Risk, capital requirements, and the asset structure of companies

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Abstract

Purpose – Financial institutions have been subject to minimum capital requirements for considerable time while other companies do not face any such regulation. This paper investigates the capital requirements of companies and how it should relate to the assets of a company.

Design/methodology/approach – The theoretical approach in this paper integrates aspects of liquidity, asset characteristics and capital requirements into a single setting to address the problem of capital requirements for non-financial companies.

Findings – The paper develops a framework in which the impact losses have on the future performance of the company are used to develop three categories of capital and suggest a measure for each category. The paper then relates these categories to properties of the assets the capital should be invested in, which include aspects of liquidity as well as the source of this capital. It is finally pointed out how cost considerations can be used to obtain the optimal asset and capital structure of a company.

Research limitations/implications – This paper presents the conceptual basis for the determination of capital requirements of companies and future research is needed to formalize the ideas presented here more thoroughly and gain additional insights into the relationship to the asset structure.

Practical implications – The results of this paper can be used by companies as a first guide towards deciding on their capital requirements, taking into account the properties of the assets they invest their capital in and how to optimize their capital structure.

Originality/value – The paper provides a first insight into the relationship between capital requirements, asset structure, and risks for non-financial companies.

Keywords Risk management, Organizational structures, Capital budgeting

Paper type Research paper

1. Introduction

All activities pursued by a company are inherently risky, although to a different degree. Decisions made at present will show their full consequences only in the future and are affected not only by the behavior of competitors, customers, suppliers, or regulators, but also by the state of nature. Even the best evaluated decisions can lead to losses in unforeseen circumstances. This risk is at the core of corporate activities and companies have to ensure that they can bear the risks they are facing. Capital, used in this paper as a synonym for equity unless otherwise stated, acts as a safeguard against the losses that might occur as a result of these risks. With capital a company is only forced into bankruptcy if the losses exceed the capital held. As losses are related to the risk of a company, it becomes apparent that capital and risks are closely related with each other.

In this context, the most important question is how much capital a company needs for a given risk or, equivalently, how much risk it can take with a given capital. This so-called capital adequacy has become increasingly important in recent years, primarily in the regulation of banking activities and insurance companies.

The Basel Accord on Capital Adequacy, Basel Committee on Banking Supervision (1988), with its amendments as developed by the Bank for International Settlements (BIS) serves as the basis of most national regulations in advanced economies. The rules

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currently require a minimum capital of 8 per cent of the risk-weighted assets of the bank. Thus, far the methods employed to determine the risks of assets are very schematic, but can be expected to improve substantially with a new accord, currently under consideration, called Basel II, Basel Committee on Banking Supervision (2001). Similar rules apply also to insurance companies as well as securities firms. There are usually no rules governing the capital adequacy of non-financial companies, however, stakeholders often employ implicit rules when assessing the creditworthiness of a company, e.g. rating agencies or banks.

Efforts in recent years to develop a theoretical approach towards capital requirements, in banking and insurance primarily, gave rise to using value at risk (VaR) as the appropriate risk measure to base the capital requirements on. More recently expected shortfall has been proposed due to its superior properties. A common feature of all these contributions is that they attempt to use a single number as a risk measure. It is obvious that it is very difficult to condense all properties of the distribution of losses into a single number, despite advances like the coherence of risk measures, Artzner *et al.* (1999). Rootzén and Klüppelberg (1999) show this limitation of the current approach towards risk measurement in the presence of catastrophic risks.

Mostly in a separate regulation the liquidity of companies, again confined to banking and insurance, is addressed. We can view this regulation as an attempt to manage the risks arising from the asset structure of a company in order to ensure that it does not become insolvent. Although the losses arising from risks and a lack of liquidity are closely related, it is usually treated separately. Thus a more holistic approach towards asset and liability management is still outstanding.

In this paper, we address the two issues mentioned above. After briefly reviewing the current literature on capital allocation rules, we develop a framework to analyze the magnitude of losses according to their impact on a company and assign a special category of capital to these losses as well as provide a measure for these risks. We then continue to relate the capital structure to the assets of a company and describe properties these assets should fulfill if the capital is invested into them. Finally, we sketch the costs of such a use of capital that may lead to a method to derive the optimal capital requirements resulting in a maximum firm value.

2. Methods of capital allocation

In most cases, capital is allocated to different lines of businesses, e.g. product lines or divisions. The reason for such an allocation is the desire to charge the appropriate cost of capital to each division and thus allow for a proper costing of products by including all costs.

As a first step, let us consider a situation where the amount of capital is actually given exogenously and has to be allocated to different divisions. The main problem here is that capital is used to cover any potential losses of the entire company rather than the losses of only a certain division. With capital thus being used by all divisions, the problem of allocation to individual divisions is not trivial. The idea we will use in capital allocation is similar to the allocation of joint costs on individual products: an indicator is needed to split the capital between divisions. We briefly look into allocation procedures based on the following three principles:

(1) accounting-based capital allocation;

(2) risk-based capital allocation;

(3) incentive-based capital allocation.

As the aim of capital is to provide a cushion against potential losses, the basis for the allocation should be the size of these potential losses, i.e. the risk of the divisions. The above listed methods all attempt to address this issue, albeit in very different manners.

2.1. Accounting-based capital allocation

Traditionally, the capital allocation has been based on the capital employed in a certain division. This amount of capital can be obtained from the accounts of the company by detecting which assets are used in which division and in which way their acquisition has been financed.

Apparently in this allocation procedure there is no consideration of the risks individual divisions face. The use of capital employed as the basis for the capital allocation rule, however, can be justified if we assume that all divisions are equally risky. In this case, it is apparent that the proper allocation mechanism would only have to consider the relative sizes of the different divisions. The capital employed is in this case an obvious choice.

The only problem arising from the use of capital employed based on accounting figures is that it might not take into account all assets of a division, in particular intangible assets such as patents or licenses. Furthermore, accounting data can easily undervalue assets due to accounting rules that have to be followed. Omitting such assets or using undervalued assets could distort the capital allocation significantly, hence it is advisable to conduct the analysis based on market values rather than accounting figures.

Similarly, we could use the earnings or cash flows generated by individual divisions as the basis for the capital allocation decision. In this case, we would assume that these earnings or cash flows have all been generated with the same risks attached. The problems from using these accounting data are similar to the use of capital employed. Furthermore, the volatility of earnings and cash flows easily result in continuously changing capital allocations, particularly in cases where the divisions are performing differently over time.

Even after taking into account these problems, it is apparent that the assumption of divisions being equally risky is very unrealistic. In most cases, companies engage in various activities which differ substantially in the risks they face, making the approximation of the risk by capital employed, earnings or cash flows a too rough method and we have to take into account the risks in each division more explicitly.

2.2. Risk-based capital allocation

The simplest way of taking into account the different risks divisions face, would be to determine the risk in each division directly with an appropriate risk measure. Common risk measures are the standard deviation of returns and value at risk (VaR), which is defined implicitly by

$$\text{Prob}(\pi - \text{VaR}_c) = c \tag{1}$$

hence losses π exceed the VaR only with a probability of c. The confidence level c is set according to the risk aversion of the company. The more risk averse a company is, the smaller the confidence level has to become. Measuring risks by VaR is well established, primarily due to the Basel Accord favoring this risk measure. Theoretical arguments, however, show that VaR is neither a good risk measure nor, in general, compatible with the preferences of users, see e.g. Artzner *et al.* (1999).

The only complication arising from this approach is that the total risk of the company will be less than the sum of the risks of the individual divisions[1]. We obviously have to consider the diversification effect for the company as a whole from supporting different divisions.

If we were now to propose that the capital employed in each division is proportional to its risk, e.g. the VaR, the total capital required from the allocation procedure would exceed that of the company as a whole. Hence the diversification reduces the total amount of capital that has to be held. We thus have reduced the problem of capital allocation to the problem of fairly dividing the benefits of diversification between the different divisions.

By resorting to cooperative game theory and using results from the literature on bargaining, Denault (2001) has shown that the optimal allocation of capital should follow the simple principle that the capital allocated to a business unit be proportional to its contribution towards the total risk of the company. Rather than using the total risk a division faces, only that part of the risk which is not diversified by other divisions is considered. If we were to measure risk by the standard deviation of returns, the capital allocation would be proportional to the covariance of the returns of the divisions with the company as a whole. In this sense, the capital allocation would be proportional to the systematic risk of the division, where the market is to be replaced by the company as the benchmark. Panjer (2002) refers to this as the "internal beta", while Hesselager and Andersson (2003) show this outcome as the result of a linear approximation of risks. A similar result is obtained for other risk measures such as the VaR, e.g. shown in Tasche (1999).

An argument that could be brought against the use of this capital allocation rule is that the division does not have full control over their risk allocation as it is affected by the behavior of all divisions. It has to be noted in this context that this proposed capital allocation is an equilibrium outcome of a cooperative game, i.e. the result of negotiations between the divisions rather than decentrally taken decisions. Such a situation is considered in the coming section.

2.3. Incentive-based capital allocation

One characteristic of companies is that investment decisions in individual divisions are mostly done with great autonomy by line managers. In order to ensure that they make sensible investment decisions, suppose that managers receive a fraction of the total value generated in their division. The value generated does not only consist of the profits made, but includes a charge on the capital allocated to this division. The managers in each division decide on the size of their investments, but for simplicity cannot affect their characteristics, such as profits or risks.

With investment decisions taken decentrally, it is important to ensure that the decisions taken by individual managers are optimally for the company as a whole. Stoughton and Zechner (1999) propose that this alignment of interests between the managers and the company as a whole is conducted via the capital allocation rule.

In order to avoid that excessive risks are taken, the capital allocated obviously accounts for the risks taken by the division. The risk measure for this purpose is as outlined above the contribution of the division to the total risk of the company. In addition, however, there is an additional factor to adjust this capital allocation for the incentives of individual managers. As their compensation depends on the value generated in their division, those generating high values would easily make over-proportionally large investments, reducing the diversification benefits of having many

divisions. Although this is accounted for in the increased contribution of the division to the overall risk of the company, the incentives by managers through their higher compensation take this effect only partially into account as they only have to bear parts of these costs with the remainder borne by the other divisions (external effects).

In order to align the interests of the company with that of individual managers, well performing divisions receive an additional allocation of capital, while division performing less well than average receive a lower charge. Across all divisions, these adjustments cancel each other out. The effect is that because of the higher capital allocation to well performing divisions, the investments are reduced and the company remains optimally diversified, thus increasing the total value of the company.

Hence we observe that in companies making decentralized investment decisions, the capital allocation is driven by two factors: the risk contribution of a division and an adjustment to align the incentives of managers with the interests of the company as a whole.

2.4. Capital requirements

The above methods of capital allocation have taken the total amount of capital available for a company as given. In this section, we will in brief explore how much capital a company as whole requires. With capital having the role of providing a cushion against losses, it is obvious that again these potential losses have to form the basis of the total capital requirements, and therefore the risk plays once more a key role in our considerations.

One intuitive way to determine the total capital requirement is to set the capital such that the company avoids bankruptcy with a certain probability $1 - c$; the more risk averse the company is the larger this probability has to become. From this consideration it becomes clear that the value at risk (VaR) is a prime candidate for the determination of the total capital requirements. Indeed, using the VaR to determine the capital requirements has become a common occurrence, particularly in the financial services industry where regulation has led to a widespread proliferation of this methodology.

Although the established methods to determine the capital requirements and allocation of capital to divisions are widely used and accepted, particularly in the financial sector, many important aspects of risk management in companies are not addressed adequately as is shown in the next paragraph.

2.5. An open research problem

The capital requirement and capital allocation are based on the risk of the company or division, which are determined with the use of a single risk measure. In the banking and insurance industries, we observe that the regulation of capital requirements is complemented by a regulation of the solvency of companies, requiring a certain amount of highly liquid assets to be held by these companies in order to avoid liquidity shortfalls.

Apparently, capital requirements as well as solvency are an important aspect of risk management for companies in the financial services, but obviously it is of equal relevance to all other industries as well. An apparent question to ask is whether capital requirements and liquidity should be combined in a single framework.

In the remainder of this paper, we will have a fresh look at the characterization of risks and how they should be represented in an appropriate asset structure as well as capital requirements. In particular, we will argue that risks should not only be

measured with a single measure, but include multiple measures to capture different aspects of risk and that this differentiation of risks should be mirrored in the characteristics of assets the capital is invested in.

3. Characterization of losses

An obvious way to classify losses incurred by a company is to focus on the implications these losses have on the future performance of the company, i.e. the ability to generate earnings and the cash flow. Any losses in the current period may not have any impact on future earnings, but on the other hand they may force the company into bankruptcy if accumulated over time. We will identify three categories of losses: expected losses, unexpected losses, and stress losses as in Shepheard-Walwyn and Litterman (1998).

3.1. Expected losses

Smaller losses are part of any business and happen on a more or less regular basis, e.g. losses arising from the breakdown of a machine or small creditors defaulting. Such losses, if properly catered for, do not have any further implications beyond a reduction of earnings in the current period. We define these losses as expected losses from the usual operations and propose that they are measured by

$$\mathrm{EL} = -E[\pi|\pi < \bar{\pi}] \tag{2}$$

where π denotes the current profits, $\bar{\pi} = \min\{0; E[\pi]\}$, and $E[\cdot]$ is the expectations operator. This definition allows for losses to be defined relative to a benchmark, the expected profits, and additionally ensures that all "real" losses which reduce the capital are taken into account. These losses should easily be covered by the capital of a company. As such losses are occurring as part of the normal operation of a business, we call the capital covering losses up to the expected losses the operational capital, OC.

3.2. Unexpected losses

Inevitably a company will sometimes face losses that exceed their operational capital and hence the expected losses. We call these losses unexpected. Although such losses are still the consequence of normal business operations, they can be substantially larger than expected losses, although much less frequently observed. Examples include new products that fail to attract sufficient demand or research and development activities yielding no marketable result. They can therefore have a long-term effect on the performance of the company as it only recovers slowly from these losses, e.g. due to the observation that losses had to be covered by important assets that had to be sold. However, the losses are not that large that they threaten the survival of the company, it can comfortably bear these losses.

The risk of facing unexpected losses has to be covered by another form of capital, which we call risk capital, RC. The size of the risk capital depends firstly on the risks faced by the company and secondly on the risk aversion of the company shareholders or its managers. The more risk averse a company is, the more capital it will hold in order to cover the losses and avoid bankruptcy. Obviously the higher the risk, i.e. the possible losses and their probability, the more risk capital a company should hold.

Despite its theoretical shortcomings, value at risk (VaR) is a widespread risk measure for losses. Building on the VaR the following risk measure, called expected

shortfall, is found to be superior for theoretical reasons as it is more consistent with the preferences of individuals:

$$\mathrm{ES}_c = -E[\pi|\pi - \mathrm{VaR}_c] \tag{3}$$

The expected shortfall gives the average loss if the VaR is exceeded or the average loss in the 100c per cent worst cases. It is common in the recent theoretical literature to base the capital requirements and capital allocation on the expected shortfall rather than the VaR. As expected shortfall provides a risk measure for the entire loss, the risk capital is only the difference to the operational capital:

$$\mathrm{RC} = \mathrm{ES}_c - \mathrm{EL} \tag{4}$$

The risk and operational capital, as defined above, are together called the economic capital, EC, of the company:

$$\mathrm{EC} = \mathrm{RC} + \mathrm{OC} = \mathrm{ES}_c \tag{5}$$

Although holding capital equal to the economic capital is optimal given the risk preferences, we will see below that it may be beneficial to hold capital in excess of this amount.

3.3. Stress losses

A company holding only the economic capital would go bankrupt if a larger loss occurs. Such extreme losses we call stress losses as they mostly are the result of unusual events (stress). If we were able to cover stress losses, we can propose that they will have a severe impact on the future performance of the company, even threatening its long-term survival.

Shimpi (2001) suggests that companies should hold capital to cover such losses. His argument is that outside investors and creditors can only approximately assess the risks of a company and therefore require additional capital as a safeguard against a wrong assessment of the risks the company faces. In the same way regulators may require additional capital to reduce the social costs of a bankruptcy, i.e. systemic risk. This capital we call signaling capital, SC.

The size of the signaling capital could be determined as follows. If the economic capital is fully used, i.e. losses exceed the economic capital, we want to ensure that the company does only go bankrupt with a probability of $c^* < c$. Thus, we have to ensure that the loss of the company does not exceed a certain threshold ML_{c*} with this probability. Using the Chebyshev-theorem, we get

$$\begin{aligned} c^* &= \mathrm{Prob}(\pi + \mathrm{ES}_c < -\mathrm{ML}_{c*}|\pi - \mathrm{VaR}_c) \\ &\leq \mathrm{Prob}(|\pi + \mathrm{ES}_c| > \mathrm{ML}_{c*}|\pi - \mathrm{VaR}_c) \\ &\leq \frac{\mathrm{Var}[\pi|\pi - \mathrm{VaR}_c}{\mathrm{ML}_{c*}^2} \end{aligned} \tag{6}$$

where ML_{c*} denotes the maximal loss permissible and Var[ ] the conditional variance of the distribution of profits given that the VaR is exceeded. Solving expression (6) gives

$$\mathrm{ML}_{c*} \leq \bar{\mathrm{ML}}_{c*} = \sqrt{\frac{\mathrm{Var}[\pi|\pi - \mathrm{VaR}_c]}{c*}} \tag{7}$$

We now propose to set

$$SC = \overline{ML}_{c*} - ES_c \tag{8}$$

As for the determination of risk capital, c^* has to be determined from the risk aversion of the company or its stakeholders influencing their decisions.

It is worth to point out explicitly that even the existence of signaling capital does not prevent a company from going bankrupt, but reduces the probability of such an event. With the above considerations, the total capital requirement of a company, TC, is obviously given by

$$TC = OC + RC + SC = EC + SC = \overline{ML}_{c*} \tag{9}$$

We illustrate this result in Figure 1 with an arbitrary distribution of profits. We have thus established a multi-tier capital for a company based on the key properties of possible losses it has to cover, mainly their long-term implications. However, equally important as the amount of capital is its availability to cover the losses incurred, i.e. the asset structure. We will cover this aspect in detail in the coming section.

4. Optimal asset structure

Based on our previous analysis, we will in this section investigate how to invest the capital required to cover the identified risks. For each category of capital, we will propose characteristics that assets should fulfill such that risks are adequately covered.

4.1. Peripheral assets

Most companies have assets that they do not really need to conduct their daily operations or future investments. Therefore the loss of such assets would not harm the future prospects of the company. We call these assets peripheral assets.

When comparing these considerations with the expected losses that gave rise to the operational capital, we see that losses which can be covered by peripheral assets do not

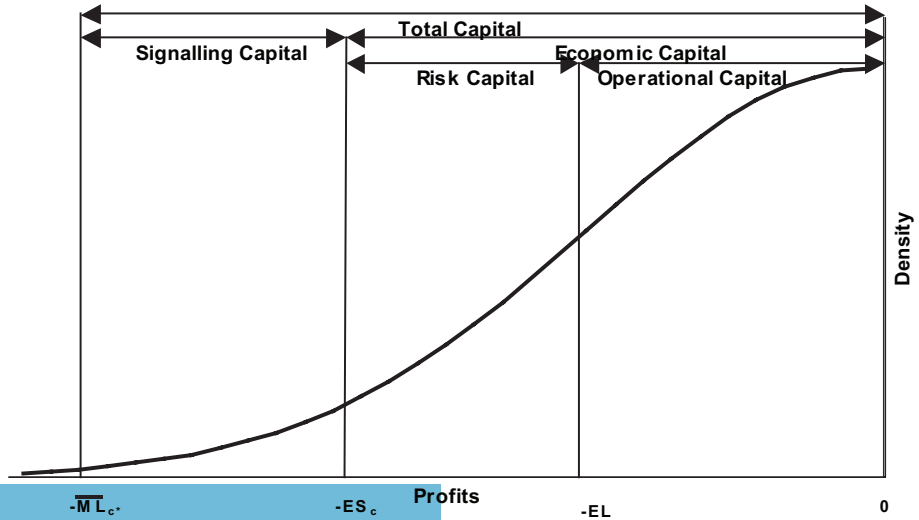

Figure 1.
Capital requirements of a company

have an impact beyond the loss of earnings in the current period. We can, therefore, conclude that the operational capital should be invested into peripheral assets. Thus, the existence of peripheral assets can be justified from a risk management perspective.

Of course, only realized losses that lead to a cash outflow or the loss of cash inflow are relevant in these considerations. But, it can be expected that losses are frequently realized and therefore do not distinguish between realized and unrealized losses. Hence to cover the losses the company has to sell these assets to meet the cash outflow or to use them in order to replace a missing cash inflow. As losses affecting the operational capital are frequent, it is important that the assets are sufficiently liquid such that they can be sold within a set time frame.

Examples for suitable peripheral assets would be excess liquidity in form of cash or cash equivalent assets, marketable securities, commodities, transferable debentures (factoring), but also negotiated and unused loan facilities with banks. Hence we interpret assets here in the widest sense by including any rights that have been granted to the company.

4.2. Non-core assets

The majority of assets a company holds will be essential, meaning that their loss would have a more or less long term effect on the future of the company. Upon loss of such assets the company may not be able to finance future investments, it might affect the future earnings capability or profitable income sources are being associated with these assets. Many of those assets are not of strategic importance for its survival, although greatly contributing to the earnings of a company and thus essential for its overall performance. We therefore call these assets non-core assets.

Comparing these reflections with the unexpected losses covered by risk capital, it becomes apparent that this category of capital should be invested into non-core assets. Such non-core asset may include overseas investments reducing the costs of production or serving a minor market, alliances with competitors, suppliers or customers, distribution networks or investment activities for diversification purposes. All such assets could be sold without threatening the survival of the company, although causing further losses.

These assets should be reasonable marketable within a given time horizon. The same liquidity as for peripheral assets is, however, not required as unexpected losses are much less common. It should be noted that for the purpose of risk management all assets should be valued at their liquidation value rather than their market value as they have to be liquidated to cover any losses.

4.3. Core assets

Finally, the signaling capital is to be invested into core assets as are the funds a company obtains from creditors. The selling of core assets, would threaten the survival of the company, i.e. they are assets that are so important for the company that it would be severely damaged from their loss. Core assets may include key production facilities, key alliances with distributors or funds for the modernization of the production process. Their loss would severely damage the survival chances of the company by exposing them much more to competition and undermining any competitive advantage. In this sense, reputation and brand names can easily be interpreted as core assets in many industries.

The liquidity of core assets is usually very low and especially their liquidation value may be substantially below the market value. Often companies loosing their core

assets have to undergo a complete restructuring in order to survive or merge with other companies.

Now that we have established into which types of assets the capital should be invested, we can consider the sources of the different categories of capital in the coming section in much more detail.

5. The sources of capital

In section 3, we identified the amount of capital to be held and which losses it should cover while the last section explored into which assets it is to be invested. We here suggest a three tier capital for each category, which is very similar to the capital definition in the Basel Accord[2].

The Tier I Capital covers the operational capital. Given the fact that it covers expected losses which are the result of the usual business activities, these losses should entirely be born by the company owners. Hence Tier I Capital should consist of paid-in shares and disclosed reserves, mostly originating from retained earnings.

Unexpected losses reduce the risk capital, which provides the Tier II Capital. The sources of this capital would be undisclosed reserves, unpaid capital, and hybrid instruments like convertible bonds.

Tier III Capital covers stress losses, i.e. is the signaling capital. The sources of this capital can be guarantees from owners or parent companies, subordinated debt or loans from affiliated persons as well as insurance-linked contingent capital. These debts are in many cases easily converted into equity when the company faces bankruptcy.

We summarize our results in Table I, which shows a balance sheet of a company showing an optimal asset and capital structure as developed in this paper. It has to be noted that this table seems to make obvious that our approach invalidates the well established view that fixed and thus illiquid assets should be financed by long-term funds, equity or long-term debt; on the other hand current and liquid asset should be financed by short-term debt. In our considerations this relationship looks as being reversed. It has, however, to be noticed that we put our considerations exclusively on risk management of losses of ongoing operations without including funding risks of the company. A more complete model would obviously take this additional problem into account, but this strand of investigation is well beyond the scope of this contribution.

6. Opportunity costs of investment

As we have seen before, the capital has to be invested into assets with certain characteristics. It is therefore reasonable that these investments are not necessarily optimal for a company, but rather driven by risk considerations, hence companies face opportunity costs of such investments.

Assets		Liabilities	
Peripheral assets	Highly liquid	Equity (+disclosed reserves)	Operational capital
Non-core assets	Modestly liquid	Undisclosed reserves, convertibles	Risk captial
Core assets	Usually illiquid	Subordinated debt, (guarantees) Debt	Signaling capital

Table I. Balance sheet of a company with an optimal asset and capital structure

The operational capital is to be invested into peripheral assets, i.e. assets that are not really needed for the pursuit of business. Investing into essential assets that contribute to the value creation by exploiting competitive advantages would in many cases be much more beneficial for the company. Thus, these investments have opportunity costs as the capital could have been used more efficiently.

A similar argument can be upheld for the investment into non-core assets as investments into core assets are usually even more beneficial, thus again also the risk capital faces opportunity costs, although to a less extend than the operational capital. As a result of these considerations, the signaling capital does not face any opportunity costs as it is already invested into core assets. However, opportunity costs may arise when financing these assets with debt would have been cheaper.

From this information, we would be able to deduct the total amount of opportunity costs a company faces. On the other hand, the company faces costs from the occurrence of losses, besides the loss in that time period. These losses include the loss of future earnings when essential assets have to be liquidated and we call them distress costs. Additionally, there are the costs of the company going bankrupt. The larger the different capital categories are the less likely these costs have to be born, thus expected costs are lower.

We could now determine the total costs of the capital structure by considering both, opportunity and distress costs. The optimal capital structure would be the one that causes the minimal total costs to the company. This procedure had the same effect as choosing appropriate probabilities c and c^* when we interpret the losses as losses in utility rather than monetary terms. Thus, when quantifying these losses we are able to derive the optimal capital requirement as well as the optimal asset structure. Conducting such an optimization is left for future research.

7. Conclusions

We provided a simple framework to analyze the amount of capital a company should hold in order to cover risks adequately. In contrast to most contributions, we did not only provide total capital requirements, but also guidelines of how to invest the capital and where the sources of the required capital could be. This was achieved by viewing capital and losses as a unity rather than distinct aspects.

The scope of future research arising from this paper is manifold. Besides a detailed evaluation of the relationship to expected utility maximization, implications for the cost of capital can be derived; regulatory aspects need exploration as well as a more detailed analysis of the asset structure of companies. Furthermore, careful consideration has to be given to the choice of risk measures. This paper only provides a few initial ideas that have to be explored in much more detail in future research. Despite these limitations of the paper it is useful for companies as it provides a first insight into the aspects to consider when determining their capital and asset structure.

Notes

1. When using VaR as risk measure this property is not necessarily fulfilled, as VaR is not sub-additive. For most realistic risk exposures this property is, however, at least approximately fulfilled.
2. Although the Basel Accord has been developed for the banking sector and we use its terminology here, its applicability is not restricted to the banking sector. The non-bank-sector could apply similar types of capital to cover the losses they face.

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