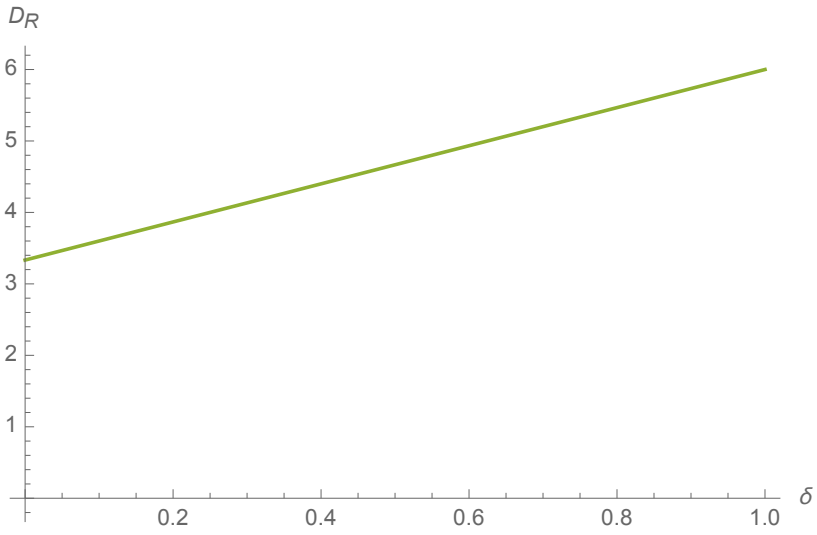

Figure 15: Repayment D_R increases with δ.
D_R=Renegotiated face value of debt, δ=Lender's bargaining power
L=2, q=0.6, λ=0.8, X=6, τ=0.8

Figure 15 depicts that an increasing lender's bargaining power δ leads to a higher face value of debt D_R. When the lender finds herself in a beneficial bargaining position, she is able to negotiate better terms for her and, thus, a higher repayment D_R. The manager, in return, has to accept the higher repayment in order to continue the project and secure a private benefit. Assumption 2 states that the expected payoff in case the soft information indicates a successful project is higher than the liquidation value L. This ensures that δ is always increasing D_R. Otherwise, the lender would always prefer liquidation over continuation in such a situation. The effect of δ on D_R is reduced by an increasing liquidation value L since it operates in the opposite direction to δ – as discussed above – and increases the value of the liquidation option in relation to the real option to renegotiate. Higher probability $\Pr(\theta_h|R_l, S_h)$ of a successful project in case the soft information indicates a high-quality project, on the other hand, increases the effect of δ. With a high probability of success in the renegotiation scenario, the expected payoff $\Pr(\theta_h|R_l, S_h)\,X$ is increased. A lender with enhanced bargaining power δ can further exploit this higher margin to increase the repayment D_R.

Accuracy of the Soft Information τ

Finally, we look at the accuracy τ of the additional soft information S. Proceeding as before, we take the first derivative of the face value of debt D_R with respect to τ and get $\frac{\partial D_R}{\partial \tau} = -\frac{(1-q)(1-\delta)\lambda L}{(1-\lambda)q\tau^2} < 0$.

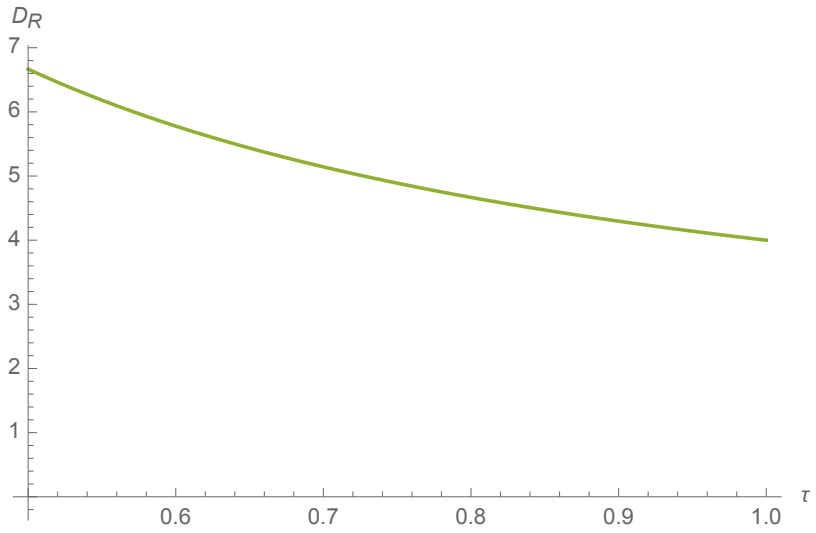

Figure 16: Repayment D_R decreases with τ.
D_R=Renegotiated face value of debt, τ=Accuracy of the soft information
L=2, q=0.6, λ=0.8, X=6, δ=0.5

Figure 16 shows that the face value of debt D_R is decreasing with a more reliable additional soft information. The two parties find themselves in a situation where the soft information S indicates a successful project. If the additional information is accurate, i.e., τ is high, it is less risky for the lender to continue the project. Hence, the manager is in a better position to negotiate a lower repayment D_R. This reducing effect is even stronger with increasing liquidation value L and increasing accuracy of the reporting system λ. Since both parameters are increasing the repayment D_R, a more reliable soft information counteracts those effects and weighs more heavily on D_R in such a situation. When the liquidation value L, that has to be renounced in case of continuation, is high and the accounting report that indicates a low-quality project is accurate, good news in form of reliable soft information, indicating a successful project, is valued even higher. The reducing effect of τ on D_R is diminished by increasing ex-ante probability q as well as a higher lender's bargaining power δ.

Manager's Expected Utility – Renegotiations Scenario

As mentioned before, the manager's expected utility U_R with the renegotiation option is divided into three parts. The first part is equal to the manager's expected utility U_S in the strict covenant contract scenario, which was already discussed above. The second part regards gains related to the renegotiation, both in case the project turns out to be successful and in case it is of low quality. This part deals with the scenario where the covenant has been violated and the lender gains control over the decision right. If the two parties can agree on a repayment D that is

satisfying for both, the project is continued, and the manager yields the private benefit B and potentially a part of the cash flows X. In case the manager and the lender fail to settle on a repayment, or the probability of success is simply not convincing enough, the lender decides to liquidate, and the manager misses out on X and B. The third part of the expected utility formula U_R considers the compensation the lender requests for forgoing the liquidation value L in case she agrees to continue the project. Parameters which influence the expected utility U_S in the strict covenant contract scenario, such as the accuracy of the reporting system λ or the liquidation value L, must be discussed here too, since both play an essential role in calculating the manager's expected utility U_R. Additionally to those parameters, we will take a look at the parameters which are specific for the renegotiation scenario. Most importantly the accuracy τ of the soft information S and the lender's bargaining power δ.

Accuracy of the Reporting System λ

The effect that the accuracy λ of the reporting system R has on the on the manager's expected utility U_R in case there is an option to renegotiate the contract in stage 2 is analysed by taking the first derivate of U_R with respect to λ. As the result we get $\frac{\partial U_R}{\partial \lambda} = [1 + (\delta - 1)\tau]qX + (q - \tau)B + [-q + (1 - q)\delta - (\delta - 1)\tau]L$. This can be positive or negative dependent on the involved parameters.

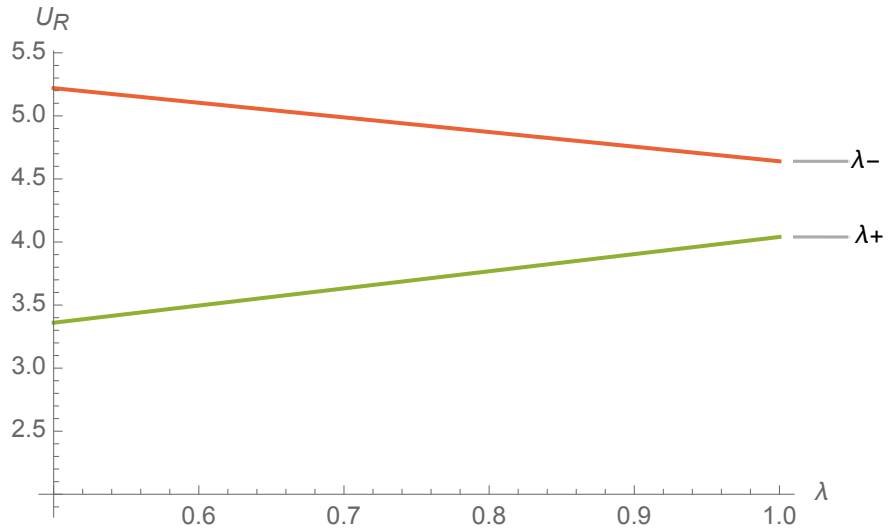

Figure 17: Expected utility U_R can be increasing or decreasing with λ.
U_R=Manager's expected utility with a strict covenant contract including the option to renegotiate,
λ=Accuracy of the reporting system
$\lambda -$: I=3, L=2, q=0.4, X=6, B=8, δ=0.5, τ=0.8
$\lambda +$: I=3, L=2, q=0.6, X=6, B=4, δ=0.5, τ=0.8

Figure 17 shows the effects that an increasingly reliable reporting system has on the manager's expected utility U_R. Dependent on the ex-ante probability q, the accuracy of the soft information τ and the private benefit B, λ can have an amplifying or diminishing effect on U_R. Only if $q < \tau$ and $B > \frac{(q-\delta+q\delta-\tau+\delta\tau)L-(1-\tau+\delta\tau)qX}{q-\tau}$ are fulfilled, does an increase in the reporting system's accuracy λ lead to a decrease in the expected utility U_R. In this case, depicted by $\lambda -$, the expected utility U_R is decreasing since the lower probability of success q in combination with a more reliable reporting system decreases the chance for the manager to yield the private benefit B in the renegotiation scenario. As B is high in such a situation, missing out on the private benefit weighs even more. The detriment of the lower chance to continue the project after the lender gained the decision right prevails over the benefit of a lower repayment D_S that comes with a more accurate reporting system. Hence, the manager's expected utility U_R diminishes. However, if $q > \tau$ or if B does not fulfil the above-mentioned inequality, the manager's expected utility U_R increases with higher accuracy λ. A more reliable reporting system then evokes fewer false warnings, i.e., it is less likely to signal low quality in case of a high-quality project θ_h. In consequence, successful projects are less likely to be liquidated. Since the manager only benefits from a continued project, his expected utility increases. The ex-ante probability q does not necessarily have to be high, it is sufficient for the private benefit to not exceed the threshold from above in order for the accuracy λ to have an increasing effect on U_R, as shown by $\lambda +$ in the depiction above.

Liquidation Value L

In order to examine the effect that an increasing liquidation value L has on the manager's expected utility U_R we proceed as usually. Taking the first order derivative of U_R with respect to L results in $\frac{\partial U_R}{\partial L} = (1-\lambda)q + (1-q)\delta\lambda - (1-\delta)(q-\lambda)\tau > 0$.

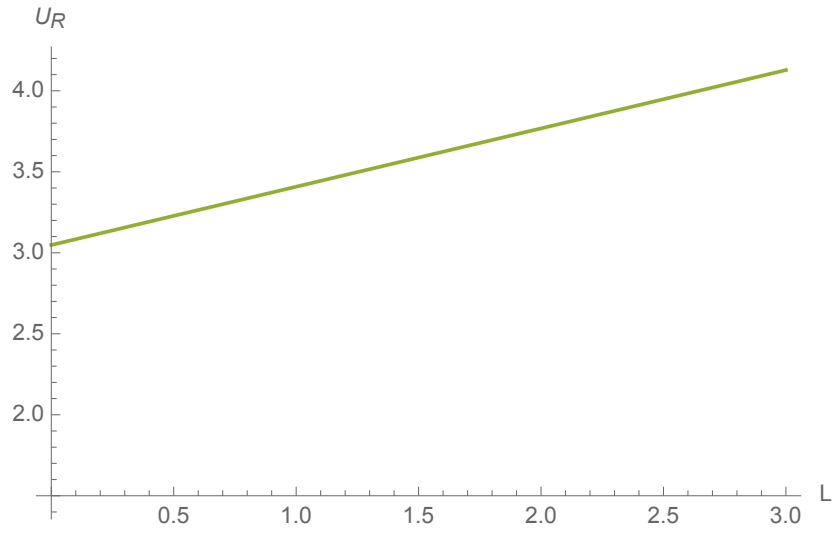

Figure 18: Expected utility U_R increases with L.
U_R=Manager's expected utility with a strict covenant contract including the option to renegotiate, L=Liquidation value
I=3, q=0.6, λ=0.8, X=6, B=4, δ=0.5, τ=0.8

It is evident from *Figure 18* that the manager's expected utility U_R, with a contract including the option to renegotiate, constantly increases with the liquidation value L. This positive effect can be ascribed to L affecting both face values of debt which are essential for the manager's expected utility U_R, namely D_S and D_R. As mentioned earlier, the liquidation value L is increasing the renegotiated repayment D_R since the lender must give up on L if she decides to continue the project. The manager thus needs to compensate the lender with a higher repayment D_R in order to convince her of the benefits of a project continuation. Naturally, a higher repayment D_R reduces the manager's expected utility as it has to be deducted from the cash flows X, leaving the manager with less profit. The reason for L still increasing U_R lies in L also affecting the repayment D_S. The face value of debt D_S, included in the formula of the expected utility U_R, is decreased by an increasing liquidation value L. A higher liquidation value equals a more appealing sum for the lender in case of project liquidation. Hence, she is ready accept a lower repayment D_S during the initial negotiations. The lowering effect that the liquidation value L has on D_S outweighs the enhancing effect it exerts on D_R.

Accuracy of the Soft Information τ

One of the parameters affecting renegotiations the most is the accuracy of the soft information τ. To analyse the effect that τ exerts on the manager's expected utility with the renegotiation option U_R we take the first derivative of U_R with respect to τ and get

$\frac{\partial U_R}{\partial \tau} = (1-\delta)(1-\lambda)qX + (q-\lambda)B - (1-\delta)(q-\lambda)L$. This again can be positive or negative.

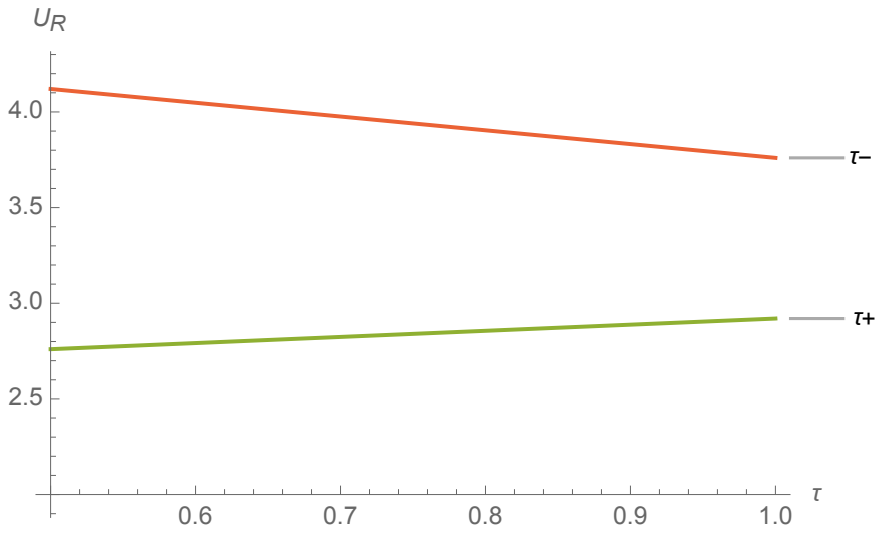

Figure 19: Expected utility U_R can be increasing or decreasing with τ.
U_R=Manager's expected utility with a strict covenant contract including the option to renegotiate
τ=Accuracy of the soft information
$\tau -$: I=3, L=2, q=0.6, λ=0.9, X=6, B=4, δ=0.5
$\tau +$: I=3, L=2, q=0.7, λ=0.8, X=6, B=2s, δ=0.5

Dependent on the circumstances, the accuracy τ of the soft information S can have a positive or negative effect on the manager's expected utility U_R. Both effects are shown in *Figure 19*. If $q < \lambda$ and $B > \frac{(1-\delta)(q-\lambda)L-(1-\delta)(1-\lambda)qX}{q-\lambda}$ apply, a more reliable soft information leads to a decrease in the expected utility U_R, depicted by $\tau -$ in the illustration above. This is, on the one hand, due to increased opportunity costs resulting from missing out on a higher private benefit B in case the lender decides to liquidate the project. On the other hand, the higher accuracy of the reporting system λ along with a lower chance of success q decrease the probability for the lender to change her mind and make use of the renegotiation option to continue the project. Under such circumstances, i.e., a reliable report predicting an unsuccessful project θ_l, the increasing accuracy of the soft information τ further diminishes the probability to convince the lender of the project continuation since the soft information is more likely to detect the low-quality project as well. If the private B is below the above-mentioned threshold or $q > \lambda$ applies, more reliable soft information increases the manager's expected utility U_R. In this case, shown by $\tau +$ in *Figure 19* the ex-ante probability of success q is relatively high and a high-quality project, thus, more likely to be detected by the increasingly accurate soft information. Additionally, we have a less reliable accounting system, indicating the project was falsely

reported as being of low quality. This on its own would be enough for an increasing τ to have a positive effect on the expected utility U_R. Alternatively, a private benefit B that does not exceed the threshold lowers the opportunity costs in case the project is liquidated also leading to an enhancing effect of τ on U_R.

5.3 Comparison of the Results

Face Value of Debt

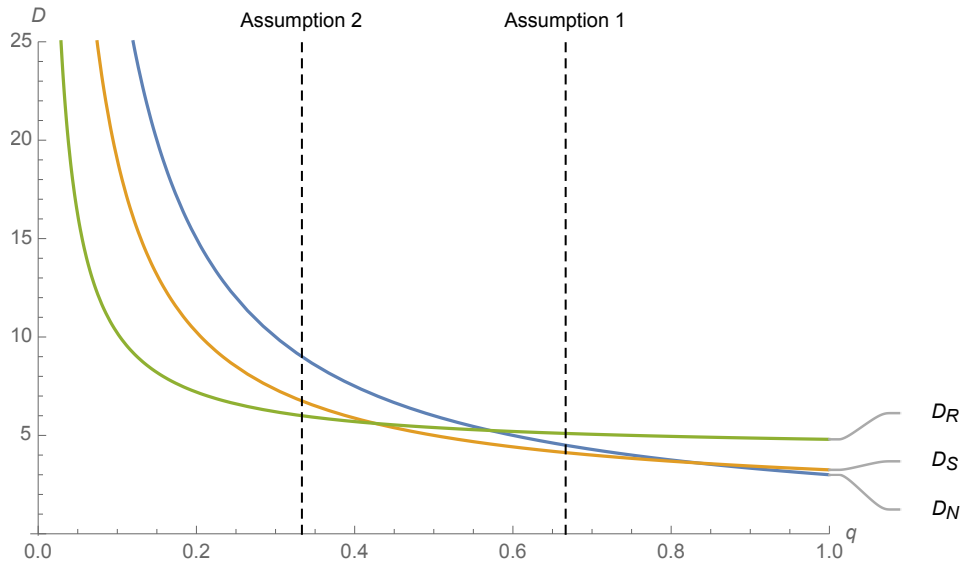

Figure 20: Increasing probability q has a stronger impact on D_N and D_S than on D_R. In the area between the dashed lines, both Assumption 1 and Assumption 2 are fulfilled. D_N=Face value of debt with no covenant contract, D_S=Face value of debt with a covenant contract, D_R=Renegotiated face value of debt, q=Ex-ante probability of a high-quality project I=3, L=2, λ=0.8, X=6, δ=0.7, τ=0.8

This chapter is dedicated to analysing how all the discussed face values of debt compare next to each other. *Figure 20* shows a direct comparison of the face values of debt D_N, D_S and D_R under the same circumstances with changing ex-ante probability q. Even though D_R is not negotiated until stage 2, the ex-ante probability q still affects the face value of debt in the renegotiation scenario since it plays a significant role in computing the probability of success $\Pr(\theta_h|R_l, S_h)$ after receiving the positive soft information S_h. Naturally, all face values of debt are decreasing with q, as the chance of a high-quality project is enhanced and, thus, the risk of failure reduced. The area between the dashed lines marks the region where both Assumption 1 and Assumption 2 are fulfilled and subsequently the lender is willing to agree to continue the project. In the area where D_S exceeds D_R, the soft information is trustworthy enough, i.e., τ is high enough, such that with a low probability of success q, the lender is willing to accept a

lower repayment than initially negotiated in stage 1 in order continue the project. This changes, though, with increasing q as it more severely affects D_S than D_R. Consequently, the lender will demand a higher repayment D_R than the initially agreed upon D_S to change her mind and continue the project. The manager is purchasing the option to renegotiate through an increased face value of debt.

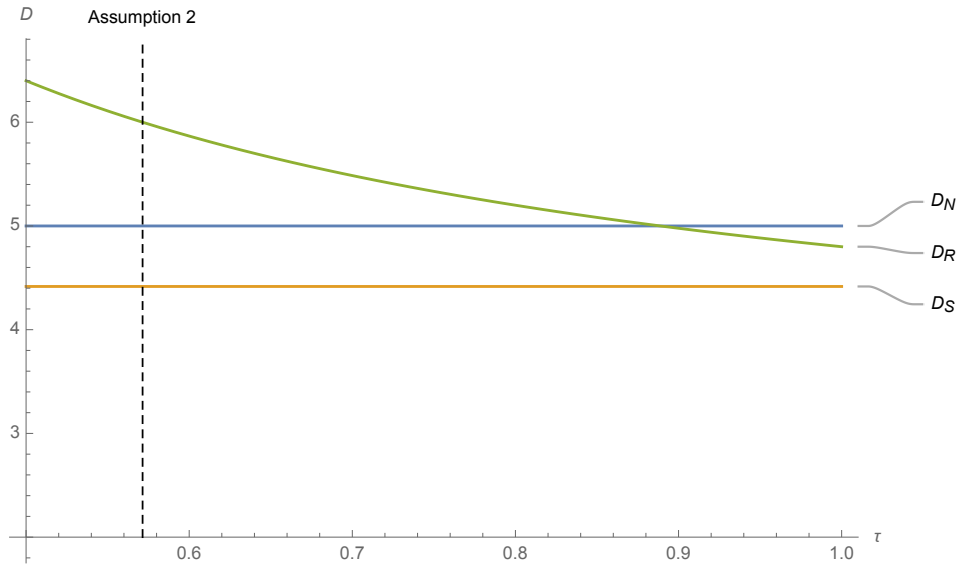

Figure 21: Accuracy τ decreases D_R but has no effect on D_N and D_S.
Assumption 1 holds everywhere in the figure, Assumption 2 is fulfilled to the right of the dashed line.
D_N=Face value of debt with no covenant contract, D_S=Face value of debt with a covenant contract,
D_R=Renegotiated face value of debt, τ=Accuracy of the soft information
I=3, L=2, q=0.6, λ=0.8, X=6, δ=0.7

Figure 21 depicts a comparison between the face values of debt D_N, D_S and D_R under the same conditions but with changing accuracy of the soft information τ. For τ to the right of the dashed line, Assumption 2 is fulfilled. It is evident that the face value of debt in the renegotiation scenario D_R is the only one affected by a change in τ. This is because D_N and D_S are negotiated before the additional soft information S is observable. In the renegotiation scenario a covenant violation has occurred, and the lender receives the decision right. She has to weigh up whether to liquidate the project or to initiate renegotiations. A more reliable soft information creates a safer environment for the lender to make her continuation decision. Thus, the repayment D_R that the lender can ask for is reduced. A highly reliable soft information can be accurate enough that it pushes the repayment D_R below D_N. This happens at $\tau > \frac{(1-q)(1-\delta)\lambda L}{(1-\delta)(\lambda-q)L-(1-\lambda)(q\delta X-I)}$. Above this point, the lender is willing to accept a lower repayment than in the no covenant contract scenario, since she is in charge of the decision right and the available information

indicates the project is of high quality. Hence, she prefers to continue and is satisfied with just a slight increase over the initially negotiated repayment D_S.

Proposition 4. *If* $\tau > \frac{(1-q)(1-\delta)\lambda L}{(1-\delta)(\lambda-q)L-(1-\lambda)(q\delta X-I)}$ *is fulfilled, then* $D_N > D_R$ *applies.*

When the accuracy of the soft information τ exceeds the above-mentioned threshold, the lender demands a higher repayment with the no covenant contract in stage 1 as compared to the repayment renegotiated in stage 2 after the two parties initially agreed on a strict covenant contract with the prospect of renegotiations.

Manager's Expected Utility

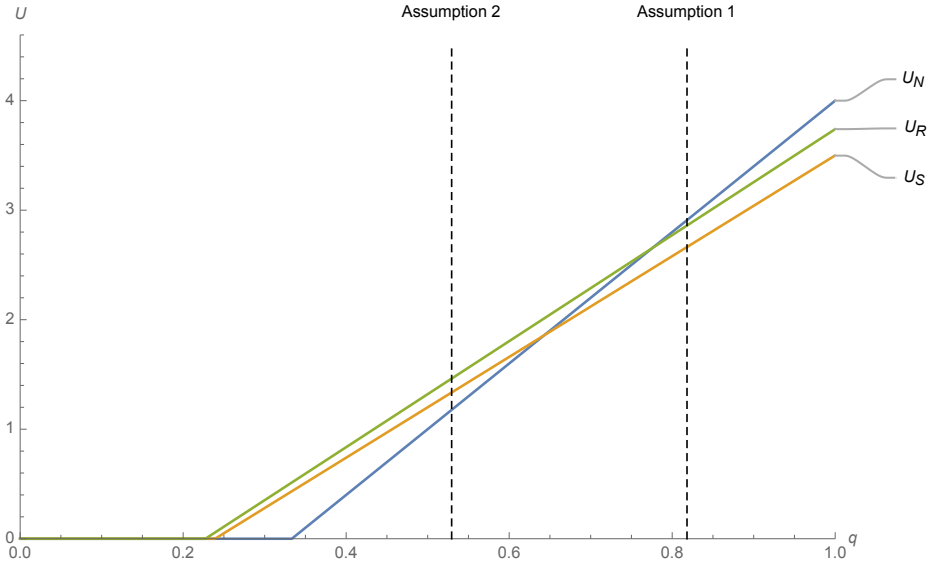

Figure 22: U_R is always higher than U_N. Increasing probability q has a stronger effect on U_N than on U_S and U_R. In the area between the dashed lines, both Assumption 1 and Assumption 2 are fulfilled. U_N=Manager's expected utility with a no covenant contract, U_S=Manager's expected utility with a strict covenant contract, U_R=Manager's expected utility with a strict covenant contract including the option to renegotiate, q=Ex-ante probability of a high-quality project I=3, L=2, λ=0.9, X=6, B=1, δ=0.5, τ=0.8

This chapter aims to provide a closer look on how the results regarding the manager's expected utility for the different debt contracts compare to each other. *Figure 22* shows a comparison between the manager's expected utility U_N when the two parties sign a no covenant contract, the manager's expected utility U_S in case they agree on a strict covenant contract and the manager's expected utility U_R if a covenant contract is signed with the option to renegotiate. The three expected utilities are compared under the same circumstances with changing ex-ante probability q. Naturally, all expected utilities are inflated with higher q since it increases the

probability of a successful project. Hence, it raises the chance to yield the cash flows X and the private benefit B in case the party in charge decides to continue the project in stage 2. The dashed lines mark Assumption 1 and Assumption 2, respectively, and enclose the area in which both assumptions are fulfilled, thus, the area which is relevant for the analysis. Left to the dashed line Assumption 2 is violated and right to the dashed line Assumption 1 is violated. When q is low within the relevant area, the figure visualizes that U_S and U_R are higher than U_N. With lower probability of success q the manager prefers a covenant contract due to the possibility to negotiate a lower repayment. This preference shifts towards the no covenant contract when the ex-ante probability q increases. In such a situation the risk to miss out on a high-quality project θ_h due to a false alarm, i.e., a low-quality report R_l is published even though the project is of high quality, is enhanced. This risk can be mitigated with a covenant contract that includes the option to renegotiate, though not completely eliminated as with the no covenant contract. Hence, with higher probability of success q the manager prefers the no covenant contract in order to eliminate the possibility of project liquidation. The threshold for U_N surpassing U_S lies at $q = \frac{\lambda(L-B)}{(1-\lambda)X-(1-2\lambda)(L-B)}$, while $q > \frac{(\delta\lambda+\lambda\tau-\delta\lambda\tau)L-\lambda\tau B}{(1-\lambda-\tau+\delta\tau+\lambda\tau-\delta\lambda\tau)X+(1-\lambda-\tau)B-(1-\lambda-\delta\lambda-\tau+\delta\tau)L}$ must be fulfilled for U_N to be higher than U_R. *Figure 22* further depicts that the manager's expected utility U_S is always below the expected utility U_R. The reason for that is given in the option to renegotiate in case the lender gains charge of the decision right, giving the manager the opportunity to still carry out the project to completion and consequently receive the private benefit B and potentially the cash flows X.

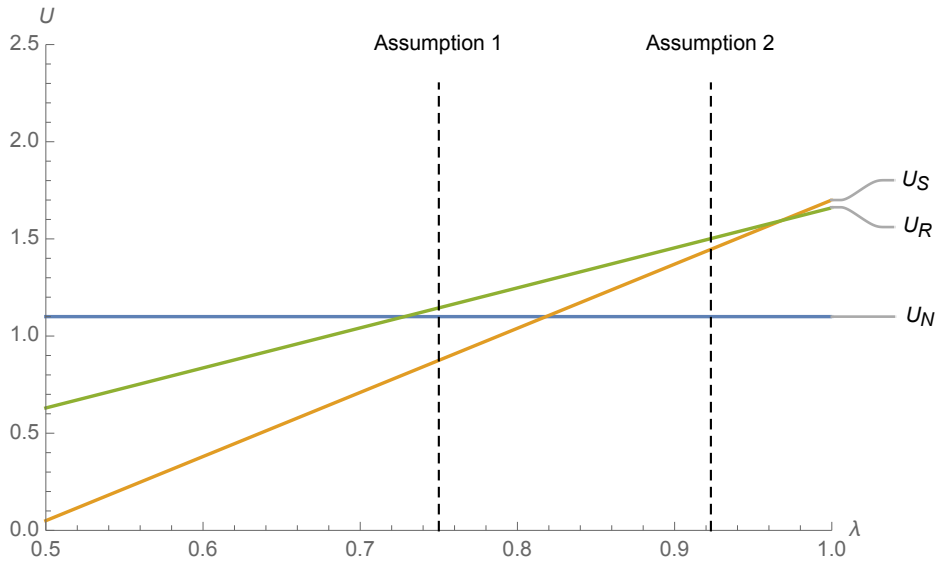

Figure 23: U_R is always higher than U_S. Accuracy λ increases U_S and U_R but has no effect on U_N. Assumption 1 and Assumption 2 are fulfilled in the area between the dashed lines. Comparison of U_N, U_S and U_R with changing λ I=3, L=2, q=0.6, X=6, B=0.5, δ=0.5, τ=0.8

Figure 23 gives a comparison of the manager's expected utilities U_N, U_S and U_R under the same conditions with changing accuracy λ of the reporting system R. While the expected utility with the no covenant contract U_N is not influenced by an increase in λ, the other two expected utilities which include a covenant contract U_S and U_R are increasing with the accuracy λ. A more reliable reporting system provides a less risky environment, allowing the manager to negotiate a lower repayment D for a contract that includes a covenant. With a lower repayment, more of the potential cash flows X remain with the manager in case the project is of high quality and carried out to completion, increasing his utility. Assumption 1 and Assumption 2 are again marked by the dashed lines. The area between the two dashed lines labels the region where both assumptions are fulfilled, thus, the region which is relevant for the analysis. It is evident that with low λ the expected utility U_N is higher than the expected utility U_S. Hence, for this area the manager prefers the no covenant contract over the strict covenant contract. This is due to an enhanced risk of a false warning in case the strict covenant contract is signed, leading to the lender gaining the decision right and subsequently liquidating the project. With higher λ the preference shifts towards the strict covenant contract, as U_S elevates above U_N.

In the example shown in *Figure 23*, the manager's expected utility U_R with a covenant contract and the renegotiation option is always above the manager's expected utility U_N, when considering the relevant region where both assumptions are fulfilled. The reason being is that the renegotiation option offers the possibility to continue the project even after a false warning. Hence, lowering the risk for the manager to miss out on the private benefit B and potentially on the cash flows X. In general, the threshold for the manager preferring the covenant contract with the prospect of renegotiation over the no covenant contract lies at $\lambda = \frac{q(1-\tau)(X+B-L)+q\delta\tau(X-L)}{q(X+B-L)+(1-q-\tau)\delta L+\tau(L-B)-(1-\delta)q\tau X}$. Above this threshold the manager is willing to possibly give up his decision right in order to be able to sign the covenant contract with the option to renegotiate rather than the no covenant contract. Thus, a more reliable reporting system allows the manager to negotiate a contract with beneficial conditions, increasing his expected utility and causing him to prefer a covenant contract.

Proposition 5. *Given that Assumption 2 is fulfilled, the expected utility U_R is always higher than the expected utility U_S.*

In our model, the manager always prefers a covenant contract with the option to renegotiate after a covenant violation. It gives the manager the possibility to still yield the private benefit

B and potentially the cash flows X, even if the decision right over the project continuation shifts towards the lender. Continuation is always the favoured decision for the manager, even if it comes at the price of an increased repayment after renegotiations.

5.4 Chart: Summary of Comparative Statics

The chart below gives an overview of the effects that each parameter has on the face values of debt, the manager's expected utilities and the probability of a successful project after receiving a low-quality report and high-quality soft information. An increasing effect is indicated by ↑, decreasing by ↓ and ↑↓ denotes a possible change in both ways dependent on the specific parameters.

	I	L	q	λ	X	B	δ	τ
D_N	↑	–	↓	–	–	–	–	–
D_S	↑	↓	↓	↓	–	–	–	–
D_R	–	↑	↓	↑	↑	–	↑	↓
U_N	↓	–	↑	–	↑	↑	–	–
U_S	↓	↑	↑	↑↓	↑	↑	–	–
U_R	↓	↑	↑	↑↓	↑	↑	↓	↑↓
$\Pr(\theta_h \mid R_l, S_h)$	–	–	↑	↓	–	–	–	↑

6. Conclusion

Covenants included in debt contracts are often described as mechanisms that aim to mitigate potential conflicts between lenders and borrowers arisen from agency problems and informational asymmetries. Such problems include claim dilution or asset substitution and other forms of opportunistic behaviour. Debt covenants can help with these issues by restricting certain actions like dividend payments and issuance of new debt or setting accounting-based thresholds and ratios such as maintaining a minimum net worth in order to monitor the company's performance. Empirical studies show that in the majority of cases, covenant violations are followed by waivers or renegotiations of the contract terms rather than execution of the covenant or contract termination. Lenders recognize an opportunity to gain access to new information that is originally exclusive to the company or implement changes to their favour in the contract. Hence, the perception of debt covenants has shifted from initially describing them

as mechanisms addressing agency problems by restricting managerial behaviour to tools that allow for modification of contractual terms and, thus, dynamically complete debt contracts.

In our model a firm's manager is given the option of three different debt contracts to finance a project. One does not include any covenants, the other is a strict covenant contract, where the decision right over the project continuation shifts towards the lender upon a covenant violation and the third is equivalent to the strict covenant contract but additionally includes the prospect for renegotiations in case of a covenant breach.

The model shows that the lender is willing to reduce the face value of debt in exchange for the implementation of strict covenants within the debt contract. This reduction can be further enhanced with a reliable reporting system, hence, a mechanism which the lender can trust to provide relatively accurate information. The firm's manager faces a trade-off between less flexibility regarding project decisions and lower costs of debt. Dependent on the circumstances, the no covenant contract as well as the strict covenant contract and the strict covenant contract with the option to renegotiate after covenant violation are relevant options for the manager, that need to be weighed up against each other.

The model further predicts that the manager always prefers a covenant contract with the option to renegotiate over the strict covenant contract. The firm's manager is even willing to compensate the lender with a higher repayment, in order to convince the lender of a project continuation. Hence, a covenant contract with the prospect of renegotiations can be beneficial for both parties. The lender profits from the included covenants and thus reduced risk in case the project turns out to be of low quality. The firm's manager, on the other hand, receives the option to avoid project liquidation following a covenant violation, given convincing soft information is provided. This is in line with empirical literature providing evidence that contract terms are frequently renegotiated or waived upon a debt covenant violation. The model's results further correspond to predictions that managers are willing to give up control and accept tighter covenants when they expect covenant breaches to be waived or renegotiated.

My model of course represents a very simplified and limited world. Future studies could, therefore, investigate more complex scenarios by analysing how renegotiations affect the lender's ability to monitor the borrower's performance and behaviour and how this impacts the

lender's incentive to implement tight covenants as a tool that amplifies the information exchange through frequent renegotiations.

7. Appendix

7.1 Proofs

Proof of Proposition 1

Proof by contradiction. Suppose that $D_S \geq D_N$ holds in equilibrium. Hence,

$$\frac{I}{q\lambda} - \frac{L(q+\lambda-2q\lambda)}{q\lambda} \geq \frac{I}{q}$$

or equivalently

$$\frac{I}{q\lambda} - \frac{I}{q} \geq \frac{L[q(1-\lambda)+(1-q)\lambda}{q\lambda}. \tag{1}$$

From Assumption 1, we know

$$\frac{q(1-\lambda)}{q(1-\lambda)+(1-q)\lambda} X < L\,. \tag{2}$$

Substituting $k := q(1-\lambda)+(1-q)\lambda$, we can rewrite (1) as

$$I\frac{(1-\lambda)}{q\lambda} \geq \frac{kL}{q\lambda}. \tag{3}$$

Additionally, we assume that a successful project is profitable, i.e., $qX > I$. Thus, the left-hand side in (3) has a boundary,

$$qX\frac{(1-\lambda)}{q\lambda} > I\frac{(1-\lambda)}{q\lambda},$$

yielding

$$qX\frac{(1-\lambda)}{q\lambda} > \frac{kL}{q\lambda} \quad \text{or equivalently} \quad qX(1-\lambda) > kL \quad \text{or} \quad \frac{qX(1-\lambda)}{k} > L \quad (\text{because } k > 0).$$

This contradicts $\frac{q(1-\lambda)}{k} X < L$ from Assumption 1. We found a contradiction and $D_S \geq D_N$ can never hold.

Proof of Proposition 5

We have shown that

$$U_S = q\lambda(X - D_S + B) + (1 - q)(1 - \lambda)B$$

and

$$\begin{aligned} U_R = {} & q\lambda(X - D_S + B) + (1 - q)(1 - \lambda)B \\ & + \Pr(\theta_h|R_l, S_h)\Pr(R_l, S_h)(X - D_R + B) \\ & + \Pr(\theta_l|R_l, S_h)\Pr(R_l, S_h)B \end{aligned}$$

apply. Thus, the expected utility in case of renegotiations can be restated as

$$U_R = U_S + \underbrace{\Pr(\theta_h|R_l, S_h)\Pr(R_l, S_h)}_{\geq 0}(X - D_R + B) + \underbrace{\Pr(\theta_l|R_l, S_h)\Pr(R_l, S_h)B}_{\geq 0}.$$

Consequently, U_R will always be larger when $(X - D_R + B)$ is positive. Substituting D_R yields

$$\begin{aligned} X - D_R + B &= X - \frac{L}{\Pr(\theta_h|R_l, S_h)} + \frac{\delta L}{\Pr(\theta_h|R_l, S_h)} - \delta X + B \\ &= (1 - \delta)X - (1 - \delta)\frac{L}{\Pr(\theta_h|R_l, S_h)} + B \; > \; (1 - \delta)[X - \frac{L}{\Pr(\theta_h|R_l, S_h)}] \end{aligned}$$

as $B \geq 0$. However, $X - \frac{L}{\Pr(\theta_h|R_l, S_h)} > 0$ is equivalent to $\Pr(\theta_h|R_l, S_h)\,X - L > 0$.

The last term represents the potential residual of continuing the project, discussed in equation (11) and the paragraph above. Only if this residual is positive will the lender consider arranging renegotiations. Hence, $(X - D_R + B)$ has to be positive and $U_R > U_S$ always holds.

7.2 Additional Effects of the Accounting Information Accuracy under Strict Covenants

Positive Effect of λ

Under most circumstances the accuracy of the reporting system λ will have a positive effect on the manager's expected utility in the strict covenant contract scenario U_S. Such a scenario is depicted in *Figure 24*.

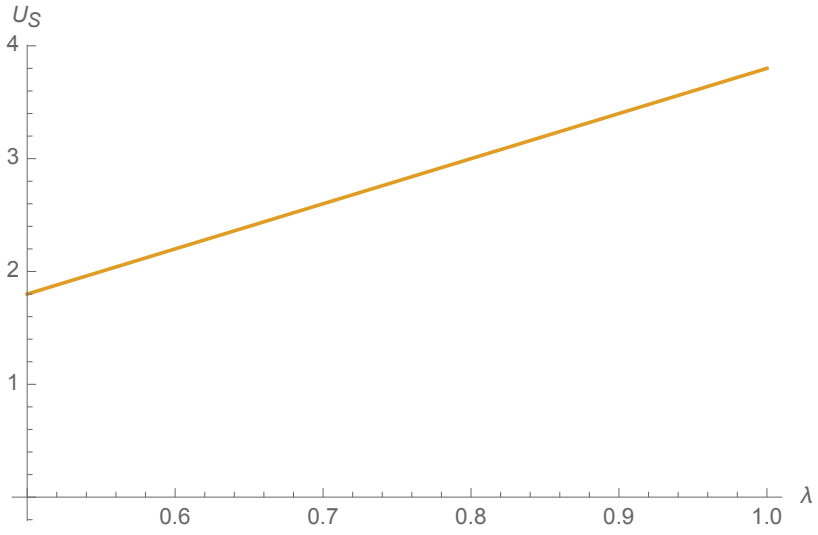

Figure 24: Expected utility U_S increases with λ.
U_S=Manager's expected utility with a strict covenant contract, λ=Accuracy of the reporting system
I=3, L=2, q=0.6, X=6, B=4

With increasing reliability λ of the accounting report R the manager can expect a higher utility. The risk of taking the wrong decision regarding the project continuation is decreased due to a precise reporting system with high informational value. Thus, it is less likely to receive a false warning, which would indicate a covenant violation and a shift in the decision right towards the lender. Since the lender believes in the accounting report's assessment, liquidation of a high-quality project and missing out on the cashflow X would be the consequence. With a more accurate reporting system this can be prevented. Additionally, the more reliable report R influences the face value of debt D_S. The manager can negotiate a lower repayment in a less risky environment due to a trustworthy accounting system, which further positively affects his expected utility.

In most cases, the positive effect that λ exerts on the manager's expected utility U_S is enhanced with increasing ex-ante probability q. Nevertheless, when $B < L - \frac{X}{2}$ applies, q diminishes the

effect that the accuracy of the accounting system λ has on U_S. Both cases are shown in *Figure 25*.

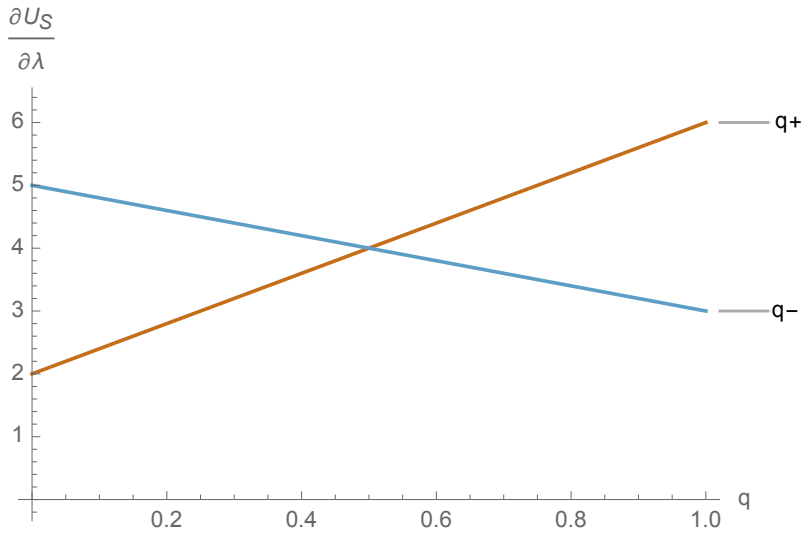

Figure 25: Probability q can enhance or diminish the positive effect of λ.
$\frac{\partial U_S}{\partial \lambda}$=Marginal impact of the accuracy of the reporting system λ on the manager's expected utility with a strict covenant contract U_S,
q=Ex-ante probability of a high-quality project
q +: I=7, L=3, λ=0.8, X=8, B=1
q −: I=7, L=6, λ=0.8, X=8, B=1

Under usual conditions, an increased q will amplify the effect of λ. With a high probability of successfully carrying out the project, the desire for an accurate reporting system increases. The manager wants a reliable report R in stage 2 in order to enhance his chance to stay in charge of the decision right in case the project is indeed of high-quality. This enables him to continue the project and receive the private benefit B as well as yielding cash flows X. Higher probability of obtaining private benefit B and cash flows X naturally further increases the manager's expected utility U_S. This is shown with the graph marked by "$q+$" in *Figure 25*. Furthermore, a reliable accounting system is able to mitigate the risk of a false warning. In a scenario with increasing chance of success, the false warning R_l leads to missing out on the cash flows of a high-quality project θ_h due to liquidation. This increases the opportunity costs for the manager of forgoing the project and in consequence decreases his expected utility. Hence, with increasing ex-ante probability q, a more reliable reporting system is even more beneficial for the manager.

In some situations, i.e., given $B < L - \frac{X}{2}$ applies, an increased ex-ante probability q weakens the positive effect that λ has on the expected utility U_S, as depicted by "$q-$" in *Figure 25.* This inequality is fulfilled only for a very high liquidation value L in connection with a low

private benefit B. In such a rare situation, the manager does not exert much additional benefit from an enhanced probability of success q. Continuing the project becomes less important to the manager due to a low private benefit B, while the very high liquidation value L already lowers the repayment D_S in stage 1. Both combined provide that in such a scenario, the higher the ex-ante probability of success q, the lower the impact of an increase in the accuracy of the reporting system λ on the manager's expected utility U_S, applies.

The effect that an increasingly accurate reporting system has on the manager's expected utility U_S is further influenced by the liquidation value L. Whether this effect is increasing or decreasing with L is once more dependent on the ex-ante probability q. Both scenarios are shown in *Figure 26*.

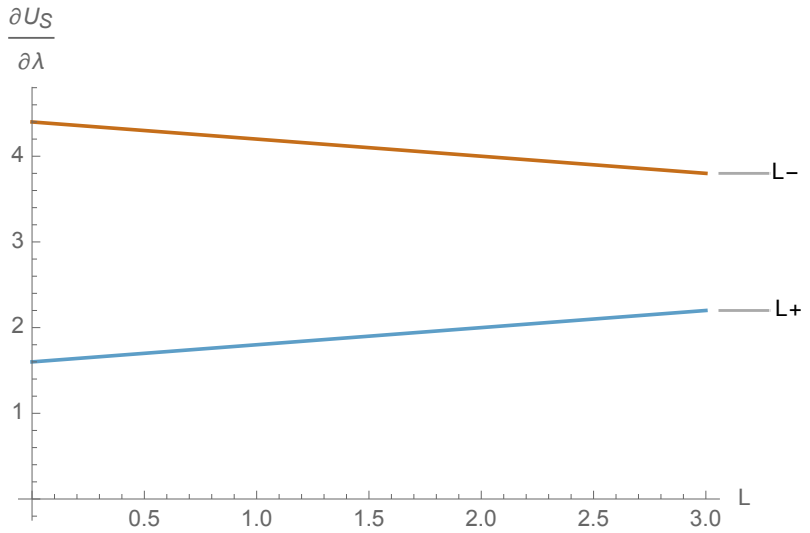

Figure 26: Liquidation value L can enhance or diminish the positive effect of λ.
$\frac{\partial U_S}{\partial \lambda}$=Marginal impact of the accuracy of the reporting system λ on the manager's expected utility with a strict covenant contract U_S,
L=Liquidation value
L +: I=3, q=0.4, λ=0.8, X=6, B=4
L −: I=3, q=0.6, λ=0.8, X=6, B=4

If $q < \frac{1}{2}$ is fulfilled, the liquidation value L is enhancing the accounting system's influence on the expected utility. In this situation the probability of success q is relatively low. The lender, therefore, demands other reliabilities like a high liquidation value L in case the project turns out to be of low quality θ_l. A more accurate reporting system R, and thus higher λ, is desired in order for the lender to be willing to a accept a lower face value of debt D_S. This lower repayment in return increases the manager's expected utility. The enhancing impact of L is demonstrated by "L +" in the figure above. However, the liquidation value's influence shifts in case $q > \frac{1}{2}$

applies. The graph labelled with "$L-$" shows how the liquidation value L can attenuate the effect of an increasing λ. In this scenario the manager already faces a lower repayment D_S in stage 1, compared to the repayment above, since the lender is satisfied with the high ex-ante probability of success q. An additionally increased liquidation value L then only reduces the scope of influence for the accuracy of the report λ, because there is only limited space for further diminishing the repayment and hence increasing the manager's expected utility. Therefore, an increased liquidation value L can weaken the effect the accuracy of the reporting system λ has on the expected utility U_S. Nonetheless, for the example in *Figure 26*, this is a rather modest effect.

Finally, we will discuss another parameter which can influence the positive effect of λ on U_S in both ways, the private benefit B. Again, it depends on q whether B is enhancing or weakening the impact of an increasing accuracy of the reporting system λ.

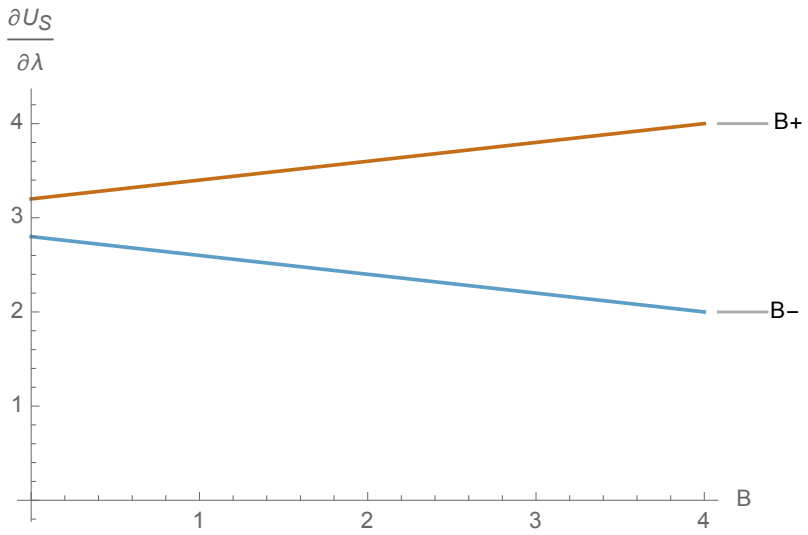

Figure 27: Private benefit B can enhance or diminish the positive effect of λ.
$\frac{\partial U_S}{\partial \lambda}$=Marginal impact of the accuracy of the reporting system λ on the manager's expected utility with a strict covenant U_S,
B=Manager's private benefit
B +: I=3, L=2, q=0.6, λ=0.8, X=6
B −: I=3, L=2, q=0.4, λ=0.8, X=6

Figure 27 depicts two different scenarios. One in which the private benefit B is enhancing the effect of an increasing λ and the other where B diminishes this effect. Regarding λ, the private benefit B operates in the opposite direction of the liquidation value L from above. In case $q > \frac{1}{2}$ the private benefit B increases the impact that λ has on the manager's expected utility U_S. A higher ex-ante probability of success q equals an increased chance of a high-quality project θ_h.

The accounting report R, with increasing accuracy λ, is then more likely to detect the high-quality project θ_h correctly and transmit this information the lender and the manager, hence allowing him to stay in charge of the decision right. This becomes even more important to the manager with increasing private benefit B at stake. Since only continuing the project enables the manager to receive the private benefit, thus, increasing his expected utility U_S with respect to λ even further. In the other case, i.e., if $q < \frac{1}{2}$ is fulfilled, the effect of the accuracy of the reporting system λ is diminished by an increasing private benefit B. Corresponding to the interpretation above, the probability of success is lower in this situation, making it more likely to end up with a low-quality project θ_l. With increasing private benefit B the manager loses out on a higher B in case the accounting report correctly detects the project as low-quality. Thus, reducing the positive effect a more accurate reporting system.

Negative Effect of λ

A highly accurate reporting system might influence the manager's expected utility negatively in some instances, as discussed in the chapter above. A possible scenario for this is shown in *Figure 28*.

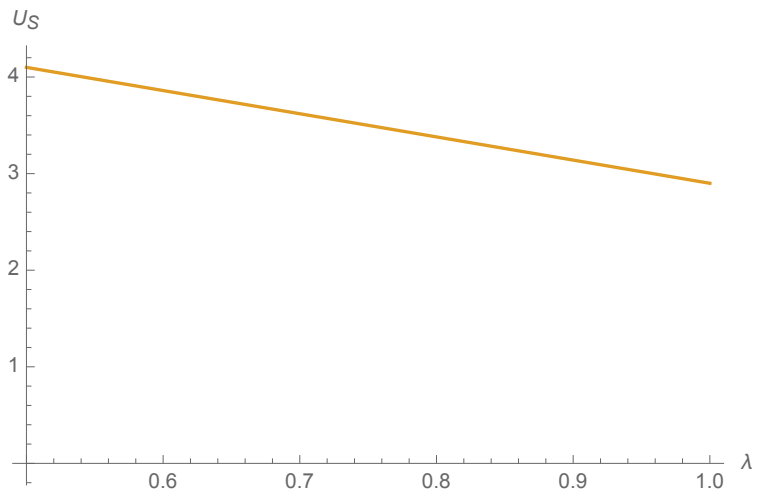

Figure 28: Expected utility U_S decreases with λ.
U_S=Manager's expected utility with a strict covenant contract, λ=Accuracy of the reporting system
I=2, L=1, q=0.35, X=4, B=10

In this case the manager prefers a less accurate reporting system since an increase in λ decreases his expected utility U_S. Under these circumstances both the cash flows X and the private benefit B must be very high in relation to the initial investment I and the liquidation value L. Otherwise, the manager would not be willing to accept the strict covenant contract in the first place, since

the repayment D_S is exceeding the expected payoff qX. The reduction of the expected utility U_S due to an increased accuracy of the reporting system λ, can be explained by the manager's reluctance to give up the decision right in such a situation. Due to the low probability of success q, the likelihood of a low-quality report R_l is increased in case the two parties are confronted with a highly accurate accounting system. Since a low report R_l equals a covenant violation, the decision right over the project continuation shifts towards the lender. Consequently, the lender decides to liquidate the project, leaving the manager with no return at all, neither in form of the cashflow X nor the private benefit B. It is, hence, in the manager's interest to prevent this from happening. Therefore, he prefers a less accurate reporting system λ in order to increase his expected utility U_S.

This negative effect on the expected utility U_S is further influenced by the other parameters. A decreasing ex-ante probability q, for example, is reinforcing this effect. It is quite intuitive that the lower probability of success q combined with a more accurate reporting system further reduces the manager's expected utility in the strict covenant contract scenario. In this situation the chance of a shift in the decision right is enhanced. Thus, it is more likely for the project to be liquidated and subsequently the manager losing out on the cashflow X and the private benefit B. An increase in the liquidation value L, on the other hand, reduces the negative effect that λ has on the manager's expected utility U_S. The reason being is that a higher liquidation value reduces the face value of debt D_S which in return enhances the manager's expected utility U_S. The private benefit B, once more, works in the opposite direction to the liquidation value L. Increasing the private benefit leads to amplifying the negative effect of a more reliably accounting system. This is due to increased opportunity costs for the manager in case of missing out on B. Missing out becomes more likely as the accuracy of the accounting report λ increases, because of the more probable shift in the decision right and the following liquidation of the project. Therefore, the manager prefers a less accurate accounting report.

Since an increase in the accuracy λ of the reporting system negatively affecting the expected utility U_S is a relatively unlikely scenario and only appears under very specific circumstances – a low probability of success q which also further reduces the chance of conclusion of the strict covenant contract in the first place, and a very high private benefit B – it is only discussed briefly here.

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