Relational Contracts and the Commitment Role of Equity Financing*

Matthias Fahn[†], Valeria Merlo[‡], Georg Wamser[§]

May 10, 2013

Abstract

This paper shows that a firm's financing structure has a substantial impact on the relational contracts formed between a firm and its managers/employees. In particular, equity generally strengthens the firm's commitment to honor relational contracts. The reason is that bankruptcy determines the firm's off-equilibrium payoff, and too much leverage allows the firm to share the costs of reneging with its creditors: The enforceability constraint determining managerial effort is generally tightened by debt, and reneging and consequently defaulting becomes more attractive. We provide empirical evidence that a higher relevance of relational contracts is indeed associated with lower leverage. In addition, high bankruptcy costs can be beneficial for a firm and reduce the maximum amount of debt even more. Hence, this paper can help to shed light on the puzzle why so many firms seem to be substantially underlevered.

*This is a preliminary version. We thank Ricardo Alonso, Mike Fishman, Jin Li, Niko Matouschek, David Matsa, Monika Schnitzer, Caspar Siegert and Robert Ulbricht, as well as seminar participants at the 1st Bavarian Micro Workshop (Regensburg) and the 16th Colloquium on Personnel Economics (Tuebingen), for helpful comments.

[†]Affiliation: University of Würzburg. Address: Unversity of Würzburg, Stephanstr. 1, 97070 Würzburg, Germany. E-mail: matthiasfahn@web.de

[‡]Affiliation: ETH Zürich. Address: ETH Zürich, KOF, Weinbergstrasse 35, WEH E7, 8092 Zürich, Switzerland. E-mail: merlo@kof.ethz.ch.

[§]Affiliation: University of Tübingen and CESifo. Address: University of Tübingen, Melanchthonstraße 30, 72074 Tübingen, Germany. E-mail: georg.wamser@uni-tuebingen.de.

1 Introduction

There is now a wide consensus that not all relevant aspects of interactions between economic agents can be pinned down in formal, court-enforceable contracts. Informal arrangements serve as substitutes and determine rules for how employees are rewarded for their performance, when someone is fired, or who gets promoted to a vacant position. In (potentially) long-run interactions, so-called relational contracts - i.e., self-enforcing implicit agreements - help to sustain cooperation even if it is against the short-run interest of players. In recent years, enourmous progress has been made in analyzing relational contracts in isolation. Only first steps, however, have been taken to understand how they interact with the various institutions that shape the environment in which the involved parties operate.

The following article shows that there is a strong link between a firm's financing decision, i.e. to what extent it should finance its operations with debt or equity, and the relational contracts it has with its managers, employees or suppliers. Generally, debt has a negative impact on the enforceability of relational contracts - because too much debt increases the firm's reneging temptation. The reason is that even if the likelihood of bankruptcy is negligible in equilibrium, it still determines the firm's outside option. Hence, leverage allows a firm to shift some of the negative consequences of breaking implicit promises to its creditors. Our major prediction - firms that have to rely more on relational contracts should have lower debt levels - is supported by an empirical analysis, using data of German multinationals and their foreign affiliates: After the costs of writing formal contracts increased in a number of countries, a substantial reduction of debt ratios could be observed there. More generally, by showing that equity financing increases a firm's commitment in relational contracts, we can also contribute to a better understanding of a puzzle that has been identified in the corporate finance literature: Given present theories and potential tax benefits of debt, firms seem to be substantially underlevered (Graham, 2000, or Graham and Leary, 2011).

In particular, there is evidence that leverage is low whenever issues like reputation, trust and long-term commitment are a crucial determinant of a firm's success. Strebulaev and Yang (2012) show that in industries like healthcare or technology, the share of firms with a negligible amount of debt is substantially higher than in other industries. In addition, Graham and Leary (2011) present an established result in the corporate finance literature, namely that firms that are more R&D intensive have more equity. Furthermore, an interesting observation can be made with regard to family firms. For example, a study by Price Waterhouse Coopers (2012) identifies a larger commitment of family firms to jobs, which "translates into greater loyalty and commitment from those they employ" (p. 5). This leads "family-run businesses ... to have more loyalty toward their staff – people are not just a number" (p. 6). But family firms on average also have substantially higher equity ratios than non-family firms (see Ampenberger et. al, 2011, or PwC, 2012). This is often attributed to higher risk aversion of families and the fear of loosing control if circumstances turn out to be bad (Mishra and McConaughy, 1999) or the inability to attract external capital. We argue that the low debt level of family firms might also be a consequence of the importance they attribute to relational contracts formed with their employees.

Thereby, we develop a dynamic model where a risk-neutral firm (the principal) needs capital and effort of a risk-neutral agent to operate. The agent might be a manager of the firm, but could also be the firm's total workforce or a supplier that delivers an important intermediate good. Capital can be financed via equity or debt, and the use of neither of them is exogenously restricted. As creditors and principal share the same time preferences, the direct costs of debt and equity are identical. Furthermore, the agent has to be motivated to exert effort. However, effort is not verifiable, and relational contracts are required to provide incentives. The enforceability of relational contracts is determined by the future value of operating the firm, compared to its value after declaring bankruptcy. The latter is realized in case the firm has not kept its promises and lost the agent's trust, who subsequently cannot be motivated to exert effort anymore.

The firm has an incentive to reward the agent accordingly because bankruptcy is costly. These costs do not only manifest in foregone profits when the firm cannot be operated anymore. In addition, the firm's liquidiation value is lower than the capital initially invested. Reasons are that physical assets are firm-specific and need to be tied to the firm's needs, hence being less valuable in alternative settings. Furthermore, rent-seeking activities by different share- or stakeholders might be observed, or lawyers be hired to accompany the firm's liquidation. Now, as loans can only be credibly pledged against the firm's liquidation value, the debt level should not exceed the amount creditors get back for sure in case of a bankruptcy. If debt was higher, the firm would not have to bear the full costs of reneging. Consequently, low debt keeps incentives to deviate down and raises the firm's credibility in the relational contract. Hence, we develop an argument in favor of equity financing that does not rely on debt increasing the risk of going bankrupt - in our benchmark model, a bankruptcy is actually never observed in equilibrium; hence, the direct costs of debt financing do not increase in leverage. In addition, agency problems between a firm and its creditors - which drive the results in many of the established theories - are not assumed away in our setup but still exist. However, they never bind in equilibrium, given the agency problem between principal and agent.

In a couple of extensions, we explore the impact of an increase in bankruptcy costs and how this can affect the firm's ability to motivate the manager. There, we consider two channels, namely a direct reduction of the firm's liquidation value and a longer duration before the firm can actually be liquidited after filing for bankruptcy. These costs can be affected by bankruptcy laws or the extent to which rent-seeking activities are possible in this case. Maybe surprisingly, higher bankruptcy costs are beneficial for the firm whenever the likelihood of bankruptcy is relatively low in equilibrium. Then, the firm's outside option is reduced without too much affecting equilibrium profits, thereby increasing its commitment. Furthermore, a longer duration between filing for bankruptcy and actual liquidation of the firm gives an even stronger case against using debt. The reason is that debt allows the firm to share the costs of a delay with its creditors and hence increases the firm's reservation value. As long as creditors always face some costs in case of bankruptcy, it is actually optimal for the firm to use no debt at all. This result is related to the recent empirical contribution of Strebulaev and Yang (2012), who show that surprisingly many firms operate at a zero-debt level. These firms are more profitable, pay higher dividends and often are family owned - hence they seem to leave substantial tax shields on the table. We show that this "puzzle" can be driven by an attempt of these firms to maximize commitment in their employment relationships. In a next step, we assume that debt is cheaper than equity, which might be driven by the tax-deductability of interest. We show that our results basically remain valid, as long as this cost advantage is not too high.

Finally, we conduct an empirical analysis to test our prediction that a higher relevance of relational contracts should be associated with lower leverage. Thereby, we slightly extend our model and assume that formal contracts can generally be written as well. However, the principal can refuse to pay the bonus by claiming effort was too low. Then, the agent has to go to court and sue the principal, which however is associated with costs. If these costs are too high, formal contracts cannot be used to motivate the agent, and the relationship has to be based on relational contracts. We observe those "costs of enforcing (formal) contracts" in the World Bank's World Development Indicators (WDI) database and have data on the capital structure of the foreign affiliates of German multinationals. In line with our theory, we indeed observe that an increase in the costs of enforcing contracts - which should be associated with a larger relevance of relational contracts - is associated with lower debt ratios.

Related Literature

Since Modigliani and Miller's irrelevance result (1958), the corporate finance literature has been concerned with the impact of a firm's financing structure on its value. Various benefits and costs have been attributed to the use of either debt or equity, where the most prominent ones can be subsumed under tax incentives and agency problems (see Harris and Raviv, 1991, or Myers, 2003, for reviews of the literature). Agency problems are caused by the unverifiability of (aspects of) an entrepreneur's or manager's activities. Myers (1977), Stiglitz and Weiss (1981, 1983), or Holmström and Tirole (1997), among others, apply moral hazard models to show that using too much debt can increase the probability of bankruptcy. Because a firm is protected by limited liability, its downside risk after a default is reduced. This induces firms to take insufficient measures to reduce their bankruptcy risk - for example by selecting too risky investments, or by enforcing inadequate effort to make projects successful and consequently ensure the existence of the firm. The relating "costs of financial distress" constitute one part of the so-called trade-off theory of capital (Modigliani and Miller, 1963), which claims that a firm's optimal debt ratio should balance the costs and benefits of debt. These benefits are to a large extent associated with tax shields driven by the deductibility of interest payments. Furthermore, debt might be the optimal response to agency problems between the firm and its managent or the firm and outside investors. For example, managers might have tendencies to overinvest[1]. If it is not possible to otherwise induce them to act in shareholders' interest, debt can optimally reduce the free cash flow available to managers and hence restrict their investment opportunities (see Jensen, 1986, Hart and Moore, 1995, or Zwiebel, 1996). In addition, debt shifts control rights to debtholders in bad states of the world. This threat of a potential loss of control is supposed to discipline managers and incentivize them to choose the right actions and repay investors (see Bolton and Scharfstein, 1990, Dewatripont and Tirole, 1994, Hart and Moore, 1998, or Inderst and Müller, 2003).

However, neither the empirical case for the tradeoff nor for the free-cash-flow theory is too strong. It rather seems that debt levels in reality are much lower than predicted, and firms where potential costs of financial distress seem to be very low are substantially underlevered (see Graham, 2000, among others). As Myers (2003, pp. 21) put it, "...studies of the determinants of actual debt ratios consistently find that the most profitable companies in a given industry tend to borrow the least... High profits mean low debt, and vice versa. But if managers can exploit valuable interest tax shields, as the tradeoff theory predicts, we should observe exactly the opposite relationship. High profitability means that the firm has more taxable income to shield, and that the firm can service more debt without risking financial distress." Hence, Graham and Leary (2011) come to the conclusion that traditional explanations of a firm's optimal capital structure are incomplete and that new approaches are needed. Those should also consider the effect of a firm's financing structure on its relationship with non-financial stakeholders, for example employees. Several steps have already been taken into that direction. Brander and Lewis (1986) develop the idea that debt might be used by firms as a negotiating tool in labor bargaining to demand larger concessions from its employees.[2] More recently, Berk et al. (2010) show that risk-averse employees demand higher wages if leverage is increased. The idea is that if their employer goes bankrupt, they become unemployed, and hence must be compensated for any increase in this risk induced by higher debt ratios. Titman (1984) analyzes the impact of a firm's capital structure on implicit contracts with its customers/suppliers. If the firm produces durable goods that require future maintainance or other services - and no other firm in the market can provide these services at a comparable

[1]Potential reasons identified in the literature are preferences for empire building (see Williamson, 1964, or Jensen and Meckling, 1976), short-termism of managers who focus on activities the market can easily observe (see Stein, 1989, or Bebchuk and Stole, 1993), or managers' overconfidence into their own abilities (see Roll, 1986, or Heaton, 2002).

[2]This argument received empirical supported by Matsa (2010) or Benmelech et al. (2012).

price or quality - the firm's liquidation imposes costs on its customers. However, the firm does not take these costs into account when considering a liquidation. Then, equity can serve as a commitment device to not liquidate the firm too early.[3] This theory has also received some empirical support. Titman and Wessels (1988) show that firms with unique and specialized products, and in particular having large R&D expenditures, high selling expenses and employees with low quit rates, have lower leverage. Kale and Shahrur (2007) find that R&D intensities - which are regarded as a proxy for the willingness to make relationship-specific investments - are negatively correlated with leverage across industries. Furthermore, firms active in industries with more joint ventures and strategic alliances with customers/suppliers are less levered. Their results are stronger in concentrated industries and for firms with a high market share. Banerjee et. al (2008) show that firms in bilateral relationships, i.e., those that only have business with a few major customers or suppliers, have lower leverage - in particular in durable goods industries. However, the observation that closer links between firms lead to lower debt levels do not necessarily have to be implied by costs that are imposed on suppliers or customers by a liquidation, but might also indicate the importance of relational contracts between the involved parties. In particular, we add to the standard tradeoff argument and show that more debt can even be costly if it does not increase the risk of going bankrupt.

Another interesting observation is made by Bae et. al (2011). They discover a negative connection between a firm's debt ratio and its reputation for providing fair employee treatment (where the latter is measured by an index that measures the degree of a firm's employee friendliness.). Although honoring relational contracts does not have to make a firm appear more "friendly" to its employees, the opposite should certainly be true: A firm that is not trusted to keep its promises will definitely not be known to be fair towards employees.

Furthermore, we contribute to the literature on relational contracts. Generally, relational contracts are repeated games based on signals that are not verifiable but observable to the parties involved. Cooperation can be sustained if players can credibly commit to keep their promises, which is the case if the future payoff of sustained cooperation is sufficiently large. Future surplus is hence used as a collateral to support cooperative behavior today. Theoretical foundations were laid by Bull (1987), MacLeod and Malcomson (1989), or Levin (2003). Recent developments include the introduction of limited liability (Fong and Li, 2010, or Thomas and Worral, 2011) or shocks on the costs a firm faces when compensating its employees (Li and Matouschek, 2011, or Englmaier and Segal, 2011). Many economists now are convinced that the appropriate handling of relational contracts is crucial for the success of firms. Gibbons and Henderson (2012), for example, argue that different aspects of relational contracts are responsible for observed persistent performance difference among seemingly similar enterprises.

[3]In a related paper, Maksimovic and Titman (1991) show that equity can also be a commitment device to invest into product quality. These investments are associated with costs today, but - by increasing firm reputation for product quality - increase profits tomorrow. However, if the likelihood of going bankrupt is too high, the firm is tempted to shift future consequences of a lower reputation to its bondholders.

However, we still need to make progress in understanding the precise impact of relational contracts on a firm's success, in particular when the institutional environment principal and agent operate in is taken into account as well. For example, we already know that the enforceability of relational contracts is crucially affected by the existence of explicit contracts. In particular, explicit contracts might make it more difficult to sustain cooperation, simply because players' outside options are increased (Baker et. al, 1995, or Schmidt and Schnitzer, 1995). More recently, Fong and Li (2010) and Fahn (2012) analyze the impact of a binding minimum wage on the efficiency of relational contract. Whereas the former show that inefficiency generally goes down, the latter identifies an efficiency *increase* whenever agents can be replaced and endogenous turnover costs are needed to induce firms to not fire agents instead of compensating them. Furthermore, Powell (2011) shows that the need to use relational instead of formal contracts can be associated with equilibria where firms have different marginal productivities. He claims that this outcome can contribute to the long-discussed question of why productivity difference between countries persistently are so large. Finally, Fahn and Rees (2012) analyze the impact of divorce laws on the enforceability of relational contracts between spouses in a marriage.

2 Model

In the following, we construct a principal-agent model to analyze the impact of a firm's financing structure on relational contracts it has with its stakeholders - like managers, employees, or suppliers. For expositional convenience, though, we first focus on the agent being a manager of the firm. Later, we show that the formal analyis is unaffected if the agent is a supplier or the firm's total workforce.

The risk-neutral firm (principal, he) needs two kinds of inputs for production, namely capital and effort from a risk-neutral manager (agent, she). The time horizon is infinite, time is discrete, and players share a discount factor δ, with $0 < \delta < 1$.

In period $t = 0$, the principal has to make a capital investment K to get the firm running (the amount K is exogenously given) and can either use equity (assuming that he is not liquidity constrained and has sufficient funds to finance K[4]) or debt financing. If he wants to use debt financing, he can enter a perfectly competitive credit market in every period $t = 1, 2, ...$, where all potential creditors are risk neutral and also have a discount factor δ. The total debt level in period t is denoted $D_t \leq K$, implying that equity amounts to $K - D_t$. Interest is paid at the end of period t and denoted r_t. Furthermore, D_t is pledged against the firm's assets, which have a liquidation value of γK, with $\gamma < 1$. Hence, $(1-\gamma)K$ are the total costs of a bankruptcy the firm faces. These costs can manifest in firm-specific assets needing

[4] Alternatively, we could assume that a market for external equity exists and that there are no agency problems between different shareholders.

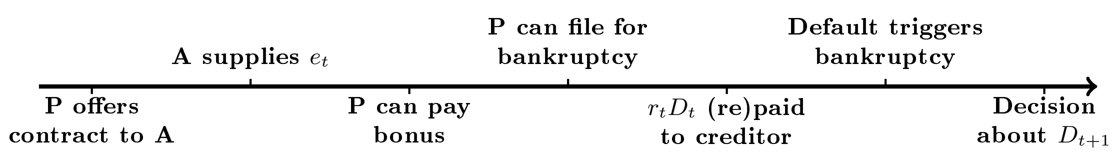
particular attempts to be tied to the firm's needs - and hence being less valuable outside the firm. Also, rent-seeking activities by different stake- and shareholders might destroy value in case of bankruptcy, or lawyers have to be paid to accompany the liquidation process.

At the beginning of every period $t = 1, 2, ...$, the principal makes an employment offer to the agent. This offer involves a compensation package $W_t = (w_t, b_t)$, where w_t is a fixed component paid at the beginning of the period and b_t a discretionary bonus potentially forwarded later. More precisely, the bonus is supposed to be paid whenever the agent exerted the appropriate (i.e. equilibrium) effort level. If the agent rejects the offer, she consumes her outside utility $\overline{u}$. Then, the firm has to be liquidated; the consequences of a liquidation are further described below.[5]

Upon accepting the contract offer, the agent subsequently chooses effort. Effort is continuous, $e_t \geq 0$, and associated with private effort costs $c \cdot e_t$, with $c > 0$. The firm's production function is $y_t = f(e_t)$, with $f' > 0$, $f'' < 0$, and $f(0) = 0$. Then, the principal has the choice to forward b_t to the agent.

Subsequently, the principal is supposed to repay the loan D_t, plus interest $r_t D_t$.[6] If he defaults, he has to file for bankruptcy. In this case, the liquidation value γK is immediately realized[7], and allocated between creditors (who receive $\overline{D}_t = \min\{D_t(1 + r_t), \gamma K\}$) and the firm (getting $\overline{\Pi}_t = \max\{0, \gamma K - D_t(1 + r_t)\}$). If the principal does not default and instead decides to repay his obligations, he enters the credit market again to borrow D_{t+1}, the debt used in the next period.

The timing within a period $t \geq 1$ is summarized in the following graph:



As stated previously, the agent in our setup does not necessarily have to be the manager of a firm. The setup could also be applied to a situation where relational contracts are formed between the firm and its total workforce. This aspect is formally derived in section 7 below. Furthermore, we can analyze the relationship between a downstream firm (principal) that needs exactly one unit of an intermediate good produced by an upstream firm (agent) in every period t. For convenience, we would assume that the downstream firm is not able to produce

[5]Note that a liquidation in case of a rejection would not be necessary if another manager could be hired in that case. This would leave the present analysis unaffected as long as all potential managers were aware of deviations from equilibrium behavior by the firm.

[6]r_t also constitute the - implicit - costs of equity financing.

[7]In section 8.2 below, we analyze what happens if the firm's liquidation value is realized later.

the intermediate good itself.[8] Now, e_t captures the quality of the intermediate good, and delivering a quality e is associated with costs $c \cdot e$. Then, w is the base price and b an additional bonus if quality is satisfactory (alternatively, we could say that $p_t = w_t + b_t$ is the agreed upon price, but the downstream has the option to refuse on the payment of b_t by claiming that product quality is not satisfactory). This interpretation of the model is particularly relevant for the empirical analysis in section 9 below.

3 Contractability & Equilibrium Concept

Effort and output are observed by principal and agent but not by any party outside. Hence, no explicit, court-enforceable contract can be based on their realizations. This implies that a relational contract between principal and agent is required to motivate the latter.

Between principal and creditors, though, formal (short-term) contracts are possible. Such a debt contract determines the firm's repayment obligations (including interest). Repayment obligations are pledged against the firm's assets. Hence, a failure to make repayments results in the creditors getting access to these assets, and consequently a liquidation and bankruptcy of the firm. Furthermore, the formal credit contract also includes the fact that D_t actually has to be invested into the firm, hence the principal is not able to "steal" D_t after borrowing it. The firm's total debt level D_t, complete debt history $(D_1, ..., D_{t-1})$ and all repayments are observable to all (potential) creditors. Finally, the structure of the game, as well as preferences and production function are common knowledge and also known to (potential) creditors.

The equilibrium concept applied here is Perfect Bayesian Equilibrium. Although information between principal and agent is symmetric, creditors do not know whether the game is in equilibrium and have to form their beliefs given the firm's activities on the credit market. Since creditors' beliefs are only needed in the proof to Lemma 4, we formally introduce them there.

Then, all players choose their strategies, actions and beliefs in order to maximize their discounted payoff streams in every period t, given all other players' strategies and actions, on and off the equilibrium path. In the following, our objective is to characterize a Perfect Bayesian Equilibrium that maximizes the firm's profits as regarded in $t = 0$.

[8] If the downstream firm were able to produce the intermediate good itself, our results would still be valid as long as this was associated with lower profits and a higher likelihood of going bankrupt.

4 Payoffs & Constraints

In a period $t \geq 1$ where the firm is active, the principal's equilibrium payoff can be defined recursively and equals

$$\Pi_t = f(e_t) - w_t - b_t - D_t (1 + r_t) + D_{t+1} + \delta \Pi_{t+1}.$$

Furthermore, since the investment is made in period $t = 0$, we have $\Pi_0 = -(K - D_1) + \delta \Pi_1$.

The agent's equilibrium payoff in a period $t \geq 1$ where the firm is active is

$$U_t = w_t + b_t - c \cdot e_t + \delta U_{t+1}.$$

Concerning creditors, we can assume without loss of generality that the firm always borrows the whole amount D_t from only one creditor. Hence, this creditor's payoff in a period $t \geq 1$ where the firm is active is equal to

$$V_t = D_t(1 + r_t) - D_{t+1} + \delta V_{t+1}.$$

To characterize an equilibrium, we also have to specify what happens if the game is out of equilibrium. If the agent did not select equilibrium effort e_t or the principal failed to make a promised bonus payment b_t, we follow Abreu (1988) - who shows that in such a situation the most severe (credible) punishment after cheating can be used to characterize any equilibrium - and assume that all trust between the players is lost. Then, the agent is not willing to choose a positive effort level anymore, whereas the principal is not going to pay any bonus. As a consequence and since $f(0) = 0$, the firm will be liquidated.

Constraints

In any non-trivial equilibrium where the agent is employed and exerts effort, a number of constraints have to be satisfied. First of all, the agent must prefer to be employed by the firm, compared to consume her outside option. This is captured by her individual rationality (IRA) constraints,

(IRA)

$$U_t \geq \overline{U}, \text{ all } t \geq 1,$$

where $\overline{U} = \frac{\overline{u}}{1-\delta}$.

Furthermore, it must be optimal for the agent to deliver equilibrium effort e_t, given that she trusts the principal to actually pay the bonus b_t - and given an equilibrium continuation payoff U_{t+1}. This is captured by incentive compatibility (IC) constraints for every period t. There, if the agent deviates and chooses non-equilibrium effort (in which case she will obviously set

$e = 0$), she does not receive the bonus and is fired.[9]

Hence, we have

(IC)

$$-c \cdot e_t + b_t + \delta U_{t+1} \geq \delta \overline{U} \; \forall t \geq 1.$$

The following contraints must hold for the principal. In an equilibrium with production, it must be optimal to make the investment K and get started, hence $-(K - D_1) + \delta \Pi_1 \geq 0$. From now on, we assume that this is the case, for example because δ and/or $f(\cdot)$ is sufficiently large or c or K sufficiently small.

Furthermore, it must always be optimal for the principal to stick to equilibrium behavior - instead of liquidating the firm. The principal's individual rationality (IRP) constraints guarantuee that the agent receives the equilibrium offer at the beginning of a period, i.e.

(IRP)

$$\Pi_t \geq \overline{\Pi}_t \; \forall t \geq 1,$$

where $\overline{\Pi}_t = \max\{0, \gamma K - D_t(1 + r_t)\}$. In addition, it has to be optimal for the principal to make the promised payment b_t. If he reneges and does not forward the bonus to the agent, all trust between them is lost, and no positive effort can subsequently be enforced (following Abreu, 1988). Denoting $\tilde{\Pi}_t$ the principal's maximum payoff after reneging, his so-called dynamic enforcement (DE) constraints equal

(DE)

$$-b_t - D_t(1 + r_t) + (D_{t+1} + \delta \Pi_{t+1}) \geq \tilde{\Pi}_t \; \forall t \geq 1.$$

$\tilde{\Pi}_t$ might be identical to $\overline{\Pi}_t = \max\{0, \gamma K - D_t(1 + r_t)\}$, but only if defaulting on the loan is optimal after refusing to pay b_t. As creditors cannot observe whether the market is in equilibrium or not, the principal could also repay the loan, enter the credit market again and file for bankruptcy at a later stage. However, in Lemma 4 below, we show that reneging on b_t is indeed followed by an immediate default.

Furthermore, equilibrium behavior also has to be optimal after the principal has paid b_t. Paying back $D_t(1 + r_t)$ and continuing with equilibrium actions is better than defaulting, if $-D_t(1 + r_t) + (D_{t+1} + \delta \Pi_{t+1}) \geq \overline{\Pi}_t$. However - as $b_t \geq 0$ and $\tilde{\Pi}_t \geq \overline{\Pi}_t$ - this assumption is automatically satisfied given (DE).

Hence, agency problems between firm and creditor are still present. These agency problems - or, more precisely, agency problems between a firm and outside investors - are at the core of a major part of the literature on a firm's optimal financing structure. We show that they can be superposed by the presence of another agency problem - namely between a firm and

[9] This is based on the presumption that once the agent deviated, the principal thinks she will not exert effort in the future as well. However, the analysis would be identical if the principal believed that the deviation was a singular event and kept the agent. The reason is that we are in a profit-maximizing equilibrium, where the agent's (IRA) binds anyway (see below).

its manager or employees.

After repaying $D_t(1+r_t)$, the principal has to prefer to still run the firm, and $D_{t+1}+\delta\Pi_{t+1} \geq \gamma K$ must hold. However, these is implied by the following no-default (ND) constraints, which make sure that liquidating the firm is not optimal after having borrowed D_{t+1}:

(ND)

$$\delta\Pi_{t+1} \geq \max\{0, \gamma K - D_{t+1}\}, \forall t \geq 1.$$

There, note that the right hand side is not identical to $\overline{\Pi}_{t+1} = \max\{0, \gamma K - D_{t+1}(1+r_{t+1})\}$, as the principal does not owe interest payments if borrowing and default happen in the same period.

Finally, the creditor must not make a loss in equilibrium, giving creditor constraints

(CR)

$$-D_t + \delta V_t \geq 0 \, \forall t \geq 0.$$

Assuming that starting the firm is optimal, our objective is to find an equilibrium that maximizes

$$\Pi_0 = -(K - D_1) + \delta\Pi_1,$$

subject to the constraints derived above.[10] Before presenting the main results, we can substantially simplify the problem.

5 Auxiliary Analysis

In Lemma 1, we formalize the fact that the credit market is competitive and creditors do not get a rent. Furthermore, maximizing Π_0 implies that the agent does not get a rent as well.

Lemma 1: *Any profit-maximizing equilibrium can be replaced by one where the constraints (IRA), (IC) and (CR) bind in every period t.*

The proof to Lemma 1 can be found in the Appendix.

In a next step, we use the fact that (CR) constraints bind to determine interest rates r_t.

Lemma 2: *Interest rates r_t are the same in every period t, and equal*

$$r_t = \frac{(1-\delta)}{\delta}, \text{ all } t \geq 1. \tag{1}$$

[10] Note that our main results would not change if the agent would receive part of the surplus (however, the principal's profits must be high enough to make starting the firm optimal).

Proof: Plugging $V_t = D_t(1 + r_t)$ into (CR) $-D_t + \delta V_t = 0$ gives (1). Q.E.D.

Using Lemmas 1 and 2, the set of constraints can be simplified and reduced to
(DE)

$$-c \cdot e_t - \frac{D_t}{\delta} + D_{t+1} + \delta \Pi_{t+1} \geq \tilde{\Pi}_t \ \forall t \geq 1$$

(ND)

$$\delta \Pi_t \geq \max \{0, \gamma K - D_t\} \ \forall t \geq 1,$$

where (IRP) constraints, which are $\delta \Pi_t \geq \max \{0, \delta \gamma K - D_t\}$, can be omitted since they are automatically satisfied given (ND) constraints.

Furthermore we can restrict our analysis to stationary contracts - in a sense that effort and debt are the same in every period. In general, the analysis of a stationary setting where no player is wealth constrained and where maximum one player has private information (see Levin, 2003, or Fong and Li, 2011) can be restricted to relational contracts that are stationary. Under these conditions, a termination of the relationship will not happen in equilibrium, and the risk-neutrality of players makes them indifferent between being compensated today or in the future.

This notion is formalized in

Lemma 3: *Without loss of generality, effort and debt in a profit-maximizing relational contract are constant over time.*

The proof to Lemma 3 can be found in the Appendix.

This also allow us to omit (ND), $\delta \Pi \geq \max \{0, \gamma K - D\}$, which is automatically satisfied since starting the firm is optimal by assumption, i.e., given that $\Pi_0 = -(K - D) + \delta \Pi \geq 0$ holds in equilibrium.

Finally, we can show that it is indeed optimal for the principal to immediately default after refusing to pay the bonus b.

Lemma 4: *In any profit-maximizing equilibrium, we can set* $\tilde{\Pi} = \overline{\Pi} = max\left\{0, \gamma K - \frac{D}{\delta}\right\}$.

The proof to Lemma 4 can be found in the Appendix.

After reneging, the principal would like to use the informational advantage he has over creditors and replace as much equity as possible with debt. However, creditors will get suspicious if the principals tries to borrow more than expected in equilibrium. In this case, creditors know that the game is not in equilibrium anymore and are not willing to lend money at all .

Concluding, the principal's problem is to choose debt D and effort e to maximize

$$\Pi_0 = -(K - D) + \delta\Pi,$$

subject to (DE)

$$-c \cdot e - rD + \delta\Pi \geq \overline{\Pi},$$

where $\Pi = \frac{f(e)-\overline{u}-c \cdot e-rD}{1-\delta}$, $r = \frac{1-\delta}{\delta}$ and $\overline{\Pi} = \max\left\{0, \gamma K - \frac{D}{\delta}\right\}$.

6 The Optimal Level of Debt Financing

Having simplified the problem, we come to the question to what extent the firm's financing structure has an impact on the enforceability of the relational contract between the firm and its manager. Proposition 1 shows that the capital structure is irrelevant if the (DE) constraint does not bind in equilibrium.

Proposition 1: *If the (DE) constraint is slack,* Π_0 *is independent of* D*.*

Proof: Follows immediately from $\Pi_0 = -(K - D) + \delta\frac{f(e)-\overline{u}-c \cdot e-\frac{1-\delta}{\delta}D}{1-\delta}$, where D cancels out. Q.E.D.

This result in the spirit of Modigliani and Miller shows that if creditors have perfect foresight what happens in equilibrium and if their bonds can be pledged against the firm's physical capital, the firm's financing structure is irrelevant. The intuition is straightforward. Creditors and principal have identical time preferences, and no distortations like taxes are present.

However, this irrelevance result is not necessarily valid anymore when the firm is restricted in enforcing its desired effort level e. As the debt rate affects the firm's default payoff and hence the principal's outside option, it has an impact on the costs of reneging. This is captured by

Proposition 2: *If the (DE) constraint binds, it is optimal to have* $\frac{D}{\delta} \leq \gamma K$*.*

Proof: Proposition 1 above established that if the (DE) constraint does not bind, first-best effort can be implemented, and the firm's profits Π_0 are independent of the financing structure.

However, the level of D might have an impact on the enforceability of an effort level e and hence on the respective dynamic enforcement constraint:

$$-c \cdot e - D(1+r) + (D + \delta\Pi) - \overline{\overline{\Pi}} \geq 0,$$

where $r = \frac{1-\delta}{\delta}$, $\Pi = \frac{f(e)-\overline{u}-c \cdot e-rD}{1-\delta}$ and $\overline{\overline{\Pi}} = \max\left\{0, \gamma K - \frac{D}{\delta}\right\}$.

Hence, we have to distinguish between the following two cases:

(A) $\frac{D}{\delta} \leq \gamma K$; then, the (DE) constraint equals $-c \cdot e + \delta\frac{f(e)-\overline{u}-c \cdot e}{1-\delta} - \gamma K \geq 0$ and is independent of D.

(B) $\frac{D}{\delta} > \gamma K$; then, the (DE) constraint equals $-c \cdot e - \frac{D}{\delta} + \delta\frac{f(e)-\overline{u}-c \cdot e}{1-\delta} \geq 0$, and its left hand side is decreasing in D. Q.E.D.

The intuition for this result is straightforward. If $\frac{D}{\delta} > \gamma K$, the principal can share parts of the bankruptcy costs with the creditor. Hence, the outside option becomes relatively more attractive - compared to equilibrium payoffs - for higher values of D, which restricts the enforceable effort level.

7 Multilateral Relational Contracts

As pointed out above, the results derived in this paper can also be used to analyze multilateral relational contracts with a firm and its workforce as whole. The most crucial aspect of multilateral relational contracts (see Levin, 2002) is that the behavior of the firm towards one particular agent can be observed by all other employees. Hence, reneging on one agent can (and optimally will) be punished by all of them: They subsequently loose trust and are not willing to exert effort anymore. Then, assume that the firm's production function is $f(n_t, K)$, where n_t is the number of agents who are employed in period t and exert effort. Morever, effort is binary, $e_t \in \{0,1\}$, where $e = 1$ is associated with effort costs of c, whereas $e = 0$ is not costly for the respective agent. For simplicity, also assume that $\overline{u} = 0$ (a positive value of $\overline{u}$ would have no qualitative impact on the results).

In this case, all constraints are identical to the ones derived above, with the only difference that e_t is replaced by n_t. Then, a binding (DE) constraint restricts enforceable (productive) employment, and debt above $\delta\gamma K$ further tightens the constraint and reduces employment.

8 Extensions

In this section, we want to relax some assumptions and furthermore explore the impact of changes in some parameters. First of all, we show that higher bankruptcy costs - in the form of a reduced value of γ or a delay in the time before the bankrupt firm can actually be liquidated and the proceeds be consumed - relax the firm's (DE) constraint and hence increase the enforceable effort level. In addition, the use of debt should even be further restricted. Then, we allow for bankruptcy also happening in equilibrium and show that this has no substantial impact on our analysis. Finally, we assume that debt is generally cheaper than equity, for example due to the tax-deductability of interest payments and show how this affects our results.

8.1 Liquidation Value γK

The firm's liquidation value γK plays a crucial role in our analysis, since it determines a maximum bound on the firm's debt. But how does γK affect firm value itself? Maybe surprisingly, firm value is decreasing in γ, which is captured by

Proposition 3: Π_0 *is (weakly) decreasing in* γ, *and strictly so if the (DE) constraint binds.*

Proof: As long as the firm's (DE) constraint does not bind, Π_0 is unaffected by γ.

Consider the (DE) constraint, which equals $-c\cdot e-\frac{D}{\delta}+\delta\frac{f(e)-\overline{u}-c\cdot e}{1-\delta}-\max\left\{0,\gamma K-\frac{D}{\delta}\right\}\geq 0$. If it binds, it is optimal to set $\gamma K-\frac{D}{\delta}\geq 0$. Then, the constraint becomes $-c\cdot e+\delta\frac{f(e)-\overline{u}-c\cdot e}{1-\delta}-\gamma K\geq 0$, and is relaxed by lower values of γ. Q.E.D.

A lower γ reduces the firm's outside option and hence the principal's benefits from reneging. Therefore, the firm would gain from a reduction in γ. Although its value is exogenously given in our model, one could think about activities that reduce a firm's liquidation value. A dispersion of ownership, for example, could induce rent seeking activities in case of bankruptcy and consequently increase the associated efficiency loss.

Note that even if bankruptcy is observed in equilibrium, this result generally remains valid, as long as the (DE) constraint binds and the likelihood of bankruptcy is not too high in equilibrium.

8.2 Liquidation Value Realized in Later Periods

A rather strong assumption in our analysis relates to the possibility to immediately liquidate the firm and consume γK after filing for bankruptcy. In reality, however, collecting claims after a bankruptcy can take some time for the creditor, even for low debt level. Reasons might be legal disputes that have to be settled or complicated bankruptcy laws. Then - if the creditor is not fully compensated for these costs - it is optimal for the firm to have no debt at all.

Formally deriving this point, we make the simplifying assumption that the creditor is not compensated *at all* for waiting, however would get the same results as long as no *full* compensation occurs. Hence, assume that the firm's liquidation value is not immediately realized after the principal has filed for bankruptcy (note that the principal would not be able to "hide" this act, thereby neutralizing the effect of a delayed realization). Instead, creditors and shareholders have to wait for $T \geq 0$ periods before they can share and consume γK. This implies that the firm's outside option after reneging is

$$\overline{\Pi} = \delta^T \max\left\{0, \gamma K - \frac{D}{\delta}\right\},$$

where we assume that even though the creditors have to wait before being paid back, they do not accumulate additional interest claims during their waiting time.

Relaxing the assumption of immediate liquidation makes the use of debt even more problematic than before. In particular, we have

Proposition 4: *Assume $T \geq 1$. If the (DE) constraint binds, it is strictly optimal to set $D = 0$. If it does not bind, any level of D is optimal.*

Proof: As long as the firm's (DE) constraint does not bind, Π_0 is unaffected by T, hence above results prevail.

The (DE) constraint now equals $-c \cdot e - \frac{D}{\delta} + \delta \frac{f(e) - \overline{u} - c \cdot e}{1-\delta} - \delta^T \max\left\{0, \gamma K - \frac{D}{\delta}\right\} \geq 0$, and we have the two cases

(A) $\frac{D}{\delta} \leq \gamma K$; then, the (DE) constraint equals $-c \cdot e - \frac{D}{\delta}\left(1 - \delta^T\right) - \delta^T \gamma K + \delta \frac{f(e) - \overline{u} - c \cdot e}{1-\delta} \geq 0$, and its left hand side is decreasing in D for $T \geq 1$.

(B) $\frac{D}{\delta} > \gamma K$; then, the (DE) constraint equals $-c \cdot e - \frac{D}{\delta} + \delta \frac{f(e) - \overline{u} - c \cdot e}{1-\delta}$, and its left hand side is decreasing in D. Q.E.D.

Applying the presumably more realistic assumption that a bankruptcy takes time to be processed and is always associated with costs for all investors actually strengthens our result and provides an even stronger case against debt. The intuition for this result is the following: Having to wait for the liquidation of the firm presents additional costs of being out-of equilibrium, and debt gives the firm the possibility to share these costs. Hence, debt reduces the firm's commitment, and $D = 0$ becomes optimal.[11]

[11] If the creditor's obligations would increase by a factor $(1 + r)$ for every waiting period, with $r = \frac{1-\delta}{\delta}$, $T = 0$ would not necessarily be optimal. However, the maximum debt level would be lower than before, since a larger T would then equivalent to a lower value of γ.

In addition - equivalently to a lower value of γ - the firm benefits from a delayed realization of its liquidation value, since the costs of a bankruptcy are further increased.

Proposition 5: Π_0 *is (weakly) increasing in* T, *and strictly so if the (DE) constraint binds.*

Proof: As long as the firm's (DE) constraint does not bind, Π_0 is unaffected by T. If it binds, Proposition 4 showed that setting $D = 0$ is optimal. Then, the (DE) constraint equals $-c \cdot e - \delta^T \gamma K + \delta \frac{f(e)-\overline{u}-c \cdot e}{1-\delta} \geq 0$, and its left hand side increases in T. Q.E.D.

Again, note that this results remains valid even if bankruptcy is possible in equilibrium - as long as the likelihood is not too high.

8.3 Bankruptcy in Equilibrium

Now, we show that our results do not depend on the assumption that bankruptcy solely is an out-of-equilibrium phenomenon. Thereby, we extend the model in the following way. In every period, $t \geq 1$, after the bonus has been paid, but before repayments are made and the principal can enter the credit market again, the firm has to be liquidated with exogenous probability $1 - \rho$.[12] Furthermore, we keep the assumption that the firm's liquidation value can be consumed $T \geq 0$ periods after filing for bankruptcy.

First of all, note that we can still focus on stationary contracts, and equilibrium effort, debt and compensation are constant over time. Now, we have to be aware of the possibility that even in equilibrium, creditors cannot be certain to receive full repayment. Hence, they generally demand an interest rate that is higher than $\frac{1-\delta}{\delta}$.

Lemma 5: $r = \frac{D(1-\delta\rho)-(1-\rho)\delta\overline{D}}{\delta\rho D}$, *where* $\overline{D} = \delta^T min\{(1+r)D, \gamma K\}$.

Proof: Follows from the fact that creditors still make no profits in equilibrium, which implies that the condition $-D + \delta\left(\rho(1+r)D + (1-\rho)\overline{D}\right) = 0$ has to be satisfied. Q.E.D.

It is straightforward to show that only for $T = 0$ *and* $\frac{D}{\delta} \leq \gamma K$, we still have $r = \frac{1-\delta}{\delta}$. Otherwise, $r = \frac{(1-\delta\rho)-(1-\rho)\delta^{T+1}}{\delta(\rho+(1-\rho)\delta^T)}$ if $(1+r)D \leq \gamma K$, and $r = \frac{D(1-\delta\rho)-(1-\rho)\delta^{T+1}\gamma K}{\delta\rho D}$ if $(1+r)D > \gamma K$, and, more debt and a larger value of T is generally associated with a higher interest rate. Concluding, the firm's equilibrium payoff Π equals $\Pi = f(e) - \overline{u} - c \cdot e + \rho\left(-rD + \delta\Pi\right) + (1-\rho)\overline{\Pi}$,

[12] Here, we do not consider the case that effort also affects the probability of bankruptcy. The reason is that in this case, debt should already be relatively low when the (DE) constraint does not bind, which is equivalent to the case that effort is verifiable or can directly be chosen by the principal. However, the latter case does not describe an agency problem between firm and employees but only between firm and creditors. It has been analyzed in Holmström and Tirole (1997), and refers to the standard argument that debt increases the likelihood of a bankruptcy.

or

$$\Pi = \frac{f(e) - \overline{u} - c \cdot e - \rho r D + (1-\rho)\overline{\Pi}}{1 - \delta\rho},$$

with $\overline{\Pi} = \delta^T \max\{0, \gamma K - (1+r)D\}$.

The firm's objective now is to maximize $\Pi_0 = -(K - D) + \delta\Pi$, subject to its (DE) constraint, which - taking into account that the agent's (IC) constraint still binds - equals $-c \cdot e + \rho(-rD + \delta\Pi) + (1-\rho)\overline{\Pi} \geq \overline{\Pi}$, or

$$-c \cdot e + \rho\left(-rD + \delta\Pi - \overline{\Pi}\right) \geq 0.$$

Now, we can state the results of this section, which are summarized in

Proposition 6: *Assume bankruptcy in every period occurs with exogenous probability* $1-\rho$*. If the (DE) constraint does not bind,* Π_0 *is independent of the firm's financing structure. If it binds and* $T \geq 1$*, it is optimal to set* $D = 0$*.*

The proof to Proposition 6 can be found in the Appendix.

8.4 Debt Cheaper than Equity

Finally, we relax the assumption that the costs of debt and equity are identical. In reality debt is often regarded as being cheaper than equity, in particular because interest payments are tax-deductable (see Graham, 1996, or Graham and Rogers, 2002, for estimates on how much cheaper debt is compared to equity). In this section, we hence assume that using debt is effectively cheaper than equity. Furthermore, we stick to the assumption that the firm's liquidation value is realized $T \geq 0$ after filing for bankruptcy, but go back to the initial setup with bankruptcy solely being an out-of-equilibrium phenomenon. Therefore, it is sufficient to set the interest rate to a fixed level $r < \frac{1-\delta}{\delta}$.

Proposition 7: *Assume* $r < \frac{1-\delta}{\delta}$*. If the (DE) constraint does not bind, it is optimal to set* $D = K$*.*

If the (DE) constraint binds and

- $T < \frac{ln\frac{r}{(1-\delta)(1+r)}}{ln\delta}$*, then* $\gamma K \leq D(1+r) \leq K$
- $T > \frac{ln\frac{r}{(1-\delta)(1+r)}}{ln\delta}$*, then* $(1+r)D$ *might be higher or lower than* γK*, and is decreasing in* r *and* T*.*

The proof to Proposition 7 can be found in the Appendix.

If debt is exogenously cheaper than equity, the results derived above are obviously weakened. However, a lower difference in the costs between debt and equity and longer delay after bankruptcy is still associated with a lower debt level.

9 Empirical Analysis - Variations in the Costs of Enforcing Formal Contracts

9.1 Extension of Model and Empirical Hypothesis

As pointed out down above, there is plenty of evidence that our main result - a higher relevance of issues like implicit arrangements, reputation, trust, and long-term relationships should be associated with lower debt levels - is in line with what we observe in reality. Of course, this does not automatically imply that other mechanisms are not the main drivers of these observations. In general, it is very difficult to precisely test the impact of implicit arrangements on a firm's capital structure. Reasons are that these arrangements are usually not observed by outsiders, and that a firm's capital structure is potentially affected by so many other forces as well. The papers testing Titman's (1984) stakeholder theory face similar problems and hence are only able to show that their observations are in line with the theory - without really testing the underlying mechanism. However, we think that we are able to identify an instance where the importance of relational contracts changes over time. In this case, it should be very likely that subsequent adjustments of firms' capital structures are actually driven by this change: The World Bank's World Development Indicators (WDI) database includes the variable "cost of enforcing contracts". It measures the country-specific cost to enforce a contract in percent of claim. The cost of enforcing contract measure is based on a hypothetical case of a legal dispute between a seller and a buyer.[13] The dispute arises from a goods delivery by the seller, for which the buyer refuses to pay on the grounds of inadequate goods quality. Subsequently, the seller sues the buyer referring to their sales agreement. Expert witnesses are called on the quality of the delivered good, i.e., the court cannot decide the verdict based on documentary evidence or legal title alone. Furthermore, the seller attaches the buyer's movable assets because of the fear that the buyer may become insolvent. Finally, only cases are included where the judgement is in favor of the seller, i.e., in the end the buyer has to pay the original price. The variable "cost of enforcing contracts" measures costs related to such a case as, for example, court costs, enforcement costs, and average attorney fees. Naturally, these costs of enforcing contracts refer to formal contracts. Our hypothesis is that if these costs increase, firms will rely more on relational contracts - and hence reduce leverage.

To underpin this hypothesis formally, we slightly extend our model. Note that to make our

[13] See http://www.doingbusiness.org/methodology/enforcing-contracts, for more details on how this case is constructed.

point, we stick to a very stylized setting and abstract from aspects like competition or market interaction. First of all, we apply the interpretation of arrangements between a downstream and an upstream firm, where e_t describes delivered product quality. Furthermore, assume that formal contracts can be written between principal and agent. Such a contract specifies the agent's obligation to produce the product and deliver it to the agent, as well as the intended product quality e_t. Furthermore, the contract determines the payment $P = w + b$ that the principal has to forward to the agent after delivery of the product.

Disputes over the quality of the product are settled in the following way: The principal can withhold payment of b by claiming that the product quality is not satisfactory. The agent has the option to either accept that or sue the principal. For simplicity, we assume that - given product quality was satisfactory - the agent always wins the case and finally receives b[14], but that taking legal action is costly for the agent. In expection, these costs amount to $C > 0$ and include the agent's risk of actually loosing the lawsuit, as well as costs to enforce the verdict and expenses that the agent does not expect to get reimbursed.[15]

All this implies that - upon receiving satisfactory quality - the principal accepts to pay b if he expects to get sued otherwise. However, taking legal action is only optimal for the agent, if

$$b \geq C \tag{2}$$

holds.[16] In addition to (2), the agent's incentive compatability constraint, $b \geq c \cdot e$, must be satisfied.

If $b < C$, the agent will not sue the principal. In this case, the principal always refuses to make the payment b, and the agent is not willing to deliver a satisfactory quality. Then, the parties have to use a relational contract if they want to enforce cooperation. This has the consequence that - given that the firm's (DE) constraint binds - the firm's debt level should not be too high.

This is captured in the following prediction, where we also assume that firms in a given country are heterogenous, hence their thresholds from which they should start using relational contracts differ.

Empirical Prediction: *Assume a country faces an increase in C. Then, the share of firms using relational contracts increases and we should generally observe lower debt ratios.*

[14]This also implies that the principal cannot elude the verdict by filing for bankruptcy, for example because the court has access to the output $f(e_t)$.

[15]Note that we chose the present structure to have it as close as possible to the one imposed by our empirical case. The analysis would be unaffected by different structures, for example if the principal had to sue the agent to get back b after receiving unsatisfactory quality.

[16]Without deriving it formally, we assume that given product quality was not satisfactory and the principal refused to pay b, it is not worthwhile for the agent to sue the principal.

Proof: This follows from the discussion above - as well as the analysis of a firm's optimal capital structure when it uses relational contracts - furthermore assuming that there are many independent markets in a given country, each served by one principal. Conditions in the different markets are heterogenous with respect to costs the firms face, the value of a single transaction, or the frequency of interactions. Furthermore, it is important that the court also has access to the firm's output, such that it is not optimal for the principal to refuse to pay b and then going bankrupt. Then, firm value is again independent of its debt level. One additional issue must be taken into consideration, though: Given C just exceeds $c \cdot e^{FB}$ and a given firm's (DE) constraint would bind, it will first be optimal to induce an inefficiently *high* quality level. However, given the concavity of a firm's output function - and given that payments are non-negative (otherwise, the problem could be resolved by reducing w and increasing b) - it will at some point be optimal to switch to relational contracts.

9.2 Data and Approach

To test this prediction, we use data on foreign subsidiaries of German multinational enterprises (MNEs) provided by Deutsche Bundesbank (the German Central Bank). Since there is typically a controlling owner of the foreign entity (the parent firm) or just a few owners in case of joint ownership, this is a natural application of our theory as suggested above. One advantage of our data is that German firms are subject to reporting requirements, so that we observe the universe of German multinationals and their foreign activities. The data provides information on external debt, internal debt, as well as equity capital, allowing us to determine the capital structure of foreign entities.[17] As internal debt financing (provided internally from affiliated entities or the parent firm) is in many aspects – though not all, of course – similar to equity financing, we think that the ability to distinguish between external and internal debt is crucial.

We expect the importance of relational contracts to vary across specific industries with different production processes and labor relations. For this reason, we first explore descriptive statistics of the relevant variables across industries. In particular, we calculate the share of external debt financing for each foreign entity j, ED_j, and determine the average value over all entities of a specific industry group. ED_j is determined as the external debt of j relative to total capital (where total capital consists of registered capital, capital reserves and profit reserves, as well as internal and external debt). Table 10 presents the 5 lowest-ranking as well as the 5 highest-ranking industries in terms of the average share of external debt. Beside average external debt, the table also shows averages of affiliates' *total assets* and *sales*, as well as averages of the variables *cost of enforcing contracts* and *rule of law*. The variable *cost of*

[17] A 'brief guide' (Lipponer, 2007) on the data is available online.

enforcing contracts has already been explained above. A similar measure is the variable *rule of law*, which is an indicator taken from the Worldwide Governance Indicators (WGI) also provided by the World Bank. While the latter measure captures country-specific "perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement" (Kaufmann, Kraay, and Mastruzzi, 2009), it also includes other dimensions of governance (such as property rights, the police, and the courts, as well as the likelihood of crime and violence), which are not necessarily relevant in our context. On average, we expect that *low-debt industries* exhibit a high cost of contract enforcement (low rule of law level), while the cost of contract enforcement (rule of law level) should on average be low (high) in *high-debt industries.*

– Table 10 –

The numbers presented in Table 10 do not exhibit a specific pattern and seem to be rather unrelated to the debt ranking. Of course, particularly the last two columns of Table 10 describe cross-country averages within given industries, which are difficult to compare. At the same time, Table 10 points at two important things. First, it shows that simple cross-country cross-industry identification may lead to wrong conclusions. And second, it demonstrates that there are huge differences in financing behavior across industries. A simple regression analysis confirms that about 14% of the variation in ED_j can be explained by cross-industry differences. However, affiliate-specific effects are even more important and explain about 66% of the variation in ED_j; aggregate country effects only about 9%.[18] The large part of the variation in ED_j that is related to affiliate-specific effects highlights the particular problem when testing basic features of our model: individual subsidiaries operate under very different (unobserved) conditions which determine the respective role of relational contracts.

Given the difficulties related to the largely unobserved determinants of relational contracts, our empirical analysis relies on an identification strategy that exploits the (limited) time variation in the country-specific costs of enforcing contracts. We prefer to restrict our analysis first to this variable and later provide robustness results using the governance indicator rule of law, because the latter captures too many aspects whose impact on relational contracts is not quite clear. Let us therefore approach the problem by focusing on the variable "cost to enforce a contract (% of claim)" and the year 2008. In this particular year, the cost of contract enforcement increased significantly in a number of countries.[19] To find out whether and to

[18] We measure this by an adjusted R^2 statistic obtained from regressing ED_j on affil- iate-, industry-, and country-fixed effects, respectively. All regressions additionally include a set of aggregate time effects.

[19] Note that we may also pool all available observations over all years and identify effects from time and cross-country differences. We prefer to avoid this, however, as, on the one hand, unobserved country and firm characteristics may bias estimates from such an approach and, on the other hand, the limited time-variation of CCE forbids a reliable identification coming from this source of variation in a large sample with many observations. However, the simple correlation coefficient between ED_j and CCE_j using all available

what extent a subsidiary j responds to a change in the cost of contract enforcement variable by adjusting its capital structure, we define the variable $\Delta ED_{j,2008}$ as $ED_{j,2008} - ED_{j,2007}$[20] and run the following regression

$$\Delta ED_{j,2008} \;=\; \alpha \cdot \Delta CCE_{j,2008} + \beta \cdot \Delta X_{j,2008} + \Delta \varepsilon_{j,2008}. \tag{3}$$

In Equation (3), Δ indicates that we use a first-differencing transformation of all variables included. CCE_j denotes the cost of contract enforcement faced by subsidiary j. $X_{j,2008}$ is a vector of explanatory variables and $\varepsilon_{j,2008}$ is an error term. $X_{j,2008}$ includes several affiliate- and country-specific variables, which are all subject to a first-differencing transformation, so that they measure changes in these variables with respect to 2007 values. Affiliate-specific variables include the log of subsidiary j's sales, $log\ Sales_{j,2008}$, as well as the log of subsidiary j's number of employees, $log\ Employees_{j,2008}$. Both variables might capture the size of a subsidiary. As larger subsidiaries are expected to face lower bankruptcy probabilities, we expect them to be positively related to debt financing (Graham and Harvey, 2001). $log\ Employees_{j,2008}$ may of course capture additional aspects that are important in the context of relational contracts. We also include subsidiary j's profits relative to j's assets, $Profit_j$, and expect a positive impact. Note, however, that the profit variable available in our data-set refers to profits after tax and interest and may therefore be blurred by effects of income shifting, etc. The so-called z-score of a company is also one of the standard regressors used in the literature. We calculate $Z - Score_{j,2008}$ according to Graham and Leary (2012). For reasons of data availability, we have to rely on rather imperfect measures when calculating it.[21] The higher $Z - Score$, the lower is the risk of insolvency, which implies a positive relation to external debt financing. $Loss\ carryforward_{j,2008}$ is a dummy variable taking value 1 in case subsidiary j carries forward any losses and zero otherwise. The variable is related to tax incentives faced by a foreign affiliate. If losses have been carried forward from past financial years, tax savings

observations is -0.0062 (after netting out country-specific effects in ED_j). The cost of enforcing contracts increased in case of 4 countries included in our estimation sample: Iceland, Switzerland, Austria, and Singapore (1,473 foreign entities of German MNEs are located in these countries). The raw data provided by the World Bank include only 9 incidences where the cost increased, and 4 incidences where the cost decreases (considering the actual location of subsidiaries as well as the time period that can potentially be used for our analysis, 2007-2009). Although firms faced an increase in the cost of contract enforcement in Estonia, Latvia, Romania, Belarus, Moldova, Kenya and New Zealand in 2009, we are left with too few observations as too few German firms operate foreign entities in these countries (we loose even more observations in a multivariate regression analysis because other important control variables are not available for these countries).

[20] An additional specification specifies the dependent variable as $\Delta^2 ED_{j,2009} = ED_{j,2009} - ED_{j,2007}$.

[21] We use a modified measure of Almann's z-score as suggested by Graham and Leary (2012): $Z - Score = [3.3 \cdot operating\ income + sales + 1.4 \cdot retained\ earnings + 1.2 \cdot current\ assets - current\ liabilities)]/assets$. Since most of the variables are not available in our balance-sheet data-set, we use the following proxies. To calculate *operating income*, we use *sales* and multiply it by 1 plus the share of fixed and financial assets over total assets. The reason for the latter is that we do not have any information on asset sales and, hence, we try to capture this possibility by using the adjustment factor; results without adjustment do not differ at all, though. Instead of *current liabilities*, which are also not available, we use the variable *other liabilities*.

associated with interest deductions are crowded out and we expect a negative effect on external debt. When, on the other hand, a $Loss\ carryforward_{j,2008}$ means that a subsidiary faces a higher default probability, or if it captures liquidity problems and cannot retain earnings, the effect is ambiguous. Also the variable $Tangibility_{j,2008}$ calculated as fixed assets relative to total assets may be related to tax incentives. On the one hand, higher values imply that tax benefits are crowded out because there are more non-debt tax shields (like depreciation allowances) that crowd-out tax benefits. On the other hand, there is more collateral facilitating borrowing, and the impact on external debt might be positive.

Country-specific characteristics include a country's tax rate $Tax_{j,2008}$, $Domestic\ Credit_{j,2008}$, $Financial\ Freedom_{j,2008}$, and $Lending\ \ Rate_{j,2008}$ as measures for the quality of the local capital market; $GDPgrowth_{j,2008}$ as a measure for market growth, as well as an index on corruption perception $CPI_{j,2008}$. Higher $Tax_{j,2008}$ is associated with more external debt since the value of interest deductions associated with debt increase in the tax. $Domestic\ Credit_{j,2008}$ is measured as domestic credits provided by the banking sector relative to GDP and should be positively related to external debt. We also expect a positive effect for $Financial\ Freedom_{j,2008}$, as more financial freedom may simplify the access to external debt. The local $Lending\ Rate_{j,2008}$ might capture a number of additional aspects of the local credit market (Buettner et al., 2009), so that a good quality of the local lending market is reflected in low lending rates. Good growth options measured by $GDPgrowth_{j,2008}$ may imply more debt financing. Graham and Leary (2012) argue, however, that high market-to-book ratios – indicating good growth options – should be negatively related to leverage because of debt overhang concerns. High growth also allows firms to issue more equity. In any case, market-to-book ratios are not available in our data, but $GDPgrowth_{j,2008}$ may capture the latter effects.

9.3 Results

Descriptive statistics on the endogenous as well as exogenous variables are provided in Table 10. The results of the empirical analysis are presented in Table 10. The estimated coefficient on $CCE_{j,2008}$ suggests that if the cost of contract enforcement increases by one standard deviation, the share of external debt decreases by about 0.4 percentage points. Our identification strategy relies on a change in $CCE_{j,2008}$ in four countries. On average, the costs of contract enforcement (in % of claim) changed by 5.4 percentage points. This implies that affiliates in these countries reduced their external-debt-to-capital ratios by 1 percentage point, on average. Comparing a country with very low cost of contract enforcement, say Norway with a value of 9.9%, to a country with a very high cost of contract enforcement, say Indonesia with a value of 122.7%, the estimates would imply that the average affiliate located in Indonesia exhibits an external-debt ratio that is about 23 percentage points lower than the one of the comparable affiliate located in Norway.

– TABLE 10 –

As for the other explanatory variables, only three of them are significantly related to the share of external debt. Of course, this is not very surprising in case of some country-specific variables, which show limited variation over time (for example countries' tax rates), as the first-differencing transformation removes all cross-section variation in these variables; on the other hand, we exploit the fact that there is variation in $CCE_{j,2008}$ in a number of important countries. As expected, the two measures for the size of entities, $log\ Sales_{j,2008}$ and $log\ Employees_{j,2008}$, are both positively related to the share of external debt. The negative effect of $Tangibility_{j,2008}$ confirms the tax-benefit-crowding-out hypothesis. We do not want to overemphasize the negative estimate for $Z - Score_{j,2008}$ since too many variables that are typically used to calculate the score are not reported in our data.[22]

We provide a number of robustness tests. The first one relates to the effects of aggregate industry differences. In columns 2 of Table 10, we include industry dummies according to the industry classification of the foreign affiliates. In column 3 of the same table we additionally condition on the industry group of the German parent firm, which is also reported in our data. The estimates for $CCE_{j,2008}$, as well as for all other explanatory variables, remain very robust.

Table 10 provides further robustness tests. The first one uses a treatment indicator instead of $CCE_{j,2008}$. The binary variable $ICCE_{j,2008}$ takes value 1 if subsidiaries faced an increase in CCE in 2008. Formally $ICCE_{j,2008} = 1$ if $CCE_{j,2007} < CCE_{j,2008}$, and 0 otherwise. The estimated coefficient on $ICCE_{j,2008}$ (column 1 in Table 10) implies that subsidiaries that are subject to an increase in the cost of enforcing contracts are reducing their share of external debt by 4.3 percentage points, which seems to be a relatively large impact. Apart from the treatment indicator, we use the same regression setting as in Table 10, including affiliate industry dummies.

– TABLE 10 –

The second robustness test presented in column 2 in Table 10 relates to a different specification of the outcome variable. In particular, we define $\Delta^2 ED_{j,2009} = ED_{j,2009} - ED_{j,2007}$, to capture sluggish behavior of firms adjusting their capital structures. While the coefficient on $CCE_{j,2008}$ is estimated with less precision, the results suggest that it triples in magnitude.

Column 3 of Table 10, finally, uses the variable $Rule\ of\ law_{j,2008}$, which also captures aspects related to the 'quality of contract enforcement'. As argued above, though, the measure includes a number of additional dimensions less relevant in our context. The estimate presented in column 3 supports our view that a higher quality of contract enforcement (lower cost), i.e. an increase in the index $Rule\ of\ law_{j,2008}$, induce firms to use more external debt financing.

[22]We tested a number of possible ways to calculate the z-score. However, estimated coefficients on the z-score were always negative and statistically insignificant.

10 Conclusion

We showed that too much debt hampers the enforceability of relational contracts between a firm and its managers and provided empirical evidence that larger costs of enforcing *formal* contracts generally are associated with lower leverage.

In a next step, it might be worthwhile to extend the model in a way that also includes agency problems among different shareholders.

Tables

Table 1: LOW-DEBT AND HIGH-DEBT INDUSTRIES

Industry	*Average share of external debt*	*Average total assets (in 1,000 Euro)*	*Average sales (in 1,000 Euro)*	*Average cost of enforcing contracts*	*Average rule of law indicator*
Forestry, logging	0.031	12,081.040	1.179	17.657	1.317
Management activities of holdings	0.138	330,772.100	1.977	19.706	1.473
Accounting, book-keeping, auditing	0.245	67,027.110	61.521	20.149	1.075
Miscellaneous business activities	0.258	59,066.830	13.102	20.928	1.312
Sporting activities	0.272	26,192.130	22.100	21.390	1.151
Industrial cleaning	0.590	7,099.281	15.351	18.507	1.273
Labor recruitment, provision of personnel	0.614	207,044.500	159.122	23.586	0.973
Building, repairing of ships, boats	0.646	72,873.080	76.694	15.998	0.944
Investigation, security activities	0.680	17,453.700	41.826	20.748	1.474
Other entertainment activities	0.820	8,787.214	26.929	21.129	1.797

Notes: To determine the 5 lowest- and highest-debt industries we first calculate the average share of external debt over all affiliates within an industry group and then rank industry groups according to this average value. Industries with 3 or less observations are excluded because of confidentiality reasons.

Table 2: DESCRIPTIVE STATISTICS

	Mean	*(Std. Dev.)*
$ED_{j,2008}$	-0.014	(0.145)
$ED^a_{j,2009}$	0.142	(0.267)
$CCE_{j,2008}$	0.655	(1.733)
$ICCE_{j,2008}$	0.143	(0.350)
$Rule\ of\ law_{j,2008}$	0.016	(0.063)
$log\ Sales_{j,2008}$	0.066	(0.394)
$log\ Employees_{j,2008}$	0.048	(0.301)
$Profit_{j,2008}$	-0.002	(0.724)
$Z-Score_{j,2008}$	0.016	(0.417)
$Tax_{j,2008}$	-0.014	(0.024)
$Loss\ carryforward_{j,2008}$	-0.012	(0.310)
$Tangibility_{j,2008}$	0.003	(0.075)
$Domestic\ credit_{j,2008}$	2.016	(11.092)
$Lending\ rate_{j,2008}$	0.001	(0.020)
$GDP\ growth_{j,2008}$	-2.484	(1.381)
$CPI_{j,2008}$	-0.076	(0.278)

Notes: 7,923 observations ([a] 7,381 observations). All variables are defined in first differences, except $ICCE_{j,2008}$ and $ED_{j,2009}$. The former one is defined as a binary treatment indicator as explained in the text, the latter one refers to the second difference in ED_j. $CCE_{j,\ 2008}$ is taken from the World Bank's World Development Indicators (WDI); $Rule\ of\ law_{j,2008}$ from the Worldwide Governance Indicators (WGI), which are also provided by the World Bank. $log\ Sales_{j,2008}$, $log\ Employees_{j,2008}$, $Profit_{j,2008}$, $Z-Score_{j,2008}$, $Loss\ carryforward_{j,2008}$, and $Tangibility_{j,2008}$ are calculated using the affiliate-level data-set MIDI (Microdatabase Direct invesment). Tax data ($Corporate\ Income\ Tax_{it}$) are taken from from databases provided by the International Bureau of Fiscal Documentation (IBFD) and tax surveys provided by Ernst&Young, PwC, and KPMG. $Domestic\ credit_{j,2008}$ measures domestic credit provided by banking sector (in % of GDP) is taken from World Bank's World Development Indicators. $GDP\ growth_{j,2008}$ is from the same source. $Lending\ rate_{j,2008}$ is the lending rate for credit to the private sector taken from the International Financial Statistics (IFS) database provided by the IMF. $CPI_{j,2008}$ (Corruption Perception Index) is published annually by Transparency International. It ranks countries in terms of perceived levels of corruption, as determined by expert assessments and opinion surveys. The scores range from 10 (country perceived as virtually corruption free) to 0 (country perceived as almost totally corrupt).

Table 3: EFFECT OF CHANGE IN COST OF ENFORCING CONTRACTS ON EXTERNAL DEBT

$CCE_{j,2008}$	-0.002***	-0.002***	-0.002***
	(0.001)	(0.001)	(0.001)
$log\ Sales_{j,2008}$	0.019**	0.019**	0.019**
	(0.007)	(0.007)	(0.007)
$log\ Employees_{j,2008}$	0.039***	0.039***	0.039***
	(0.010)	(0.010)	(0.010)
$Profit_{j,2008}$	-0.003	-0.002	-0.004
	(0.002)	(0.002)	(0.003)
$Z - Score_{j,2008}$	-0.023*	-0.023	-0.023
	(0.013)	(0.014)	(0.014)
$Tax_{j,2008}$	0.008	0.008	0.006
	(0.051)	(0.060)	(0.063)
$Loss\ carryforward_{j,2008}$	0.010	0.010	0.009
	(0.008)	(0.008)	(0.008)
$Tangibility_{j,2008}$	-0.079***	-0.080***	-0.077***
	(0.024)	(0.024)	(0.026)
$Domestic\ credit_{j,2008}$	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)
$Lending\ rate_{j,2008}$	-0.026	-0.031	-0.020
	(0.087)	(0.090)	(0.091)
$GDP\ growth_{j,2008}$	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)
$CPI_{j,2008}$	0.002	0.002	0.001
	(0.004)	(0.004)	(0.004)
Affiliate industry dummies	no	yes	yes
Parent industry dummies	no	no	yes
Observations	7,923	7,923	7,923

Notes: OLS estimates. All variables are defined in first differences. Dependent variable is the share of external debt, ED_j, calculated as external debt of j relative to total capital (total capital consists of registered capital, capital reserves and profit reserves, as well as internal and external debt). ***, **, and * indicate that coefficients are significantly different from zero at 1, 5, and 10 percent, respectively. Robust standard errors (clustered by country) are reported in parenthesis. We focus on majority-owned foreign entities and exclude affiliates active in the financial services sector. Financial decisions of subsidiaries concerned with business in the latter industry sector are possibly determined in a very different way and not comparable to firms from other industries.

Table 4: Sensitivity Analysis

	Binary Treatment	*Outcome* $\Delta^2 ED_{j,2009}$	*Rule of Law*
$ICCE_{j,2008}$	-0.043***		
	(0.011)		
$CCE_{j,2008}$		-0.006**	
		(0.003)	
$Rule\ of\ law_{j,2008}$			0.042*
			(0.021)
$log\ Sales_{j,2008}$	0.021**	0.021**	0.019**
	(0.009)	(0.009)	(0.007)
$log\ Employees_{j,2008}$	0.040***	0.041***	0.039***
	(0.014)	(0.014)	(0.010)
$Profit_{j,2008}$	-0.008*	-0.008*	-0.002
	(0.004)	(0.004)	(0.002)
$Z - Score_{j,2008}$	-0.043*	-0.043*	-0.023
	(0.023)	(0.023)	(0.014)
$Tax_{j,2008}$	-0.046	-0.063	0.013
	(0.194)	(0.196)	(0.073)
$Loss\ carryforward_{j,2008}$	0.012	0.013	0.010
	(0.013)	(0.013)	(0.008)
$Tangibility_{j,2008}$	-0.024	-0.023	-0.081***
	(0.041)	(0.041)	(0.024)
$Domestic\ credit_{j,2008}$	-0.001**	-0.001*	-0.000
	(0.000)	(0.000)	(0.000)
$Lending\ rate_{j,2008}$	-0.146	-0.147	-0.058
	(0.237)	(0.245)	(0.082)
$GDP\ growth_{j,2008}$	-0.002	-0.003	0.001
	(0.004)	(0.004)	(0.001)
$CPI_{j,2008}$	0.012	0.011	-0.003
	(0.020)	(0.019)	(0.005)
Affiliate industry dummies	yes	yes	yes
Observations	7,923	7,381	7,923

Notes: OLS estimates. All variables are defined in first differences except $ICCE_{j,2008}$ and the dependent variable $\Delta^2 ED_{j,2009}$. The former one is defined as a binary treatment indicator as explained in the text, the latter one refers to the second difference in ED_j. ***, **, and * indicate that coefficients are significantly different from zero at 1, 5, and 10 percent, respectively. Robust standard errors (clustered by country) are reported in parenthesis. We focus on majority-owned foreign entities and exclude affiliates active in the financial services sector. Financial decisions of subsidiaries concerned with business in the latter industry sector are possibly determined in a very different way and not comparable to firms from other industries.

Appendix

Lemma 1: *Any profit-maximizing equilibrium can be replaced by one where the constraints (IRA), (IC) and (CR) bind in every period t.*

Proof: If (CR) constraints did not bind, all interest payments r_t could be slightly reduced, without violating any constraint but increasing Π_0. Concerning (IC) constraints, assume that (IC) does not bind in any period t'. Now, reduce $b_{t'}$ and increase $w_{t'}$ by an $\varepsilon > 0$ sufficiently small for (IC) for period t' still to hold. This has no impact on any (IRA) constraint, as well as on (IC) constraints in periods $t \neq t'$. Furthermore, Π_1, as well as all constraints relating to the principal are not affected, with the exception of (DE) for period t', which is relaxed.

Concerning (IRA), plug in binding (IC) constraints, i.e., $\delta\left(U_{t+1} - \overline{U}\right) = c \cdot e_t - b_t$, into the agent's payoff $U_t = w_t + b_t - c \cdot e_t + \delta U_{t+1}$ to get $U_t = w_t + \delta\overline{U}$. Now, assume (IRA) does not bind in any period t'. Then, $w_{t'}$ can be slightly reduced, without violating any constraint, however increasing Π_0. Q.E.D.

Lemma 3: *Without loss of generality, effort and debt in a profit-maximizing relational contract are constant over time.*

Proof: Since K is given, it is sufficient to consider the maximization of$D_1 + \delta\Pi_1$, subject to (DE) and (ND) constraints.

Here, it is sufficient to show that profits are the same in every period, i.e., $\Pi_1 = \Pi_2 = ... \equiv \Pi$. To the contrary, assume that there are two subsequent periods t' and $t'+1$ with $\Pi_1 \neq \Pi_2$ (if there are two periods with differing profits, there have to be two subsequent periods where this is the case). First, assume that $\Pi_{t'} > \Pi_{t'+1}$. Then, replace e_t and D_t in all periods $t \geq t'+1$ by e_{t-1} and D_{t-1}, respectively. All these values are enforceable, given the original values constituted an equilibrium. Furthermore, $\Pi_{t'}$ is increased, hence (DE) for period 1 relaxed (note that D_{t+1} actually cancels out in (DE) because $\Pi_{t+1} = f(e_{t+1}) - \overline{u} - c \cdot e_{t+1} - \frac{D_{t+1}}{\delta} + D_{t+2} + \delta\Pi_{t+2}.$), and Π_0 increased as well.

If $\Pi_{t'} < \Pi_{t'+1}$, e_t and D_t in all periods $t \geq t'$ can replaced by e_{t+1} and D_{t+1}, respectively, thereby increasing $\Pi_{t'}$ and hence Π_0. It follows immediately that e as well as D can be constant throughout. Q.E.D.

Lemma 4: *In any profit-maximizing equilibrium, we can set* $\tilde{\Pi} = \overline{\Pi} = max\left\{0, \gamma K - \frac{D}{\delta}\right\}$.

Proof: If the principal immediately defaults after reneging, his payoff is $\overline{\Pi} = \max\{0, \gamma K - \frac{D}{\delta}\}$. If he does not default and instead repays $\frac{D}{\delta}$, he can enter the credit market again, where the off-equilibrium debt level issued for the subsequent period is denoted $\hat{D}$. However, note that after receiving $\hat{D}$ and investing it into the firm (recall that we assume that the principal can not just steal $\hat{D}$), the principal will immediately default afterwards. The reason is that motivating the agent is not possible anymore after reneging, however preventing a default in the next period requires compensating the agent for her outside option $\overline{u} \geq 0$. As $f(0) = 0$, capital costs are positive and all restructuring of the financing structure can happen immediately via an appropriate choice of $\hat{D}$, the principal will default after selecting $\hat{D}$.

Now, the principal can either choose $\hat{D} = D$ or $\hat{D} \neq D$. There, the creditor's belief whether the game is still in equilibrium is crucial (recall that creditors are not able to actually observe whether the game is out of equilibrium). Let us denote the creditor's belief that the game is in equilibrium μ. Hence, as long as the equilibrium debt D is chosen, $\mu = 1$. Furthermore, we show below that for $\hat{D} \neq D$, μ must be zero.

It remains to prove that no matter how $\hat{D}$ is chosen, the payoff is not higher than from defaulting immediately after reneging.

(A) $\hat{D} = D$ As shown above, the principal will default after getting $\hat{D}$, then having a total payoff of $-\frac{D}{\delta} + D + \max\{0, \gamma K - D\} = -D\frac{(1-\delta)}{\delta} + \max\{0, \gamma K - D\}$. Immediately defaulting after refusing to pay b would hence be optimal, if $\max\left\{0, \gamma K - \frac{D}{\delta}\right\} \geq -D\frac{(1-\delta)}{\delta} + \max\{0, \gamma K - D\}$. There are three potential cases:

- $\gamma K - \frac{D}{\delta} \geq 0$; then, the condition above equals $0 \geq 0$
- $\gamma K - \frac{D}{\delta} < 0 \leq \gamma K - D$; then, the condition above equals $0 \geq \gamma K - \frac{D}{\delta}$ and is is satisfied by assumption
- $\gamma K - D < 0$; then, the condition above equals $0 \geq -D\frac{(1-\delta)}{\delta}$.

(B) $\hat{D} \neq D$ First, we show that in this case, μ must be zero. If $\mu > 0$, the creditor would be willing to lend $\hat{D}$, demanding an interest rate $\hat{r}(\mu)$ - where the exact level is not relevant since the principal will immediately default after receiving $\hat{D}$ anyway. Then, the principal would select $\hat{D}$ to maximize $\hat{D} + \max\{0, \gamma K - \hat{D}\}$, and hence choose $\hat{D} = K$. In this case, however, the creditor's payoff would be $-K + \gamma K < 0$, hence a belief $\mu > 0$ cannot be part of an equilibrium in this case, and $\mu = 0$ (note that for any $\hat{D} < K$, we can set $\mu = 0$ as well). This implies that the principal cannot borrow a positive $\hat{D} \neq D$, and would receive a payoff of $-\frac{D}{\delta} + \gamma K$. Since $-\frac{D}{\delta} + \gamma K \leq \overline{\Pi}$, repaying the loan and lending $\hat{D} \neq D$ after reneging can also not be optimal compared to an immediate default. Q.E.D.

Proposition 6: *Assume bankruptcy in every period occurs with exogenous probability $1-\rho$. If the (DE) constraint does not bind, Π_0 is independent of the firm's financing structure. If it binds and $T \geq 1$, it is optimal to set $D = 0$.*

Proof: $\Pi_0 = -(K-D) + \delta\frac{f(e)-\overline{u}-c\cdot e-\rho rD+(1-\rho)\overline{\overline{\Pi}}}{1-\delta\rho}$, with $\overline{\overline{\Pi}} = \delta^T \max\{0, \gamma K - (1+r)D\}$ and $r = \frac{D(1-\delta\rho)-(1-\rho)\delta\overline{D}}{\delta\rho D}$. Hence,

- $(1+r)D \leq \gamma K$: $\Pi_0 = -K + \delta\frac{f(e)-\overline{u}-c\cdot e+(1-\rho)\delta^T\gamma K}{1-\delta\rho}$
- $(1+r)D > \gamma K$: $\Pi_0 = -K + \delta\frac{f(e)-\overline{u}-c\cdot e+(1-\rho)\delta^T\gamma K}{1-\delta\rho}$, and Π_0 is independent of D for a given effort level.

  If the (DE) constraint binds, it determines the firm's optimal debt level. (DE) equals $-c\cdot e + \rho\left(\frac{\delta(f(e)-\overline{u}-c\cdot e)-rD-(1-\delta)\delta^T \max\{0,\gamma K-(1+r)D\}}{1-\delta\rho}\right) \geq 0$, where we have

- $(1+r)D \leq \gamma K$: $-c\cdot e+\rho\frac{\delta(f(e)-\overline{u}-c\cdot e)-(1-\delta)\delta^T\gamma K}{1-\delta\rho} - \rho\frac{D\left(1-\delta^T\right)}{\delta(\rho+(1-\rho)\delta^T)} \geq 0$, which is decreasing in D for $T \geq 1$ and unaffected by D for $T=0$.
- $(1+r)D > \gamma K$: $-c\cdot e + \rho\frac{\delta(f(e)-\overline{u}-c\cdot e)-rD}{1-\delta\rho} \geq 0$, which is decreasing in D. Q.E.D.

Proposition 7: *Assume $r < \frac{1-\delta}{\delta}$. If the (DE) constraint does not bind, it is optimal to set $D = K$.*

If the (DE) constraint binds and

- $T < \frac{ln\frac{r}{(1-\delta)(1+r)}}{ln\delta}$, *then $\gamma K \leq D(1+r) \leq K$*
- $T > \frac{ln\frac{r}{(1-\delta)(1+r)}}{ln\delta}$, *then $(1+r)D$ might be higher or lower than γK, and is decreasing in r and T.*

Proof: $\Pi_0 = -(K-D) + \delta\frac{f(e)-\overline{u}-c\cdot e-rD}{1-\delta} = -K + D\left(1 - r\frac{\delta}{1-\delta}\right) + \delta\frac{f(e)-\overline{u}-c\cdot e}{1-\delta}$, which is increasing in D as $1-r\frac{\delta}{1-\delta} > 0$. Hence, $D=K$ if the (DE) constraint does not bind.

The (DE) constraint equals

$$-c\cdot e - rD\frac{1}{1-\delta} + \delta\frac{f(e)-\overline{u}-c\cdot e}{1-\delta} - \delta^T \max\{0, \gamma K-(1+r)D\} \geq 0,$$

giving the two cases

- $(1+r)D \leq \gamma K$: $-c\cdot e + D\left(\delta^T + r\left(\frac{\delta^T(1-\delta)-1}{1-\delta}\right)\right) + \delta\frac{f(e)-\overline{u}-c\cdot e}{1-\delta} - \delta^T\gamma K \geq 0$ and
- $(1+r)D > \gamma K$: $-c\cdot e - rD\frac{1}{1-\delta} + \delta\frac{f(e)-\overline{u}-c\cdot e}{1-\delta} \geq 0$.

Now, the respective Lagrange functions are:

- $(1+r)D \leq \gamma K$: $L = -K + D\left(1 - r\frac{\delta}{1-\delta}\right) + \delta\frac{f(e)-\overline{u}-c\cdot e}{1-\delta} + \lambda_{DE}\left[-c\cdot e - rD\frac{1}{1-\delta} + \delta\frac{f(e)-\overline{u}-c\cdot e}{1-\delta} - \delta^T(\gamma K - (1+\right.$
  $\lambda_{D\geq 0}D + \lambda_{D\leq\frac{\gamma K}{1+r}}\left[\frac{\gamma K}{1+r} - D\right]$
  $\frac{\partial L}{\partial e} = \delta\frac{f'-c}{1-\delta} + \lambda_{DE}\left[-c + \delta\frac{f'-c}{1-\delta}\right] = 0 \Rightarrow \lambda_{DE} = \frac{\delta(f'-c)}{[c-\delta f']}$
  $\frac{\partial L}{\partial D} = \left(1 - r\frac{\delta}{1-\delta}\right) + \lambda_{DE}\left[\delta^T(1+r) - r\frac{1}{1-\delta}\right] + \lambda_{D\geq 0} - \lambda_{D\leq\frac{\gamma K}{1+r}} = 0$
- $(1+r)D > \gamma K$: $L = -K + D\left(1 - r\frac{\delta}{1-\delta}\right) + \delta\frac{f(e)-\overline{u}-c\cdot e}{1-\delta} + \lambda_{DE}\left[-c\cdot e - rD\frac{1}{1-\delta} + \delta\frac{f(e)-\overline{u}-c\cdot e}{1-\delta}\right] +$
  $\lambda_{D\geq\frac{\gamma K}{(1+r)}}\left[D - \frac{\gamma K}{(1+r)}\right] + \lambda_{D\leq K}[K - D]$
  $\frac{\partial L}{\partial e} = \delta\frac{f'-c}{1-\delta} + \lambda_{DE}\left[-c + \delta\frac{f'-c}{1-\delta}\right] \Rightarrow \lambda_{DE} = \frac{\delta(f'-c)}{[c-\delta f']}$
  $\frac{\partial L}{\partial D} = \left(1 - r\frac{\delta}{1-\delta}\right) - \lambda_{DE}r\frac{1}{1-\delta} + \lambda_{D\geq\frac{\gamma K}{(1+r)}} - \lambda_{D\leq K} = 0$

If the (DE) constraint binds and $\left[\delta^T(1+r) - r\frac{1}{1-\delta}\right] \geq 0$, then $D \geq \frac{\gamma K}{(1+r)}$. If the (DE) constraint binds and $\left[\delta^T(1+r) - r\frac{1}{1-\delta}\right] < 0$, then D might be higher or lower than $\frac{\gamma K}{(1+r)}$ and decreasing in r and T. Q.E.D.

References

[1] Abreu, D. "On the Theory of Infinitely Repeated Games with Discounting." *Econometrica*, Vol. 56 (1988), pp. 383-396.

[2] Ampenberger, M., Schmid, T., Achleitner, A.-K., and Christoph Kaserer (2011), "Capital structure decisions in family firms: empirical evidence from a bank-based economy," *Review of Managerial Science*, 1-29.

[3] Bae, Kee-Hong, Kang, Jun-Koo, and Jin Wang (2011), "Employee Treatment and Firm Leverage: A Test of the Stakeholder Theory of Capital Structure", *Journal of Financial Economics*, 100(1), 130-153.

[4] Banerjee, Shantanu, Dasgupta, Sudipto, and Yungsam Kim (2008), "Buyer-Supplier Relationships and the Stakeholder Theory of Capital Structure", The Journal of Finance, 63(5), 2507-2552.

[5] Bebchuk, L.A., and L.A. Stole (1993), "Do short-term objectives lead to under- or over-investment in long-term projects," *Journal of Finance*, 48, 719-729.

[6] Benmelech, Efraim, Bergman, Nittai K., and Ricardo J. Enriquez (2012), "Negotiating with Labor under Financial Distress," *Review of Corporate Finance Studies,* 1, 28-67.

[7] Berk, J., Stanton, R., and J. Zechner (2010), "Human Capital, Bankruptcy and Capital Structure," *Journal of Finance,* 65, 891-926.

[8] Bolton, P., and D. Scharfstein (1990), "A theory of predation based on agency problems in financial contracting," *American Economic Review*, 80, 93-106.

[9] Brander, J., and T. Lewis (1986), "Oligopoly and Financial Structure: The Limited Liability Effect," *American Economic Review,* 76, 956-970.

[10] Bull, Clive (1987), "The Existence of Self-Enforcing Implicit Contracts," *The Quarterly Journal of Economics*, 102(1), 147-159.

[11] Dewatripont, M., and J. Tirole (1994), "A theory of debt and equity: diversity of securities and manager-shareholder congruence," *Quarterly Journal of Economics*, 69, 811-838.

[12] Fong, Y., Li, J. (2010), "Relational Contracts, Efficiency Wages, and Employment Dynamics." Mimeo, Northwestern University.

[13] Graham, John R. (1996), "Proxies for the Corporate Marginal Tax Rate," *Journal of Financial Economics*, 42, 187-221.

[14] Graham, John R. (2000), "How big are the tax benefits of debt?" *Journal of Finance,* 55, 1901-1941.

[15] Graham, John R., and Mark T. Leary (2011), "A Review of Empirical Capital Structure Research and Directions for the Future," *Annual Review of Financial Economics*, 3, 309-345.

[16] Graham, John R., and Daniel A. Rogers (2002), "Do Firms Hedge in Response to Tax Incentives?" *The Journal of Finance*, 57, 815-839.

[17] Harris, M., and A. Raviv (1991), "The theory of capital structure," *Journal of Finance*, 46, 297—355.

[18] Hart, Oliver D., and John Moore (1989),

[19] Hart, Oliver D., and John Moore (1995), "Debt and Seniority: An Analysis of the Role of Hard Claims in Constraining Management," *American Economic Review*, 113, 1-41.

[20] Hart, Oliver D., and John Moore (1998), "Default and Renegotiation: A Dynamic Model of Debt," *Quarterly Journal of Economics*, 63, 1-41.

[21] Heaton, J.B. (2002), "Managerial Optimism and Corporate Finance," *Financial Management*, 31, 33-45.

[22] Holmström, Bengt, and Jean Tirole (1997), "Financial Intermediation, loanable funds, and the real sector," *Quarterly Journal of Economics,* 62(3)*,* 663-691.

[23] Inderst, Roman, and Holger M. Müller (2003), "Internal versus External Financing: An Optimal Contracting Approach," *The Journal of Finance*, 58(1), 1033-1062.

[24] Jensen, M.C., and W.R. Meckling (1976), "Theory of the firm, managerial behaviour, agency costs and ownership structure," *Journal of Financial Economics*, 3, 305-360.

[25] Jensen, M.C. (1986), "Agency Costs of Free Cash Flows, Corporate Finance, and Takeovers," *American Economic Review*, 76, 323-329.

[26] Jensen, M.C. (1993), "The Modern Industrial Revolution, Exit, and the Failure of Internal Control Systems," *Journal of Finance*, 48, 831-880.

[27] Kale, Jayant R., and Husayn Shahrur (2007), "Corporate Capital Structure and the Characteristics of Suppliers and Customers", *Journal of Financial Economics*, 83, 321-365.

[28] Levin, Jonathan (2003), "Relational Incentive Contract," *The American Economic Review*, 93(3), 835-857.

[29] Li, Jin, and Niko Matouschek (2011), "Managing Conflicts in Relational Contracts," mimeo.

[30] MacLeod and Malcomson (1989), "Implicit Contracts, Incentive Compatibility, and Involuntary Unemployment," *Econometrica*, 57(2), 447-480.

[31] Maksimovic, V., and S. Titman (1991), "Financial Policy and Reputation for Product Quality", *Review of Financial Studies*, 4, 175-200.

[32] Matsa, D. (2010), "Capital Structure as a Strategic Variable: Evidence from Collective Bargaining," *Journal of Finance*, 65, 1197-1232.

[33] McKinsey & Company (2010), "The five attributes of enduring family businesses," *McKinsey Quarterly*, January 2010.

[34] Mishra, C., and D. McConaughy (1999), "Founding family control and capital structure: The risk of loss of control and the aversion to debt," *Entrepreneurship Theory and Practice*, 23, 53-64.

[35] Modigliani, F., and M. Miller (1958), "The cost of capital, corporation finance, and the theory of investment", American Economic Review, 48, 261–297.

[36] Modigliani, F., and M. Miller (1963), "Corporate income taxes and the cost of capital: A correction," *American Economic Review*, 53, 433-443.

[37] Myers, Stewart C. (1977), ““Determinants of corporate borrowing,” *Journal of Financial Economics*, 5, 147-175.

[38] Myers, S.C., and N.C. Majluf (1984), “Corporate financing and investment decisions when firms have information that investors do not have”, *Journal of Financial Economics,* 13, 187–222.

[39] Myers, Stewart C. (2003), “Financing of Corporations,” Handbook of the Economics of Finance.

[40] Price Waterhouse Cooper (2012), “Family Firm: A resilient model for the 21st Centry,” *PwC Family Business Survey*, October 2012.

[41] Powell, Michael (2011), “Productivity and Credibility in Industry Equilibrium,” mimeo.

[42] Roll, R. (1986), “The Hubris Hypothesis of Corporate Takeovers,” Journal of Business, 59, 97-216.

[43] Schmidt, K.M. (1997), “” *The Review of Economic Studies*,

[44] Stein, Jeremy C. (1989), “Efficient Capital Markets, Inefficient Firms: A Model of Myopic Corporate Behavior,” *Quarterly Journal of Economics*, 104, 655-669.

[45] Stein, Jeremy C. (2003), “Agency, Information and Corporate Investment,” Handbook of the Economics of Finance, 111-165.

[46] Stiglitz, J.E., and A. Weiss (1981), “Credit rationing and markets with imperfect information”, *American Economic Review,* 71, 393–411.

[47] Stiglitz, J.E., and A. Weiss (1983), “Incentive effects of terminations: applications to the credit and labor markets”, *American Economic Review,* 73, 912–927.

[48] Strebulaev, Ilya A., and Baozhong Yang (2012), “The Mystery of Zero-Leverage Firms,” mimeo.

[49] Titman, Sheridan (1984), “The Effect of Capital Structure on a Firm’s Liquidation Decision”, *Journal of Financial Economics*, 13, 137-151.

[50] Titman, Sheridan, and Roberto Wessels (1988), “The Determinants of Capital Structure Choice”, *The Journal of Finance*, 43(1), 1-19.

[51] Williamson, O.E. (1964), The Economics of Discretionary Behavior: Managerial Objectives in a Theory of the Firm (Prentice Hall, Englewood Cliffs, NJ)

[52] Zwiebel, J. (1996), “Dynamic capital structure under management entrenchment”, *American Economic Review,* 86, 1197–1215.