Financing of Business Groups

Who should do the borrowing?

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Abstract

We analyze the optimal debt structure of business groups depending on the legal and institutional environment. In principle, business groups can choose between a centralized and a decentralized debt structure. We identify how this choice is affected by managerial incentives and risk-sharing considerations. We find that centralized debt is optimal in countries and businesses with intermediate levels of risk and high bankruptcy costs. With high or low levels of risk and strong incentive effects decentralized debt is preferred even if bankruptcy is very costly. We also provide a rationale for mixed debt structure.

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1 Introduction

Business groups differ significantly from stand-alone single-entity firms. First of all, they typically consist of separate, often legally independent entities that are in many cases organized in a pyramidal structure, in which a parental company holds the majority of voting rights over several subsidiaries. Secondly, business groups face a wider range of financing options. In particular, they do not only decide on how much external debt and equity to raise, but they also have to choose the degree of centralization in their capital structure. Thus, they have to decide whether capital should be raised centrally by the parental company or better decentrally by the single subsidiaries.

Over the last years an increasing number of theoretical and especially empirical analyses investigated the functioning of business groups. While much work has been done with respect to the boundary of the firm, its organizational structure and performance, emphasizing optimal investment policies, corporate governance issues and agency problems between insiders and external minority shareholders, almost nothing has been said about the issue of debt allocation within the business group. This is particularly surprising as debt is a major source of financing for most of the business groups in developed as well as emerging markets.

Our model is one of the first theoretical approaches focusing on the optimal debt structure within business groups. The aim of our paper is to determine the optimal debt allocation of a business group taking into account its specific legal and institutional environment. We show that business groups will optimally adjust the degree of debt centralization in order to balance incentive and risk-sharing effects of subsidiary vs. parental debt. Decentralizing debt increases subsidiary managers' effort incentives in order to avoid bankruptcy. This incentive effect arises as subsidiary managers want to consume control benefits for managing their subsidiary and are directly liable to debtholders in case of decentral borrowing.[3]

[3] The disciplining effect of bankruptcy is especially important in countries in which it is difficult or very costly to write contracts with subsidiary managers about a performance-based dismissal. Typically, this will be the case in countries with very strong employer rights, like Germany and other Western European countries. Furthermore, managerial entrenchement might reduce the credibility of contract enforcement.

Centralizing the debt structure, on the other hand, allows the realization of risk-sharing effects, which are specific to business groups as compared to stand-alone firms. Business group managers can use the net profits of all its subsidiaries in order to repay their debt and thus avoid costly bankruptcy. Only if the sum of net profits is not enough to cover all debt repayments bankruptcy occurs.

As we show in our analysis, the trade-off a value maximizing CEO of a business group faces in his decision about the degree of debt centralization is between expected returns and expected bankruptcy costs. While expected returns are solely influenced by the incentive effect and are therefore highest with a fully decentralized debt structure, the effects on expected bankruptcy costs are not as straightforward. Bankruptcy costs are affected by the risk-sharing effect as well as the incentive effect. A higher degree of debt centralization allows for a better exploitation of the risk-sharing effect as the occurance of bankruptcy decreases. On the other hand, centralizing the debt structure reduces managerial incentives, which adversely effects the probability of bankruptcy and thus expected bankruptcy costs. While we can show that with respect to bankruptcy costs a fully decentralized debt structure will never be optimal, the overall optimality of the debt structure depends on firm charcteristics and the specific legal and institutional settings.[4]

In particular, our analysis allows us to draw the following conclusions:

First, business groups operating in countries with high bankruptcy costs will prefer a more centralized debt structure. However, if the incentive effects of decentralized debt are very strong, a fully centralized financial structure can never be optimal. In these cases a mixed financing structure will be chosen. Secondly, business groups with very profitable investment projects will prefer a fully decentralized debt structure in order to fully exploit the incentive effect. Thirdly, business-specific and country-specific risks, which influence the probability of success of the investment projects independent of managerial effort, are also crucial for the resulting degree of centralization. While for business groups operating in

[4]Note that the optimal degree of centralization can imply a debt structure with partial borrowing by the parental company and partial borrowing on the subsidiary level. Throughout this paper, we will refer to this debt structure as a mixed debt structure.

businesses or countries with very low or very high levels of risk a fully decentralized debt structure will be preferred, business groups operating in businesses or countries with intermediate levels of risk will chose a completely centralized debt structure. All other business groups will decide on a mixed structure.[5]

Despite the predominance of business groups in many developed as well as emerging markets, the question of the borrowing structure within business groups has practically not been investigated yet. The focus of the literature on business groups is mainly on corporate governance issues and the explanation of concentrated, often pyramidal and family controlled, ownership structures, while taking into account different legal environments (Almeida & Wolfenzon (2006), Bebchuk (1999) and Burkart et al (2003)).

A closely related strand of the literature is the literature on internal capital markets. Extensive empirical as well as theoretical research has been done in this area to highlight agency problems within multi-entity corporations. However, the focus of this work is on the allocation of existing internal funds and its positive and negative effects on investments and performance (e.g., Gertner et al (1994), Stein (1997), Scharfstein & Stein (2000), Rajan et al (2000)).[6]

Thus, even though related to our research, neither the literature of business group financing nor the internal capital markets literature explicitly considers the debt allocation within a business group.

To our knowledge, there are only two other theoretical analyses carried out by Bianco and Nicodano (2006) and Moriones (2005), which explicitly investigate the debt structure within business groups.

Bianco and Nicodano acknowledge the richer debt structure choice of business groups as compared to stand-alone firms. Their work builds on the insight that parental companies typically enjoy limited liability when the borrowing is undertaken by the business group's subsidiaries. In their analysis, business groups have an incentive to decentralize the debt structure in order to exploit the limited liability of the holding company with respect to subsidiary lending. But as this is

[5] Interestingly, Khanna and Yafeh (2005) find empirical evidence for the existence of risk-sharing within a business group only for some countries, while for others not – an insight consistent with our analysis.

[6] A good survey of the internal capital markets literature is given by Stein (2003).

associated with an adverse risk-shifting incentive in the subsidiaries, some degree of parental debt is needed in order to credibly commit to a lower level of risk. As opposed to the business groups considered in our analysis, in which parental companies are non-operating financial holdings, the results of their analysis only apply to business groups with parental companies disposing of operational business themselves. Furthermore, Bianco and Nicodano ignore incentive effects associated with decentral borrowing and reject the disciplining hypothesis based on their empirical results, which indicate a higher leverage for the parental company. However, our model is consistent with their empirical findings even though we consider the disciplining function of decentral borrowing. The reason therefor lies in the positive risk-sharing effect of centralized debt, which is also not accounted for by the analysis of Bianco and Nicodano.

Even though Moriones (2004) also takes into account the positive incentive-effect associated with borrowing in the subsidiaries, by assuming that headquarters has enough internal funds to finance investments, the author ignores the possibility of centralized borrowing and again the positive aspect of risk-sharing.

Risk-sharing, often called the coinsurance aspect of multi-entity corporations, has already been recognized by a different strand of the literature dealing with the boundary of the firm. Lewellen (1971) was among the first to focus on this coinsurance capacity of multi-entity corporations in view of the large mergers wave in the US of the 1960s. Even though this strand of the literature has thoroughly investigated the differences between stand-alone firms and congolmerates (e.g., Inderst and Müller (2003); Berkovitch, Israel and Tolkowsky (2006); Li and Li (1996); Faure-Grimaud and Inderst (2004)), authors mainly focus on the effects on investments and internal capital markets and the valuation of these organizational forms.[7] As to our knowledge, non of these articles explicitly considers the debt allocation within the multi-entity firm. Furthermore, the exclusive comparison between stand-alone and multi-entity corporations gives rise to an important limitation in analyzing the financial structure of a business group. Linking the financial structure to the organizational form, as is typically done in this strand of

[7] While a diversification discount was identified by several earlier studies (Lang & Stulz (1994), Berger & Ofek (1995) and Serveas (1996)), more recent research highlights a selection bias underying these results (Villalonga (2001), Campa & Kedia (2002)).

literature, ignores the capability of business groups to decide on a mixed financing structure. As we show in the following analysis excatly this possibility is key to the financing decision within a business group.

The remainder of this paper is structured as follows: While the next chapter lays out the set-up and basic mechanisms of our model, chapter 3 derives the optimality conditions in a national setting and analyses the comparative statics with respect to the optimal degree of centralization. Chapter 4 concludes.

2 A Model of Business Group Borrowing

2.1 The Model Set-up

Consider a business group (BG) consisting of a non-operating parental company and two legally independent subsidiaries. All units are run by risk-neutral managers. Each subsidiary manager has an identical NPV-positive investment project, which will return R with a probability of q, or zero otherwise. The surplus after possible debt repayments is assumed to be frictionless passed on to the parental company. Depending on the effort level of the subsidiary manager the probability can either be high, thus q^H or low, thus q^L. A high effort level involves effort costs for a subsidiary manager of $e(q^H) = c$, while a low effort level is associated with effort costs of $e(q^L) = 0$. As long as the subsidiary is in business, the respective subsidiary manager will be able to enjoy private benefits of B. A certain amount of external debt D has to be raised as the assets in place within the subsidiaries are not sufficient for financing the investment project. Outside investors are assumed to be risk-neutral and fully competitive at a market interest rate normalized to zero and will therefore realize expected profits of zero. The manager of the parental company can not take any operational investment decisions, but decides on the borrowing structure of the BG. Thus he can either decide to raise the necessary debt centrally or the borrowing has to be undertaken decentrally by the subsidiary manager. The parental manager is acting in the interest of the whole business group maximizing overall firm value. If the debt can not be repaid, the borrower goes bankrupt, which also implies that in case the parental company

cannot fullfill its debt payments the whole BG will go bankrupt. Bankruptcy is costly. The bankruptcy of a subsidiary entails bankruptcy costs of K_S, while the bankruptcy of the whole BG is associated with bankruptcy costs of K_{BG}. As the parental company is only a financial holding without any assets of its own, it is assumed that $K_{BG} = 2K_S$. Thus, if both subsidiaries go bankrupt individually, this entails the same level of bankruptcy costs like the bankruptcy of the entire BG. In this basic set-up, the parental manager can decide between three financing options: He can either raise the necessary funds for both subsidiaries centrally, or he can decide on a completely decentralized financing structure with independent borrowing in both of the subsidiaries or, as a third option, he can decide on a mixed financing structure, in which the necessary debt for one subsidiary will be raised centrally, whereas the other subsidiary borrows independently.

2.2 Debt Centralization and the Effects on Risk Structure and Incentives

First, consider the effects of debt centralization on the possibility of bankruptcy. An important and plausible assumption underlying the following analysis is, that the return in case of success of a single investment project is high enough to cover both debt repayments, thus

$$R > D(1 + \widetilde{r}) \tag{1}$$

$$\forall \widetilde{r}$$

where $\widetilde{r}$ is the interest rate investors would require according to the risk-structure of the BG.[8] Given this assumption, the bankruptcy probabilities for the different outcomes and financing structures are given in the table below. 'Decentral' implies local borrowing in both subsidiaries, 'Mixed' refers to the case in which only subsidiary two is centrally financed, and 'Central' implies parental financing of both investment projects. While 'No BC' refers to the situation, in which there is no bankruptcy at all and 'BC BG' reflects the stiuation in which the

[8] Note that the magnitude of the required interest rate depends on the debt structure chosen. $\widetilde{r}$ indicates the highest possible interest rate for the relevant debt structures. For details about the interest rate see derivation of expected BG profits in the appendix.

whole BG goes bankrupt, 'BC S1' and 'BC S2' represent the situations in which respectively only the borrowing or non-borrowing subsidiary goes bankrupt. The subscribts one and two indicate the respective subsidiary.

	Decentral	Mixed	Central
No BC	$q_1 q_2$	q_1	$q_1 + (1 - q_1)q_2$
BC S1	$(1 - q_1)q_2$	$(1 - q_1)q_2$	0
BC S2	$(1 - q_2)q_1$	0	0
BC BG	$(1 - q_1)(1 - q_2)$	$(1 - q_1)(1 - q_2)$	$(1 - q_1)(1 - q_2)$

As can be seen from the table, for given effort levels of the subsidiary managers, centralizing the debt structure renders bankruptcy less probable. While the probability of no bankruptcy increases, the occurence of a single subsidiary bankruptcy decreases. This reduction in bankruptcy is due to the fact that a more centralized debt structure allows return reallocation for debt repayments. For example, imagine that a subsidiary fails on it's project. In this case, if this project was financed decentrally, the subsidiary manager would not be able to repay his debt and the subsidiary would go bankrupt. However, as long as the project was financed centrally and the other subsidiary was successful, there will be no bankruptcy as the centralization of debt allows the parental manager to use net returns of the successful subsidiary for debt repayments. Thus, as stated above, centralizing the debt structure reduces the eventuality of bankruptcy. This can be seen as a positive 'risk-sharing' effect of centralizing the debt structure.

However, as debt can have a disciplining effect on subsidiary managers, centralizing the borrowing might also entail a negative incentive effect. For analyzing this incentive effect, consider how the incentives of the subsidiary managers are determined, depending on the financing structure of the BG. Generally speaking, a subsidiary manager will only work hard if the expected private benefits he can consume due to the higher effort level outweight the costs c of a higher effort level. Thus, the optimization problem for the subsidiary manager i, with $i = 1, 2$ is

$$\underset{q_i}{Max} Bq_i - e(q_i)$$

For the following analysis we want to focus on the relevant case that parental debt

is not enough for giving the subsidiary managers the right incentives. Managers will only chose a high effort level if they have to borrow decentrally. This is reflected by the following conjecture.

Conjecture 1 *Subsidiary managers will only choose a high effort level, if they have to borrow decentrally. Thus, the following conditions hold*

$$B(q_i^H - q_i^L) > c \tag{I}$$

and

$$B(q_i^H - q_i^L)(1 - q_j^L) < c \tag{II}$$

$$\forall i, j = 1, 2 \wedge j \neq i$$

Condition I ensures that the increase in expected private benefits with higher effort, driven by the higher probability of success, is enough to compensate subsidiary managers for their effort costs in case of independent, decentral borrowing. Condition II, on the other hand, indicates that subsidiary managers will not have an incentive to work hard with a centralized debt structure.[9] Note, that in the case of centralized financing the incentives of a subsidiary manager depend also on the effort level of the other subsidiary manager. The intuition for this interdependence is as follows: If the investment project of a subsidiary is financed centrally, net returns of the other subsidiary can be used for debt repayments as well. Thus, even if a centrally financed subsidiary should fail, its manager can continue his business and be able to consume private benefits, as long as the other subsidiary does well. This holds independent of his own effort level. Thus, the marginal benefit of an higher effort level will be smaller as compared to the case of decentral borrowing. Note, that the benefits of a higher effort level will be lower the higher the effort level of the other subsidiary manager is, as the probability of bankruptcy decreases. Thus, a mixed debt structure will be even less appropriate than a fully

[9] Condition II refers to a fully centralized debt structure, for which in equilibrium, it will hold for both subsidiary managers and both will choose a low effort level.

centralized debt structure to give the centrally financed subsidiary manager the right incentives to work hard. Overall, conjecture 1 ensures that only decentral, independent borrowing has a disciplining effect.

2.3 Expected Profits of the Business Group

Having investigated the bankruptcy effects of the degree of debt centralization and its impact on the risk-structure of the BG and incentives, we now want to derive the expected profits of the business group for different degrees of centralization. First, consider a decentralized debt structure with independent borrowing by the subsidiary managers. In this case, as according to conjecture 1, both subsidiary managers have an incentive to choose a high effort level, expected profits of the whole BG are given by (all derivations see appendix):

$$E\pi^D = 2Rq^H - 2K_S(1 - q^H) - 2D \tag{2}$$

Similarly, expected profits for a mixed financing structure are given by

$$E\pi^M = R(q^H + q^L) - (2 - q^L)K_S(1 - q^H) - 2D \tag{3}$$

Finally, expected profits for a completely centralized debt structure, where all the borrowing is undertaken centrally by the parental company, are given by

$$E\pi^C = 2Rq^L - 2K_S(1 - q^L)^2 - 2D \tag{4}$$

In all three expressions, the first term gives the expected returns from the investment, while the second term accounts for the expected bankruptcy costs of the BG. The last term represents expected costs of debt.[10] Observing the profit functions already indicates that the optimal debt structure will be determined by a trade-off between expected returns and bankruptcy costs. This trade-off will be analyzed in the next section. As will be shown, the resulting optimal debt structure will critically depend on business characteristics and the specific legal and institutional environment of the country the BG is operating in.

[10] Note that the expected costs of debt are $2D$ in all cases as investors are risk-neutral and will realize expected profits of zero.

3 Optimal Degree of Centralization

3.1 Expected Returns and Bankruptcy Costs

Even though the optimal degree of debt centralization depends on the specific legal and institutional settings of the relevant countries some general assessments can be made.

Consider expected returns first.

Proposition 1 *Expected returns will be lower, the higher the degree of debt centralization is.*

Proof: Follows directly from observing the first terms in the profit functions**.**

The intuition for this proposition is straightforward: Expected returns are solely influenced by the incentive effect. As for each subsidiary centralizing debt implies a low effort level of the manager, the higher the degree of centralization the lower ceteris paribus the overall success probability and hence expected returns.

However, the effects on bankruptcy costs are not as straightforward. Bankruptcy costs are influenced by the incentive effect as well as the risk-sharing effect of debt centralization. On the one hand, centralizing debt reduces managerial incentives and thus the probability of success, which ceteris paribus leads to higher expected bankruptcy costs. On the other hand, centralizing debt also allows for more risk-sharing between the subsidiaries, which might reduce expected bankruptcy costs. Nevertheless, some general conclusions with respect to bankruptcy costs can already be drawn at this stage.

Proposition 2 *With respect to bankruptcy costs, a fully decentralized debt structure will always be dominated by a mixed structure.*

Proof: Follows directly from observing the second terms in the profit functions**.**

The intuition for this proposition goes as follows: As the mixed structure already allows for a substantial exploitation of the incentive effect, the additional

possibility to exploit the risk-sharing effect will always dominate a further 'marginal' increase in the incentive effect by providing the other manager with appropriate incentives to exert a high effort level.

Proposition 3 *With respect to bankruptcy costs, a mixed structure will be preferred over a fully centralized debt structure, as long as*

$$q^H \geq \overline{f}(q^L) = \frac{3q^L - 2(q^L)^2}{2 - q^L} \tag{5}$$

with

$$\frac{\partial \overline{f}(q^L)}{\partial q^L} > 0$$

$$\forall 0 \leq q^L \leq 1$$

Proof: See appendix.

Proposition 3 basically states that q^H has to be sufficiently larger than q^L for the mixed structure to be preferred over a fully centralized debt structure. The intution goes as follows: If q^H is relatively large as compared to q^L than the incentive effect is very strong. In particular, the incentive effect, which favours a decentralized debt structure, will be so strong as to overlay the risk-sharing effect, which favours a centralized financing structure. Thus, bankruptcy costs will be lower with a mixed financing structure.

3.2 Optimal Debt Structure

In the above section we have determined the underlying trade-offs for the optimal debt structure. In this section, we want to derive the optimal debt structure based on business- and country-specific factors for the BG. The optimality conditions, which are derived in the appendix of this paper, can be summarized by the following proposition

Proposition 4 *1) A fully decentralized debt structure is optimal, iff*

$$R(q^H - q^L) \geq K_S(1 - q^H)q^L \tag{6}$$

2) A mixed debt structure is optimal, iff

$$K_S(1 - q^H)q^L > R(q^H - q^L) \geq K_S(1 - q^H)q^L - 2K_S(1 - q^L)(q^H - q^L) \tag{7}$$

3) A fully centralized debt structure is optimal, iff

$$K_S(1 - q^H)q^L - 2K_S(1 - q^L)(q^H - q^L) > R(q^H - q^L) \tag{8}$$

Proof: See appendix.

Proposition 4 basically states that the higher the incentive effect as compared to the risk-sharing effect, the more decentralized the optimal debt structure will be. The expression $R(q^H - q^L)$ reflects the difference in expected returns between the decentralized and mixed financing structure and the mixed and centralized financing structure respectively. $K_S(1 - q^H)q^L$ is the overall bankruptcy cost advantage of a mixed debt structure as compared to a fully decentralized debt structure, whereas $K_S(1 - q^H)q^L - 2K_S(1 - q^L)(q^H - q^L)$ reflects the overall bankruptcy cost advantage of a completely centralized debt structure. Note, that this term, as opposed to $K_S(1 - q^H)q^L$, can also take on negative values. Both bankruptcy cost terms consist of a part resulting from the incentive effect and a part resulting from the risk-sharing effect. The bankruptcy cost disadvantage of a fully decentralized financing structure as compared to a mixed debt structure, thus $K_S(1 - q^H)q^L$, can be disaggregated into an incentive effect disadvantage of the mixed financing structure as compared to a fully decentralized debt structure, given by $-K_S(1 - q^H)(q^H - q^L)$ and the risk-sharing advantage, given by $K_S(1 - q^H)q^H$. Similarly, $K_S(1 - q^H)q^L - 2K_S(1 - q^L)(q^H - q^L)$, consists of an incentive advantage the mixed debt structure entails as compared to the fully centralized debt structure, which is given by the second term, and the risk-sharing disadvantage of the mixed structure, given by the first term.

The intuition for proposition 4 goes as follows: As explained before, due to the incentive effect, expected returns will be higher the more decentralized the debt structure is. Bankruptcy costs, on the other hand, will be lowest either with a fully centralized debt structure or with a mixed debt structure, depending on the trade-off between the risk-sharing and the incentive effects. A fully decentralized debt structure, however, will never exhibit the lowest bankruptcy costs.[11] These relationships imply, that a fully decentralized debt structure can only be optimal, if the adavantage in expected returns due to the incentive effect is so large that it even more than compensates the bankruptcy cost disadvantage as compared to a mixed or centralized financing structure. That is the case in part one of proposition 4. If, however, the incentive effect is not very strong, implying that the expected return advantage of a high effort level is relatively small, than either a mixed debt structure or a fully centralized debt structure is optimal. This comparison depends on the direction and strength of the bankruptcy cost advantage. If the bankruptcy cost advantage favors a mixed debt structure, thus $K_S(1-q^H)q^L - 2K_S(1-q^L)(q^H - q^L) < 0$, than the mixed structure will definitely be the optimal financing structure. Even if the bankruptcy cost advantage is towards a centralized debt structure, a mixed financing structure can still be optimal – if the advantage in expected returns more than compensates for the bankruptcy cost disadvantage of the mixed debt structure as compared to the fully centralized debt structure. If the incentive effect is so low that the advantage in expected returns of a mixed financing structure is not enough to compensate for the bankruptcy cost advantage of a fully centralized financing structure, than a fully centralized financing structure will be optimal.

To summarize, the stronger ceteris paribus the incentive effect and thus the higher the advantage in expected returns of a high effort level, the more centralized the optimal debt structure will be.

The question that arises now and will be answered in the next section is, under which circumstances this will actually be the case and especially how different institutional and legal settings will influence the above derived optimality condition.

[11] That a fully decentralized debt structure will allways be dominated by the mixed structure, can also be derived from the fact, that the bankruptcy cost difference between a fully decentralized debt structure and a mixed structure, $K_S(1-q^H)q^L$, will always be positive.

3.3 Determinants of the Optimal Debt Structure

In the section above, we have investigated how the incentive and risk-sharing effect determine the optimal debt structure. In this section we want to determine how the optimal degree of debt centralization is affected by firm-specific factors and the legal and instiutional environment. While several authors identified the relevance of country-specific legal factors for firm leverage (e.g., Rajan & Zingales (1995)), they only consider the effects on the aggregate level. While these empirical insights are important for our analysis as so far they confirm the relevance of the specific national setting, the focus of our analysis is on effects beyond the aggregate level. We want to investigate the impact of firm and country specific factors on the optimality of the debt structure within a BG. Bianco and Nicodano (2006) are the only authors to our knowledge, who empirically investigate the debt allocation within a business group.[12] As we will show in the following, their findings are consistent with our model.

Firms with ceteris paribus very profitable investment opportunities, which exhibit very high rates of return R, will tend to have a more decentralized debt structure. This relationship is straightforward and needs no further investigation: The higher the rate of return, the higher will expected profits be with no change in the bankruptcy costs, which favours a decentralized debt structure.

However, the effects with respect to bankruptcy costs are not as straightforward. The costs associated with bankruptcy can widely be subdivided into two categories.[13] First of all, there are direct costs of bankruptcy. These include filing fees, trustee expenses, legal and accounting fees, and other administrative expenses. Secondly, there are also indirect costs associated with bankruptcy. These include forgone sales and profits as well as asset-specific human capital. As Bianco and Nicodano (2006) argue, these indirect costs of bankruptcy will presumably be higher in countries with a creditor oriented bankruptcy code and strict enforcement, like Germany, France and Italy. This is mainly due to the fact that strict enforcement of a creditor oriented bankruptcy code will reduce the possibility of

[12] Note, however, that there are a few authors analyzing the internal debt structure in a multinational setting. We will discuss the empirical results of this literature in more detail in the last section of our paper.

[13] See e.g. Altman (1984), p. 1068.

going concern.[14]

Bearing this relationship in mind, we want to analyze the effects of an increase in bankruptcy costs within our theoretical framework. Given the model set-up, one would intuitively expect that higher bankruptcy costs unambigously increase the attractiveness of a centralized debt structure as this reduces the occurence of bankruptcy. Nevertheless, this conclusion can only be drawn under restrictive conditions. In particular, the following proposition holds.

Proposition 5 *Generally, a higher level of bankruptcy costs results in an increase in the optimal degree of centralization. If however* $q^H > \overline{f}(q^L)$ *a fully centralized debt structure will never be optimal regardless of how strong the increase in bankruptcy costs is.*

Proof: See appendix.

Proposition 5 holds due to the incentive effect. The underlying intuition is as follows: If incentive effects are very strong a further decrease in the occurence of bankruptcy due to the fully centralization of the debt structure as compared to the mixed debt structure can never offset the associated loss in the positive impact of the incentive effect - whatever the level of bankruptcy costs is.

This result is consistent with the empirical evidence of Nicodano and Bianco (2006). For a dataset consisting of BGs in Italy, a country with strict enforcement of a creditor-oriented bankrupcty code, they find that even though subsidiaries have external debt, a larger portion of the BG debt is borrowed by the holding company, making the holding a net borrower within the BG. Note, that this empirical result exactly reflects the predictions of our model.

Next, consider the effects with respect to the level of success probability. With 'level' of success probability we refer to changes in the success probabilities without changes in the incentive effect. That is to say we consider, for a given level of incentive effect, thus for $q^H - q^L = const.$, how the optimality conditions are affected by changes in the probability of success. The levels of probability of

[14] Bianco and Nicodano (2006), p. 940.

success are determined by different factors. First of all, they will depend on firm and industry-specific aspects. The safer the business of the BG, the higher c.p. q^H and q^L will be. On the other hand, overall economic risks of the respective country will also affect the success probabilities of the investment projects.[15] It seems plausibel to assume that the higher business- or country-specific risks, the lower will be the overall level of success probability – independent of managerial efforts. In this case, the following proposition holds.

Proposition 6 *1) With weak incentive effects, very low and very high levels of success probability lead to a fully decentralized optimal debt structure, while intermediate probability ranges render a fully centralized debt structure optimal. All other BGs will choose a mixed financing structure.*

2) With intermediate incentive effects, low and high levels of success probability lead to a fully decentralized debt structure, while all other BGs will optimally choose a mixed debt structure. Centralization of the debt structure is never optimal.

3) With strong incentive effects, all BGs will optimally choose a fully decentralized debt structure.

Proof: See appendix.

The intuition for the result is as follows: With high success probabilities the risk-sharing effect is not too important and thus is dominated by the incentive effect. If one subsidiary is successful most probably the other subsidiary will be successful as well. In this case, there is practically no need to recur to risk-sharing and making use of the profits of one subsidiary in order to repay the debt of the other subsidiary. Thus, it pays to fully exploit the incentive effect. If on the other hand, the probability levels are very low for both subsidiaries, the failure of one subsidiary is most probably accompanied by a failure of the other one as well and the business group will go bankrupt as a whole. Thus in this case, even if the

[15] Even though the same rationing might hold to some extend for political risks, we are reluctant to include these in our analysis: Political risks will reduce the probability of success independent of managerial effort levels. But political turmoils are often not only a one shot event but typically involve longer periods of total breakdown of the country. In these cases, it will not be possible to realize the risk-sharing effect of centralized debt.

risk-sharing effect is important, it can often not be exploited. Again, it pays to fully exploit the incentive effect. Only if the probability levels are intermediate, the risk-sharing effect is relevant and can be optimally exploited. This is due to the fact that for intermediate levels of risk it is very likely for one subsidiary to have positive returns while the other subsidiary is not successful. Thus, for fully exploiting the risk-sharing effect for these cases, the CEO will prefer to fully centralize the debt structure.

As we will discuss in the next section, considering these insights in a multinational context allows us to shed light on empirical evidence with respect to the debt structure of multinational subsidiaries.

Last, consider private benefits of the subsidiary managers. These are another important determinant of the optimal debt structure in equilibrium, which significantly depend on the legal environment. As shown by Dyck and Zingales (2004), less developed markets are associated with higher benefits of control, which in turn might change the incentives of subsidiary managers. This in turn might significantly influence the optimal debt structure. In our set-up the following proposition with respect to the optimal debt structure can be derived.[16]

Proposition 7 *BGs operating in countries with very high or very low private benefits of control will fully rely on centralized debt.*

Proof: See appendix.

The underlying reasoning is relatively straightforward. Consider the situation with very high benefits of control. If a subsidiary manager is able to consume relatively high private benefits, the increase in expected private benefits due to a higher effort level is stronger. If this effect is strong enough, the increase in expected benefits might be enough to cover the costs of a high effort level even with parental debt. This changes the incentives of the manager and no debt decentralization is needed in order to induce him to work hard. In this case, the optimal debt structure would be fully centralized to perfectly exploit risk-sharing

[16] Note, that for the derivation of this proposition conjecture 1 is relaxed.

effects. If on the other hand, the private benefits a subsidiary manager might be able to consume are very low, expected private benefits as compared to the costs of a high effort level will be too low to give him incentives to exert a high effort level – even with decentralized debt. In this situation the best the CEO can do, is to fully centralize the debt structure to at least fully exploit the risk sharing effect.

The analysis carried out in this chapter also highlights the importance of a differentiated approach when analyzing the effects of local settings on the debt structure of BGs. For example, as highlighted by the empirical findings of Bianco and Nicodano (2006), relatively well developed capital markets like Italy might be associated with high bankruptcy costs and thus increase the attractiveness of debt centralization. This result is due to the creditor-orientation of the bankruptcy code. On the other hand, it is feasible to assume, that underdeveloped capital markets will also be associated with a higher degree of debt centralization. This might hold for two different reasons. First of all, inefficiencies in the bankruptcy process should ceteris paribus lead to higher direct costs associated with bankruptcy, which again increases the attractiveness of a more centralized debt strcuture. Secondly, as laid out by Dyck and Zingales (2004) private benefits will be significantly higher in these countries, which might, as shown in Proposition 7, have a positive effect on managerial incentives, rendering debt centralization optimal.

4 Conclusion

In our analysis we showed that the debt structure within business groups matters – a fact that had almost been completely neglected in the literature so far. While the business groups literature mainly investigates issues related to ownership structure and agency problems between insiders and outside shareholders, we focused on the internal allocation of business group debt. Taking into account the disciplining effect of direct borrowing for subsidiary managers as well as the risk sharing effect associated with a centralized debt structure, we developed a model for business group borrowing with a given investment program. As we have shown, these effects

lead to a trade-off between expected returns and expected bankruptcy costs, which in turn determine the optimal debt structure for a business group. In particular, we demonstrated how firm-specific factors and country-specific institutional settings shape the optimal debt allocation within business groups. Our analysis also relates to the field of research on the boundary of the firm. While this strand of literature acknowledges the risk-sharing effect associated with a centralized debt structure, typically the financing structure of firms is tightly related to its organizational form allowing for the comparison between the two 'extreme' financing forms of a fully decentralized (stand-alone firm) or fully centralized (conglomerate) debt structure only. By disentangling the organizational structure and financing decision of business groups and accounting for the limited liability parental companies typically have with respect to the borrowing by subsidiaries, we were able to provide a rationale for a mixed debt structure, where the borrowing is partially undertaken by the parental company and partially by the subsidiaries.

A natural extension of our analysis is the application of our model to multinational corporations by taking into account differences between the single subsidiaries. The literature on multinational finance is mostly empirical.[17] While only very few theoretical models investigate the capital structure of multinationals, most on them focus on tax considerations for determining the optimal debt structure within multinational corporations (e.g., Chowdry und Nanda (1994); Chowdry und Coval (1998)).[18] Empirical evidence however suggests, that besides tax considerations also instiutional and country-specific factors as the degree of capital market development and political risks are significant determinants of the debt allocation within multinationals. For example, Hooper (2002) as well as De-

[17] Furthermore, most of this literature has only considered aggregate effects on leverage and valuation, controversially discussing, whether multinationals are associated with higher or lower leverage as compared to purely domestic firms. While e.g. Lee and Kwok (1988) sustain that the leverage of multinational corporations is lower than of purely domestic firms, Chkir and Cosset (2001) find a positive relationship between multinational diversification and firm leverage.

[18] To our knowledge, the only equilibrium model deriving an optimal mix of subsidiary and parental debt based on non-tax considerations is Noe (2000), who develops a bargaining-model between internal managers and external creditors. The optimal borrowing structure is determined based on the creditors bargaining power, which in turn is affected by the strength of creditor rights in the respective country.

sai, Foley and Hines (2006) found a positive relationship between the degree of subsidiary borrowing and political risk in the country the subsidiary operates in. Applying our model set-up to the specific setting of multinational corporations generates results consistent with these empirical findings Consider a multinational corporation with subsidiaries operating in low risk countries and subsidiaries allocated in countries with high political risk, thus lower probability levels of success. Note, that as stated before, for subsidiaries operating in high risk countries the possibility to recur to risk-sharing can be very limited. It is therefore plausible, that in these countries a decentralized debt structure will be preferred in order to fully exploit the incentive effect. A more centralized debt structure for the other subsidiaries can perfectly be motivated within our model setting.

However, for accomodating other empirical insights like the positive relationship between the extend of local borrowing and the level of financial development (Lehmann et al (2004)) or the negative impact of adverse market conditions, like weak creditor rights and shallow capital markets on subsidiary leverage (Desai, Foley and Hines (2004)) a richer model set-up will be needed. Thus, extending our model set-up to a multinational setting will allow us to theoretically investigate and understand the mechanisms underlying empirical evidence and to generate further testable implications.

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6 Appendix

Derivation of Expected Profits for the BG

First note that we can neglect the indices indicating the specific subsidiary, as throughout our whole analysis both subsidiaries are assumed to be identical.

1) Expected profits of a decentralized debt structure

Assumption 1 implies that with a decentralized debt structure subsidiary managers will choose a higher effort level, implying q^H. With completely decentralized debt each subsidiary operates independently and thus generate expected returns of

$E\pi^D = 2((R - D(1 + \widetilde{r}^D))q^H - K_S(1 - q^H))$

As investors are risk-neutral and fully competitive and market interest rate is 0, $\widetilde{r}^D$ has to fullfill the following equation:

$q^H D(1 + \widetilde{r}^D) \stackrel{!}{=} D(1 + 0)$

Solving for $1 + \widetilde{r}^D$ yields:

$1 + \widetilde{r}^D = \frac{1}{q^H}$

Finally, plugging this into $E\pi_i^D$ yields:

$E\pi_i^D = 2(Rq^H - D - K_S(1 - q^H))$

2) Expected profits of a mixed debt structure

Assumption 1 implies that with a mixed debt structure the manager of the subsidiary borrowing decentrally will choose a higher effort level, implying q^H, whereas the other subsidiary manager will not exert a high effort level, thus implying q^H.

Note, that with the assumption that $R > D(1 + \widetilde{r})$ for all possible $\widetilde{r}$, the follwing situation arises with respect to bankruptcy: if only the project of the locally borrowing subsidiary fails, that subsidiary will go bankrupt, whereas if only the centally financed project fails, there is no bankruptcy and the centrally borrowed debt will be repaid. Only if both projects fail contemporaneously the whole BG will go bankrupt. This gives the following expected profits for the BG:

$E\pi^M = q^H(R - D(1 + \widetilde{r}_S^M)) - K_S(1 - q^H)q^L + q^L(R - D(1 + \widetilde{r}_{BG}^M)) - (1 - q^L)q^H D(1 + \widetilde{r}_{BG}^M) - K_{BG}(1 - q^H)(1 - q^L)$

Again, with a market interest rate of 0, risk-neutral and fully competitive debtholders will require the following interest rates:

a) debtholders of subsidiary debt:

$(1 + \widetilde{r}_S^M) = \frac{1}{q^H}$

b)debtholders of parental debt:

$(1 + \widetilde{r}_{BG}^M) = \frac{1}{q^L + (1-q^L)q^H}$

Plugging these into $E\pi^M$ together with the assumption $K_{BG} = 2K_S$, $E\pi^M$ simplifies to:

$E\pi^M = R(q^H + q^L) - (2 - q^L)K_S(1 - q^H) - 2D$

3) Expected profits of centralized debt structure

Assumption 1 implies that with a centralized debt structure both subsidiary managers will not exert a high effort level. implying q^L for both subsidiaries.

As a centralized debt structure allows for full exploitation of the risk-sharing effect, there will only be bankruptcy, if both of projects fail, yielding the follwing expression for expected profits:

$E\pi^C = (2R - 2D(1 - \widetilde{r}^C))(q^L)^2 + 2(R - 2D(1 - \widetilde{r}^C))(q^L(1 - q^L)) - K_{BG}(1 - q^L)^2$

With the interest rate required by the fully competitive, risk-neutral investors at a market interest rate of

$(1 + \widetilde{r}^C) = \frac{1}{q^L + (1-q^L)q^L}$

and $K_{BG} = 2K_S$, $E\pi^C$ simplifies to

$E\pi^C = 2Rq^L - 2K_S(1 - q^L)^2 - 2D.$

Proof of Proposition 3:

Bankruptcy costs with a mixed debt structure will be higher than with a centralized debt structure if

$K_S(1-q^H)(2-q^L) < 2K_S(1-q^L)^2$

solving for q^H yields the function in the first part of the proposition

$q^H > f(q^L) = \frac{3q^L - 2(q^L)^2}{2-q^L}$

The derivation of $f(q^L)$ with respect to q^L is
$\frac{\partial f(q^L)}{\partial q^L} = \frac{2}{(2-q^L)^2}\left((q^L)^2 - 4q^L + 3\right)$

With

$\left((q^L)^2 - 4q^L + 3\right) \geq 0$
$\forall \;\; 0 \leq q^L \leq 1$
it follows immediately that $\frac{\partial f(q^L)}{\partial q^L} > 0$, ensuring a one-to-one relationship between q^H and q^L.

Proof of Proposition 4

ad 1)

For a fully decentralized debt structure to be optimal, the following two conditions have to hold:

A) $E\pi^D = 2Rq^H - 2K_S(1-q^H) - 2D > R(q^H+q^L) - (2-q^L)K_S(1-q^H) - 2D = E\pi^M$

and

B) $E\pi^D = 2Rq^H - 2K_S(1-q^H) - 2D > 2Rq^L - 2K_S(1-q^L)^2 - 2D = E\pi^C$

Condition A) will be fullfilled, if
$R(q^H - q^L) > K_S(1-q^H)q^L$
Now assume that condition B) does not hold, in this case
$R(q^H - q^L) < K_S((1-q^H) - (1-q^L)^2)$
The two inequalities can only be contemporaneously fullfilled if:
$K_S((1-q^H) - (1-q^L)^2) > K_S(1-q^H)q^L$, thus
$(1-q^H) - (1-q^L)^2 > (1-q^H)q^L$

$(1-q^H)(1-q^L) > (1-q^L)^2$
$(1-q^H) > (1-q^L)$
$q^L > q^H$

which is with the given assumption $0 \leq q^L \leq q^H \leq 1$ a contradiction. Thus, if condition A) holds condition B) will hold as well.

ad 2)

For a mixed debt structure to be optimal, the following two conditions have to hold:

C) $E\pi^M = R(q^H+q^L)-(2-q^L)K_S(1-q^H)-2D > 2Rq^H-2K_S(1-q^H)-2D = E\pi^D$

and

D) $E\pi^M = R(q^H+q^L)-(2-q^L)K_S(1-q^H)-2D > 2Rq^L-2K_S(1-q^L)^2-2D = E\pi^C$

C) simplifies to $K_S(1-q^H)q^L > R(q^H-q^L)$

whereas D) simplifies to

$R(q^H-q^L) > K_S(1-q^H)q^L - 2K_S(1-q^L)(q^H-q^L)$

As $K_S(1-q^H)q^L > K_S(1-q^H)q^L - 2K_S(1-q^L)(q^H-q^L)\ \forall\ 0 \leq q^L \leq q^H \leq 1$ combining conditions C) and D) gives $K_S(1-q^H)q^L > R(q^H-q^L) > K_S(1-q^H)q^L - 2K_S(1-q^L)(q^H-q^L)$

ad 3)

For a fully centralized debt structure to be optimal, the following two conditions have to hold:

E) $E\pi^C = 2Rq^L - 2K_S(1-q^L)^2 - 2D > E\pi^M = R(q^H+q^L) - (2-q^L)K_S(1-q^H) - 2D$

and

F) $E\pi^C = 2Rq^L - 2K_S(1-q^L)^2 - 2D > 2Rq^H - 2K_S(1-q^H) - 2D = E\pi^D$

Condition E) will be fullfilled if

$R(q^H-q^L) < K_S(1-q^H)q^L - 2K_S(1-q^L)(q^H-q^L)$

Assume that condition F) does not hold, thus

$R(q^H-q^L) > K_S((1-q^H)-(1-q^L)^2)$

The two inequalities can only be contemporaneously fullfilled, if:
$K_S(1-q^H)q^L - 2K_S(1-q^L)(q^H-q^L) > K_S((1-q^H)-(1-q^L)^2)$
$(1-q^H)q^L - 2(1-q^L)(q^H-q^L) > (1-q^H)-(1-q^L)^2$
$(1-q^H)(q^L-1) - 2(1-q^L)(q^H-q^L) > -(1-q^L)(1-q^L)$
$(1-q^H-1+q^L)(q^L-1) - 2(1-q^L)(q^H-q^L) > 0$
$(1-q^L)(q^H-q^L) - 2(1-q^L)(q^H-q^L) > 0$
which is with the given assumption $0 \leq q^L \leq q^H \leq 1$ a contradiction. Thus, if condition E) holds condition F) will hold as well.

And finally, the condition for NPV-positive investment projects has to hold. (to be completed)

Proof of Proposition 5

As shown before, $E\pi^D > E\pi^M$ implies $E\pi^D > E\pi^C$ and $E\pi^C > E\pi^M$ implies $E\pi^C > E\pi^D$ for all K_S. For investigating the effect of changes in the bankruptcy costs, K_S, it is therefore sufficient to consider the comparative statics with respect to the optimality conditions $E\pi^D > E\pi^M$ and $E\pi^C > E\pi^M$.

With $E\pi^D - E\pi^M = R(q^H-q^L) - K_S(1-q^H)q^L$ we obtain
$\frac{\partial(E\pi^D - E\pi^M)}{\partial K_S} = -(1-q^H)q^L < 0 \quad \forall\ 0 \leq q^L \leq q^H \leq 1.$
This implies that the attractiveness of a mixed debt structure over a fully decentralized debt structure increases with K_S for the whole parameter range.

With $E\pi^M - E\pi^C = R(q^H-q^L) - K_S(1-q^H)q^L + 2K_S(1-q^L)(q^H-q^L)$ on the other hand we obtain
$\frac{\partial(E\pi^M - E\pi^C)}{\partial K_S} = -(1-q^H)q^L + 2(1-q^L)(q^H-q^L) = q^H(2-q^L) - q^L(3-2q^L)$

Here, two cases have to be considered separately:

1) $BC^C > BC^M$, thus $q^H > \overline{f}(q^L) = \frac{3q^L - 2(q^L)^2}{2-q^L}$

In this case, with $q^H(2-q^L) > q^L(3-2q^L)$, it follows that
$\frac{\partial(E\pi^M - E\pi^C)}{\partial K_S} > 0$

2) $BC^C < BC^M$, thus $q^H < \overline{f}(q^L) = \frac{3q^L - 2(q^L)^2}{2-q^L}$

In this case with $q^H(2-q^L) < q^L(3-2q^L)$, it follows immediately that

$\frac{\partial(E\pi^M - E\pi^C)}{\partial K_S} < 0$

Thus, while an increase in K_S unambigously reduces the attractiveness of a fully decentralized debt structure, the effect on the attractiveness of a fully centralized debt structure depends on the direction of the BC-effect. If the BC-effect favors a mixed debt structure over a fully centralized debt structure, thus $q^H > \overline{f}(q^L)$, than the higher the increase in K_S the more centralized the optimal debt structure will be. If, however, the BC-effect favors a centralized debt structure, thus $q^H < \overline{f}(q^L)$, only the attractives of the mixed debt structure increases.

Proof of Proposition 6

TO BE COMPLETED

Proof of Proposition 7

Consider an increase in private benefits first. As long as conjecture 1 is fullfilled, there will be no change in the incentive situation and thus the optimality conditions. But if conjecture 1 is relaxed and private benefits are allowed to be very high, more precisely $B > \frac{c}{(q^H-q^L)(1-q^L)}$, incentive effects and thus the optimality conditions change. With $B > \frac{c}{(q^H-q^L)(1-q^L)}$ a subsidiary manager will work hard even with parental debt – independent of the effort level of the other subsidiary manager. In this case, expected profits are given by:

$\widetilde{E\pi}^D = 2Rq^H - 2K_S(1-q^H) - 2D$

$\widetilde{E\pi}^M = 2Rq^H - (2-q^H)K_S(1-q^H) - 2D$

$\widetilde{E\pi}^C = 2Rq^H - 2K_S(1-q^H)^2 - 2D$

With $2K_S(1-q^H) > (2-q^H)K_S(1-q^H)$ comparing $\widetilde{E\pi}^D$ with $\widetilde{E\pi}^M$ immediately yields $\widetilde{E\pi}^M > \widetilde{E\pi}^D \ \forall\ 0 \leq q^H \leq 1$

On the other hand, $\widetilde{E\pi}^C > \widetilde{E\pi}^M$, iff

$(2-q^H)K_S(1-q^H) > 2K_S(1-q^H)^2$

Simplifying the inequation yields

$(2-q^H) > 2(1-q^H)$

$2 - q^H > 2 - 2q^H$

Thus,

$2q^H > q^H$, which holds for all q^H with $0 \leq q^H \leq 1$.

Overall, with $B > \frac{c}{(q^H - q^L)(1-q^L)}$, $\widetilde{E\pi}^C > \widetilde{E\pi}^M > \widetilde{E\pi}^D$ and thus a fully centralized debt structure dominates all other financing options.

Now turn to the case with very low incentive effects. Again, there will be no change in the incentive effects and thus the optimality conditions, as long as conjecture 1 holds. Only if conjecture 1 is relaxed and lower levels of private benefits are allowed for, this will change managerial incentives and thus the optimality conditions.

More specifically, if the private benefits of control are as low as to fullfill $B < \frac{c}{(q^H - q^L)}$, subsidiary managers will never have an incentive to work hard and thus expected profits will be given by

$\widetilde{\widetilde{E\pi}}^D = 2Rq^L - 2K_S(1 - q^L) - 2D$

$\widetilde{\widetilde{E\pi}}^M = 2Rq^L - (2 - q^L)K_S(1 - q^L) - 2D$

$\widetilde{\widetilde{E\pi}}^C = 2Rq^L - 2K_S(1 - q^L)^2 - 2D$

With the same rationing as above it can be shown that overall, with $B < \frac{c}{(q^H - q^L)}$, $\widetilde{E\pi}^C > \widetilde{E\pi}^M > \widetilde{E\pi}^D$ and thus, again, a fully centralized debt structure dominates all other financing options.