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Capital Structure Determinants
An Empirical Study of Swedish Companies [1]

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Abstract

This paper analysis the explanatory power of some of the theories that have been proposed in the literature to explain variations in capital structures across firms. In particular, this study investigates capital structure determinants of Swedish firms based on a panel data set from 1992 to 2000 comprising about 6000 companies. Swedish firms are on average very highly leveraged, and furthermore, short-term debt comprises a considerable part of Swedish firms' total debt. An analysis of determinants of leverage based on total debt ratios may mask significant differences in the determinants of long and short-term forms of debt. Therefore, this paper studies determinants of total debt ratios as well as determinants of short-term and long-term debt ratios. The results indicate that most of the determinants of capital structure suggested by capital structure theories appear to be relevant for Swedish firms. But we also find significant differences in the determinants of long and short-term forms of debt. Due to data limitations, it was not possible decompose short-term debt and long-term debt into its elements, but the results suggest that future analysis of capital choice decisions should be based on a more detailed level.

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1. Introduction

This paper analysis the explanatory power of some of the theories that have been proposed in the literature to explain variations in capital structures across firms. In particular, this study investigates capital structure determinants of Swedish firms based on a panel data set from 1992 to 2000 comprising about 6000 companies. It will below become obvious that Swedish firms are on average very highly leveraged. This, in combination with the fact that short-term debt comprises a very considerable part of firms' total debt, suggest that an analysis of determinants of capital structure shall not only be based on total debt ratios, but also based on a decomposition of total debt ratios into short-term and long-term debt ratios. Hence this study will utilize panel data regression analysis to empirically examine the impact of different determinants on three leverage measures: total debt ratio, short-term debt ratio, and long-term debt ratio.

1.1. Background

It is argued that the modern theory of capital structure began with the seminal paper of Modigliani and Miller (1958) (see e.g. Rajan and Zingales, 1995; Harris and Raviv, 1991). What then was the main message that MM delivered? In brief, the MM proposition states that the value of a firm is independent from its corporate financing decisions under certain conditions. In fact, MM pointed out the direction that capital structure theories must take by showing under what conditions capital structure is irrelevant (Harris and Raviv, 1991).

Titman (2001) lists some fundamental conditions that make the MM proposition hold:

1. no (distortionary) taxes,
2. no transaction costs,
3. no bankruptcy costs,
4. perfect contracting assumptions, and
5. complete and perfect market assumption.

Since the publication of MM's irrelevance proposition, hundreds of articles on the theory of capital structure have been carried out in order to find out under what conditions capital structure *does* matter. In other words, it is of great interest to investigate if capital structure choices become relevant once one or more of the key conditions are relaxed.

1.2. Purpose and methodology

The purpose of this study is to empirically examine the link between a number of potential capital structure determinants and debt level for Swedish companies.

Panel data regression analysis is used to investigate the determinants of Swedish firms' capital structure. The choice of determinants that may affect capital structure is primarily based on the capital structure theories presented in section 3 below. While time-dummies are included in the analysis below, dummies for different industry classifications are not included.

This paper is organized as follows. Section 2 presents a brief overview of some commonly used leverage measures. Average figures of leverage of Swedish firms based on the data set are presented in section 3. Section 4 reviews major capital structure determinants suggested by the theory of finance, and presents summary statistics for those determinants based on the data set. Section 5 summarizes the econometric approach adopted in this study, while section 6 discusses the interpretation and significance of the estimates. Finally, section 7 summarizes and concludes the main findings of this paper.

2. Measures of capital structure/financial leverage

Before we discuss different measures of capital structure, a very brief repetition of the term capital structure and its related terms (financial structure, financial leverage or gearing) is given here for convenience. The term capital structure refers to the mix of different types of securities (long-term debt, common stock, preferred stock) issued by a company to finance its assets. A company is said to be unlevered as long as it has no debt, while a firm with debt in its capital structure is said to be leveraged. Note that there exist two major leverage terms: operational leverage and financial leverage. While operational leverage is related to a company's fixed operating costs, financial leverage is related to fixed debt costs. Loosely speaking, operating leverage increases the business (or the operating) risk, while financial leverage increases the financial risk. Total leverage is then given by a firm's use of both fixed operating costs and debt costs, implying that a firm's total risk equals business risk plus financial risk.[2] In this study of capital structure and its determinants, with leverage, we mean financial leverage, or its synonym gearing.

[2] For a textbook treatment of leverage and risk, see e.g. Brealey and Myers (2003).

The firms' capital structure, or financial leverage, constitutes this study's dependent variable. Since hundreds of articles have been written about capital structure and its determinants since the 1958 paper by MM, one must be aware of the fact that different measures of capital structure exist, and that each capital structure measure itself can be measured in different ways. Roughly, two major categories of leverage measures exist: those that are based on market value of equity[3], and those that are based on booked value of equity (Lööf, 2003). For instance, Titman and Wessels (1988) discuss six measures of financial leverage in their study of capital structure choice: long-term, short-term, and convertible debt divided by market and book values of equity respectively. It is though rather common that due to data limitations, empirical studies must use only leverage measures in terms of book values rather than market values of equity, as is the case in the study by Titman and Wessels. Indeed, for this study, market data is not available, implying that I have to measure leverage in terms of booked values only.

Then, how serious is the problem of lacking market data in an empirical study of determinants of capital structure choice? Unfortunately, an exhaustive discussion of this matter is outside the scope of this paper. Though, some hints can be given based on the fact that when both booked and market values are available, they are both used simultaneously. The reason for this is that the information signaled in book value and market value is informative in different aspects (Lööf, 2003). In contrast to this, Titman and Wessels (1988) refers to an earlier study by Bowman (1980), which demonstrated that the cross-sectional correlation between the book value and market value of debt is very large. Furthermore, Brealey and Myers (2003) argue that it should not matter much if only book values are used, since the market value includes the value of intangible assets generated by for instance research and development, staff education, advertising, and so on. These kinds of assets cannot be sold with easiness, and in fact, if the company goes down, the value of intangible assets may disappear altogether. Hence, misspecification due to using book value measures may be fairly small, or even totally unessential.

Irrespective of market or book value, we still face the problem of choosing an appropriate leverage measure as the dependent variable. Indeed, in an important paper by Rajan and Zingales (1995), they argue that the choice of the most relevant measure depends on the objective of the

[3] The market value of equity is normally defined as the number of outstanding shares multiplied by the share price of the last trading day of an accounting year.

analysis. Though, they conclude "the effects of past financing decisions is probably best represented by the ratio of total debt over capital (defined as total debt plus equity)". Table 1 below lists the different measures of leverage and each measure's pros and cons, discussed in Rajan and Zingales (1995). (For a more exhaustive discussion, see the Rajan and Zingales paper.)

To complete the discussion of different leverage measures, we may consider the following statement by Harris and Raviv (1991, p. 331) when we compare different empirical studies:

> *The interpretation of the results must be tempered by an awareness of the difficulties involved in measuring both leverage and the explanatory variables of interest. In measuring leverage, one can include or exclude accounts payable, accounts receivable, cash, and other short-term debt. Some studies measure leverage as a ratio of book value of debt to book value of equity, others as book value of debt to market value of equity, still others as debt to market value of equity plus book value of debt. […] In addition to measurement problems, there are the usual problems with interpreting statistical results.*

With those words of caution in mind, we now continue with choosing leverage measures for this study. Indeed, for the objective of this study, following leverage measures will be analyzed in a litter bit more detail below; the ratio of

- total liabilities over total assets (1),
- total debt over total assets (2), and
- total debt over capital (4).

The third leverage measure in table 1 above cannot be readily observed, due to limitations in the data set. The data set used in this paper consists of three variables that make up total liabilities: total short-term debt, total long-term debt, and untaxed reserves. Hence, in this paper, total debt equals total liabilities less untaxed reserves.

Table 1. Different measures of leverage and corresponding pros and cons, according to Rajan and Zingales (1995).[4]

	Leverage measure		Pros and cons
1	Total liabilities / Total assets	+	The broadest definition of leverage; proxy for what is left for shareholders in case of liquidation.
		−	Not a good indication of whether the firm is at risk of default in the near future. May overstate leverage since total liabilities includes items like accounts payable, untaxed reserves etc.
2	Total debt / Total assets	+	Does not include liabilities like untaxed reserves or accounts payable (for transaction purposes); more appropriate measure of leverage than (1) above.
		−	Affected by level of trade credit[5] (i.e. unpaid bills; makes up bulk of accounts payable).
3	Total debt / Net assets	+	Not influenced by trade credit. (Net assets = total assets − accounts payable − other liabilities).
		−	Still affected by factors that have nothing to do with financing, e.g. assets held against pension liabilities.
4	Total debt / Capital	+	Probably the best representation of past financing decisions (capital = total debt + equity).
		−	
5	EBIT / Interest expense	+	Measure of the risk that equity holders will not be able to make fixed payments and will have to give up control. Appropriate measure if investments equal in magnitude to depreciation needed to keep the firm a going concern.
		−	Based in assumption that short-term liabilities like accounts payable and short-term debt will be rolled over. Very sensitive to income fluctuations.
6	EBITDA / Interest expense	+	Measure of the risk that equity holders will not be able to make fixed payments and will have to give up control. Appropriate if no such investments as in (5) are needed.
		−	Same as for (5).

Note: EBIT = Earnings Before Interest and Taxes. EBITDA = EBIT + Depreciation.

3. Financial leverage of Swedish firms

Table 2 below, reports the yearly mean and median figures for the three different leverage measures mentioned above. Notice that no matter choice of leverage measure, Swedish companies are very highly leveraged.

[4] In addition to the leverage measures depicted in table 1, there exist other leverage measures; for instance, the ratio of total debt to equity, the ratio of only long-term debt to total assets, and so on.

[5] The term trade credit may be confusing, since it here and in other papers (e.g. Bevan and Danbolt, 2000) is an item that belongs to short-term debt, and in particular to accounts payable. If trade credit is used for financing purposes rather than for transactions, trade credit should be included in measures of leverage (Rajan and Zingales, 1995). In Brealey and Myers (2003), trade credit is synonymous with accounts *receivable*, while trade *debt* is synonymous with accounts payable.

Table 2. Mean and median figures of different leverage measures for non-financial Swedish companies 1992 – 2000. Unbalanced panel data set

Year	Total liabilities / Total assets		Total debt / Total assets		Total debt / Capital	
	Mean (%)	Median (%)	Mean (%)	Median (%)	Mean (%)	Median (%)
1992	83	85	68	69	79	83
1993	81	84	67	69	77	81
1994	79	82	66	68	75	78
1995	78	81	65	68	74	78
1996	78	81	65	68	74	78
1997	78	80	65	68	74	78
1998	78	80	65	68	74	77
1999	87	79	75	66	73	76
2000	75	78	63	65	71	75
Average	*80*	*81*	*67*	*68*	*75*	*78*

Note: Total debt = short-term debt + long-term debt. Capital = total debt + book value of equity.

According to the first leverage measure (ratio of total liabilities over total assets), yearly mean leverage amount to 80%, and the corresponding median amounts to 81%. As noted in table 1, this leverage measure may overstate leverage. By excluding untaxed reserved from total liabilities, we obtain the second leverage measure (ratio of total debt over total assets)). As we could expect, this leverage measure shows lower leverage values; yearly mean and median amounts to 67% and 68% respectively. This implies that untaxed reserves accounts for a relatively large share of total liabilities (about 14%). Finally, for the third measure (total debt to capital), mean and median leverage figures amount to 75% and 78% respectively. While we can observe a weak tendency of declining median leverage values between 1992 and 2000, the decline in mean figures are disrupted by the sharp increase in mean leverage in the year 1999.

3.1. Decomposition of total debt into short-term and long-term debt ratios

Since Swedish firms are very highly leveraged, it is of interest to examine the sources of debt in more detail. As mentioned above, the data set used in this study only allows for a decomposition of total liabilities into three items: short-term debt, long-term debt, and untaxed reserves. It would though have been of great interest to have information about the magnitudes of the components that make up short-term and long-term debt respectively, for instance the size of companies' trade credit (that is a component in short-term debt). Indeed, based on a cross-sectional analysis of leverage in UK companies (1991 figures), Bevan and Danbolt (2000) find significant differences in the determinants of short-term and long-term forms of debt. In particular, given that short-term debts like trade credit and equivalent, on average accounts for more than 62% of total debt of the

UK companies, the results are particularly sensitive to whether such debt is included in the leverage measures. Hence in line with their findings, Bevan and Danbolt argue that analysis of corporate structure is incomplete without a detailed examination of corporate debt.

In another study of capital structure of small and medium sized enterprises (SMEs), Michaelas et. al. (1999) find that most of the determinants of capital structure (e.g. size, profitability, growth, and more) seem to be relevant for both short-term and long-term debt ratios. They also find that time an industry specific effects (i.e. the include time and industry dummies) influence the maturity structure of debt raised by SMEs. By analyzing the coefficients of the time-dummies over the years studies (1988 to 1995) in relation to changes in real GDP, Michaelas et. al. find that short-term debt ratios in SMEs appear to be negatively correlated with changes in economic growth, while long-term debt ratios exhibit a positive relationship with changes in economic growth.

In attempt to analyze determinants of corporate debt with respect to both short-term and long-term debt ratios, I create two such leverage measures. The resulting leverage figures are presented in table 3 below. Interestingly, we can see that the short-term debt ratio is on average twice as large as the long-term debt ratio. Notice also the relatively sharp fall in median values for long-term leverage: from 28% to 21% between 1992 and 2000.[6] On the other hand, the other figures for the short-term and long-term debt ratios do not show any clear downward trend.

Table 3. Short-term vs. long-term debt. For convenience, the figures for total debt to capital are shown here too.

Year	Short -term debt / Capital		Long-term debt / Capital		Total debt / Capital	
	Mean (%)	Median (%)	Mean (%)	Median (%)	Mean (%)	Median (%)
1992	49	45	30	28	78	83
1993	48	45	29	27	77	81
1994	50	47	25	22	75	79
1995	50	47	24	21	74	78
1996	50	47	24	19	74	78
1997	49	45	25	21	74	78
1998	50	47	24	20	74	77
1999	49	46	24	20	73	76
2000	47	44	24	19	71	75
Average	*49*	*46*	*25*	*21*	*74*	*78*

Note: Capital = total debt + book value of equity. Usually summation of median figures does not "work well".

[6] This may indicate that companies are acting rational to the tax-reform in the beginning of the 1990s.

Inspired by the result of this decomposition of total debt, in combination with the contradictory findings of the cross-sectional analysis by Bevan and Danbolt (2000) and the panel data analysis Michaelas et. al. (1999), I will include the two new measures of leverage in the econometric analysis below.

Without having data on size of trade credit at hand, we may just speculate whether trade credit makes up a large portion of short-term debt, and why it may be so. Now, suppose that trade credit and equivalent components constitutes a large share of short-term debt. Following the arguments in Bevan and Danbolt (2000), we may then suggest that this kind of reliance on trade credit reflects a rational corporate debt policy, given that other form of borrowing result in higher costs.

Now that we know that short-term debt constitutes a large portion of total debt, it may be interesting to see if short-term and long-term debt rations vary across firm sizes. Again as usual in corporate finance, there exist several different definitions of specific factor: number of persons employed, size of total assets, size of turnover, and more. Furthermore, size can be measured as a continuous variable or as a categorical variable. In order to present a rough picture of leverage figures across different firms sizes, I choose to categorize company sizes according to following scheme: firms with less than 10 employees are defined as small firms; medium sized firms are companies with 10-100 employees; and finally large a firms are characterized as having more than 100 employees.[7] The resulting figures are presented in table 4 below. What is most strikingly is the development of short-term debt for small firms. There is a clear downward trend in medium values from 1993 to 2000: 52 to 20 percent. The same kind of trend can be found for the mean figures, ignoring the very high mean value for year 1999. On the other hand, debt ratios appear to stay very stable for both medium and larger size firms.

[7] In fact, size measures are defined in rather arbitrary manner. For instance, Van der Wijst (1989) defines small and medium firms as having 1 to 9 and 10 to 99 people employed respectively. But Michaelas et. al. (1999) consider firms with less than 200 employees as small. See Mira (2001) for further references on different firm size classifications.

Table 4. Short-term debt ratios and company sizes.

Year	Short -term debt / Capital (Very small firms)		Short -term debt / Capital (Medium size firms)		Short -term debt / Capital (Large firms)	
	Mean (%)	Median (%)	Mean (%)	Median (%)	Mean (%)	Median (%)
1992	38	32	48	43	50	48
1993	53	52	48	44	50	47
1994	53	45	49	46	50	48
1995	39	42	50	46	50	48
1996	45	41	51	48	49	47
1997	38	31	49	45	50	48
1998	35	28	50	47	50	47
1999	38	26	49	46	51	49
2000	32	20	47	44	52	50
Average	*40*	*31*	*49*	*46*	*50*	*48*

Note: Small firm: less 0 − 9 employees. Medium firms: 10 − 99 employees. Large firms: 100 and more employees.

Contrary to the findings above, table 5 below reveals that long-term debt ratios have declined across all firm sizes from 1992 to 2000, both in terms of means and medians. Though, the development of long-term debt ratios for small firms are again different compared to medium- and large size firms. For instance, while medium- and large size companies exhibit a stable negative trend of the size of long-term debt ratios, the negative trend is rather volatile for small firms. Moreover, notice that the mean and medium figures from 1995 to 2000 differ heavily for small firms. We also see that the average yearly standard deviation of long-term debt for small companies is about twice as large as compared with the two other firm size categories (see figures within parenthesis in table 5 below). Indeed, the standard deviations for medium and large firms respectively are surprisingly stable over the years.

Table 5. Long-term debt ratios and company sizes. Mean, standard deviation (std) and median statistics.

Year	Long -term debt / Capital (Small firms)		Long -term debt / Capital (Medium firms)		Long -term debt / Capital (Large firms)	
	Mean (Std) (%)	Median (%)	Mean (Std) (%)	Median (%)	Mean (Std) (%)	Median (%)
1992	35 (34)	31	31 (25)	30	27 (20)	25
1993	29 (30)	26	30 (25)	28	26 (20)	24
1994	27 (28)	19	26 (23)	24	23 (20)	21
1995	26 (30)	15	25 (23)	23	23 (20)	20
1996	20 (25)	9	24 (23)	20	23 (20)	18
1997	25 (28)	15	26 (23)	23	23 (21)	19
1998	17 (24)	0	24 (23)	20	23 (21)	19
1999	24 (32)	2	24 (23)	20	22 (21)	18
2000	29 (93)	9	24 (22)	21	21 (21)	16
Average	*25 (53)*	*10*	*25 (23)*	*22*	*23 (21)*	*20*

Note: Small firm: less 0 − 9 employees. Medium firms: 10 − 99 employees. Large to very large firms: 100 and more employees.

In this study though, we will mainly investigate if there exist differences in the short-term and long-term debt ratios, rather than analyzing differences between size categories. It is more a task for future research to analyze the important question of potential differences in capital structure determinants between small, medium and large companies.

To conclude this section, we now state the three (book-value) leverage measures that will be used in the econometric analysis below: the ratio of total debt over capital, short-term debt to capital, and long-term debt to capital.

4. Potential determinants of capital structure

In this section, we briefly present factors that different capital structure theories suggest may affect a company's financing decision. As was the case with leverage measures, there also exist problems of finding, defining and measuring the determinants of capital structure. As Harris and Raviv's (1991) demonstrate in their review article, the motives and circumstances that could determine capital structure choices seem nearly uncountable. In this paper though, we will restrict ourselves to the most commonly used explanatory variables. Furthermore, we will not present any summary of different theories of capital structure (e.g. the irrelevance theory, static trade-off theory, signaling- and agency cost models, pecking-order theory, and more).[8] Instead, the relation between a determinant and a specific capital structure theory will in some cases become clear below.

Then, what are the determinants of capital structure? According to Harris and Raviv (1991), the consensus is that "leverage increase with fixed assets, non-debt tax shields, investment opportunities, and firm size, and decreases with volatility, advertising expenditure, the probability of bankruptcy, profitability, and uniqueness of the product." Titman and Wessels (1988) state that asset structure, non-debt tax shields, growth, uniqueness, industry classification, size, earnings volatility, and profitability are factors that may affect leverage according to different theories of capital structure. Still, other authors may provide another set of potential determinants of capital structure. This clearly shows that even if there is a consensus among researchers what factor may constitute a minimum set of attributes, there is still plenty of room for arguing in favor of

[8] For an exhaustive review of capital structure theories and further references, see Harris and Raviv (1991). In the second half of the 1990s, theories based on the impact of legal environment on capital structure have been proposed), see e.g. La Porta et. al (1997).

including other determinants as well. Furthermore, we will below see that there also may exist disagreements of how a determinant may affect leverage (i.e. whether a it is negatively or positively correlated with leverage).

In this study, following determinants will be used:

- tangibility (asset structure),
- non-debt tax shield,
- profitability,
- size,
- expected growth,
- uniqueness,
- income variability,
- time dummies,
- (industry classification dummies, not applied in this study).

A short discussion of each of the determinants used in this paper, their relationship to capital structure theories, and how they can be measured will be presented below.

Tangibility (asset structure)

Ultimately, this relationship is suggested to be based on the conflict between lenders and shareholders according to agency cost theory models (see e.g. Jensen and Mekling[9], 1976; Williamson, 1988; Harris and Raviv, 1991). Very briefly, this theory states that conflicts between lenders and shareholders create incentives for shareholders to invest in a suboptimal way. Therefore, lenders take actions to protect themselves, here by requiring tangible assets as collateral.

In order to estimate the econometric models below, we use the ratio of fixed assets over total assets as a measure of tangible assets.

Non-debt tax shield

According to Modigliani and Miller (1958), interest tax shields create strong incentives for firms to increase leverage. But also the size of non-debt related corporate tax shields like tax deductions for depreciation and investment tax credits may affect leverage. Indeed, DeAngelo and Masulis (1980) argue that such non-debt tax shields are substitutes for the tax benefits of debt financing. Therefore, the tax advantage of leverage decreases when other tax deductions like

[9] In fact, Jensen and Meckling (1976) identify two types of conflicts: first, conflicts between shareholders and managers, secondly, conflicts between lenders and shareholders according to the discussion above.

depreciation increase (Wanzenried, 2002). Hence, we expect that an increase in non-debt tax shields will affect leverage negatively.

Titman and Wessels (1988) use the ratio of tax credits over total assets and the ratio of depreciation over total assets as measures of non-debt tax shield. In this study, we have only data on depreciation and therefore, the ratio of depreciation over total assets will serve as a measure for non-debt tax shield.

Profitability

The pecking order theory, based on works by Myers and Majluf (1984) suggests that firms have a pecking-order in the choice of financing their activities. Roughly, this theory states that firms prefer internal funds rather than external funds. If external finance is required, the first choice is to issue debt, then possibly with hybrid securities such as convertible bonds, then eventually equity as a last resort (Brealey and Myers, 1991). This behavior may be due to the costs of issuing new equity, as a result of asymmetric information or transaction costs. There are conflicting theoretical predictions on the effects of profitability on leverage (Rajan and Zingales, 1995); while Myers and Majluf (1984) predict a negative relationship according to the pecking-order theory, Jensen (1986) predicts a positive relationship if the market for corporate control is effective. However, if it is ineffective, Jensen (1986) predicts a negative relationship between profitability and leverage. In this paper, we expect that there is a negative correlation between profitability and leverage, i.e. high profit firms should have a lower leverage.

Here, we use the ratio of earnings before interest and taxes (EBIT) to total assets as a measure profitability.

Size

The relationship between firm size and leverage is also unclear. If the relationship is a proxy for probability of bankruptcy, then size may be an inverse proxy for the probability of bankruptcy, since larger firms are more likely to be more diversified and fail less often. Accordingly, larger firms may issue debt at lower costs than smaller firms. In this case therefore, we can expect size to be positively related to leverage. However, Fama and Jensen (1983) argue that there may be less asymmetric information about large firms, since these firms tend to provide more information to outside investors than smaller firms. This should therefore increase their preference for equity relative to debt (Rajan and Zingales, 1995). In this study, our expectation on the effect of size on leverage is ambiguous.

There exist many different measures for size, for instance (the log of) sales, number of people employed or size of total assets. Here, we use the log of sales and log of number pf people employed as a measure for size.

Expected growth

There exist quite a large uncertainty as regards the growth factor, both regarding its effect on leverage and how it shall be measured. First, we may expect a positive relationship between growth and leverage since higher growth opportunities implies a higher demand for funds, and, *ceteris paribus*, a greater preference on external financing through the preferred source of debt according to the pecking-order theory (Rao and Lukose, 200?). On the other hand, Myers (1977) argues that due to agency problems, firms investing in assets that may generate high growth opportunities in the future face difficulties in borrowing against such assets. For this reason, we may now instead expect a negative relationship between growth and leverage. However, as Michaelas et. al. (1999) and Titman and Wessels (1988) notice, Myers (1977) also points out that this agency problem is mitigated if the firms issues short-term rather than long-term debt. Therefore, we may expect that short-term debt to be positively related to growth if growing firms substitute short-term financing for long-term financing.

A commonly thought proxy for the growth determinant is the so-called market-to-book ratio; the ratio of the market value of assets over the book value of assets (see e.g. Rajan and Zingales, 1995). According to Myers (1977), high market-to-book ratios are an indicator of investment opportunities and ultimately of expected growth, since an increase in the market-to-book ratio may arise from higher expected cash flows.

Other measures of growth include the ratio of capital expenditures over total assets, research and development over sales, and the percentage change in total assets from the previous to current year (Titman and Wessels, 1988). Due to the structure of the data set available for this study, growth will be measured using the last indicator (percentage change in total assets).

Uniqueness

Lööf (2003) summarizes the idea due to Titman (1984), that the more unique a firm's asset is, the thinner the market for such assets. Accordingly the lower is the expected value recoverable by a lender in the event of bankruptcy. Hence, we may expect that uniqueness be negatively related to leverage. Following Titman and Wessels (1988), uniqueness is measured as the ratio of expenditures on research and development over sales.

Income variability

Income variability is a measure of business risk. Since higher variability in earnings indicates that the probability of bankruptcy increases, we can expect that firms with higher income variability have lower leverage. We will use the ratio of the standard deviation of EBIT over total assets as a measure of income variability.

Time dummies

In addition to the determinants above, a full set of time-dummies (one for each year, except for the first year 1992, which serves as the base year upon which the estimated dummy coefficients should be interpreted) will also be included in some regression models. By including time-dummies, we may be able to investigate whether leverage shifts over time, after controlling for the other observable determinants; i.e. the unobserved time-specific effects will be represented by the set of time dummies (Lööf, 2003).

Furthermore, Bevan and Danbolt (2000) extend the use of time-dummies in panel data regression by interacting time dummies with the constant term and all the explanatory variables. They argue that two factors can be analyzed simultaneously; "interactive intercept dummies enable us to examine the general of time-variant but firm-variant factors; interactive independent variables dummies allow us to identify how time-variant general factors influence the relation between our determining factors and gearing (leverage)". For this study though, we will restrict the use of time-dummies to be stand-alone factors, and not used in interaction terms.[10]

Table 6. Potential determinants of capital structure, corresponding measures, and expected effect on leverage.

Determinant	Measure (proxy)	Expected effect on leverage
Tangibility	Fixed assets / Total assets	Positive
Non-debt tax shield	Depreciation / Total assets	Negative
Profitability	EBIT / Total assets	Negative (ambiguous)
Size sales	Log(sales)	Ambiguous
Size employment	Log(employment)	Ambiguous
Growth	Percentage change in total assets	Ambiguous
Uniqueness	Research and development / sales	Negative
Income variability	Standard deviation of EBIT / Total assets	Negative

Note: EBIT is an abbreviation for Earnings Before Interest and Taxes.

[10] But for a future research of the dynamics of Swedish capital structure, an approach with time interactions with both the intercept and each of the independent variables may be fruitful.

Table 7. Summary statistics of the determinants

Determinant	Mean	Standard Deviation	Minimum	Maximum
Tangibility	0.288	0.220	0	1
Non-debt tax shield	0.055	0.048	0	1
Profitability	0.080	0.28	−10	14.324
Size sales (MSEK)	41	280	0	99 956
Size employment	158	737	0	41 398
Growth (%)	1.07	44.5	−1	4927
Uniqueness	0.009	0.338	0	64.698
Income variability (%)	0.279	5.576	0	729.667
Total debt ratio	0.739	0.223	0	6.733
Short-term debt ratio	0.490	0.236	0	6.733
Long-term debt ratio	0.250	0.240	0	3.81

Note: EBIT is an abbreviation for Earnings Before Interest and Taxes. A few observations (7) have a profitability less than minus 20.
Size variables not logged.
Debt ratios may be larger than 1 (i.e. >100%) if a firm has negative equity. For debt ratios, denominator is capital (= total debt plus equity).

5. Econometric method

In this study, we apply panel data regression analysis. Lately, it has become more and more popular to estimate panel data regression models in economic research, and so also in empirical corporate finance. One reason for this is an increased availability of panel data, but also an increased awareness of the advantages of panel data over cross-section or time-series data (Baltagi, 2002, lists several advantages of using panel data.)[11] In this paper, we estimate the following fixed-effect panel data model:

$$debt_{it} = X_{it}\beta + \gamma_t + u_{it}$$

where i denotes the cross-sections and t denotes time-period with $i = 1, 2,\ldots,N$ (number of firms, here N is about 6000), and $t = 1, 2,\ldots,T$ (number of time periods, here, $T = 9$ since we have yearly observations from 1992 to 2000). We include a measure of heterogeneity with respect to time since there may be a common time trend of an unknown form. Here, γ_t stands for the time specific effects. The vector X_{it} represents the explanatory variables as outlined in section two above. Finally, u_{it} is the "normal" error term.

[11] A panel data set, (also called pooled data set, or longitudinal data set) is a combination of cross-section and time series data, such that the same cross-sectional unit (for instance a firm or a household) is surveyed over time.

6. Empirical results

Here, we present the results of the fixed effect estimations. An important part of the analysis below is to consider short-term and long-term debts separately, and thus each of the tables below will show the regression results for all total debt, short-term debt, and long-term debt ratios. Indeed, as Bevan and Danbold (2000) notice, Huchinson et. al. (1999), Barclay and Smith (1999), Chittenden et. al. (1996), and Van der Wijst and Thurik (1993), they all argue that analysis of the determinants of leverage based on total debt may mask important differences between long-term and short-term forms of debt.[12]

6.1 Fixed effect estimation results

Tangibility (asset structure)

As can be seen, the coefficients of tangibility are highly statistically significant for all three debt measures. But while the results show that tangibility has a positive relationship with total debt ratio and long-term debt ratio - as expected according to the theoretical discussion above, tangibility is negatively related to the short-term debt ratio. This finding is consistent with the results of Bevan and Danbolt (2000), Huchinson et. al. (1999), Chittenden et. al. (1996) and Van der Wijst and Thurik (1993) report (see also Michaleas et.al., 1999). Indeed, this result supports the maturity matching principle: long-term debt forms are used to finance fixed (tangible) assets, while non-fixed assets are financed by short-term debt (Bevan and Danbolt, 2000).

Non-debt tax shield

According to the result, non-debt tax shield has no correlation with total debt ratio. Though, it becomes strongly significant when total debt is decomposed into short-term and long-term debts. But again, there is a significant difference between short-term and long-term debt ratios; while non-debt tax shield has a positive effect on short-term debt ratio, it is negatively correlated with long-term debt ratio. Since we expect that an increase in non-debt tax shields will affect leverage negatively, we may argue that this result indicates that non-debt tax shields are substitutes for the tax benefits of long-term debt financing to depreciation; when firms are engaged in tax shelter schemes, the mainly consider long-term debt. On the other hand, short-term debt may be used to more or less indirectly finance investments in long-lasting assets.

[12] As mentioned above, we cannot in this study disaggregate debt any further. But for future research, it is valuable if for instance, factors that make up short-term debt (e.g. trade credit and short-term bank borrowing), can be measured. In this case, we will be able to make analysis similar to the decompositional analysis of Bevan and Danbolt (2000).

Profitability
Profitability is negatively correlated with all three leverage measures, which is in line with the pecking-order theory; firms prefer using surplus generated by profits to finance investments. This result may also indicate that firms in general always prefer internal funds rather than external funds, irrespective of the characteristic of an asset that shall be financed (e.g. tangible or non-tangible asset).

Size
The results reveal that size is a significant determinant of leverage. But while size is positively related to both total debt and short-term debt ratio, it is negatively correlated with long-term debt ratio, although, the economic significance is rather small for the latter case.

Even if the data does not allow us to further decompose short-term debt, we may still find the results of Bevon and Danbolt (2000) interesting. They find that while size is positively correlated with both trade credit and equivalent and short-term securitized debt, it is negatively correlated with short-term bank borrowing. This may indicate that small firms are supply constrained, in that they do not have sufficient credit ranking to allow them to long-term borrowing.[13]

Expected growth
According to the theoretical discussion above, we either expect a positive relationship between expected growth and leverage, due to higher demand for funds, or, a negative relationship due to higher costs of financial distress. Though, the results obtained here show that there exists no relationship between expected growth and leverage that is of economic significance. One possibly explanation may be that the effects of the two different theories neutralize each other. Another reason may be that our measure used here, the percentage change in total assets, does not reflect future growth possibilities wee enough, only past growth. Thus, other more significant results might be obtained by using another measure for expected growth, for instance market-to-book ratio, a commonly used proxy for expected growth.

Uniqueness
We have again another more or less non-significant result: either statistically, economically or both. Also Lööf (2003), using Swedish data and same measure for uniqueness as in this study (ratio of research and development over sales), finds that uniqueness is not a significant factor that may affect leverage.

[13] For this conclusion, Bevan and Danbolt (2000) refer to Bank of England (1988).

Income variability

Table 8 reveals that the effect of income variability on debt is approximately zero, but still statistically significant. According to Lööf (2003), who also obtained similar results, this may be due to the fact that the time period studied (1991 to 1998; this study 1992 to 2000), coincided with a period of strong economic recovery and a generally positive trend in revenues.

Time dummies

Following Michaelas et. al. (1999), we present the regression coefficients of the time dummies, which represent unobserved time-specific effects. Table 8 reveals that almost all of the time dummies are significant (the base year is 1992). While this is in line with the declining total and long-term debt ratios observed in table 3 above, it is not clear why the time dummy coefficients are mostly negative even for the short-term debt, which has not decreased during the period (1992 – 2000). Anyway, the decrease in total and long-term debt ratio may reflect a slow adjustment to the new tax environment triggered by the radical tax reform in the beginning of 1990, which is revealed by the (mostly) negative coefficients.[14]

[14] On the other hand, Michaelas et. al. (1999) find coefficients estimates to be positive for almost all years.

Table 8. Estimation results of fixed effects panel data regression.

Explanatory variables	Total debt ratio	Short-term debt ratio	Long-term debt ratio
Tangibility	0.150 (17.26) [0.00]	− 0.179 (− 18.59) [0.00]	0.319 (35.97) [0.00]
Non-debt tax shield	− 0.001 (− 0.06) [0.955]	0 .199 (7.52) [0.00]	− 0.228 (− 9.34) [0.00]
Profitability	− 0.057 (− 17.54) [0.00]	− 0.033 (− 9.25) [0.00]	− 0.050 (− 15.20) [0.00]
Size sales	0.038 (24.06) [0.00]	0.045 (25.64) [0.00]	− 0.006 (− 3.78) [0.00]
Growth	0.000 (− 2.42) [0.02]	− 0.000 (− 2.74) [0.01]	0.000 (0.61) [0.54]
Uniqueness	− 0.001 (− 0.48)[0.632]	− 0.004 (− 1.94) [0.05]	0.003 (1.61) [0.11]
Income variability	0.001 (2.39) [0.017]	0.002 (4.76) [000]	− 0.001 (− 2.91) [0.01]
D1993	0.025 (7.58) [0.00]	− 0.004 (0.11) [0.91]	0.024 (7.15) [0.00]
D1994	(Dropped)	(Dropped)	(Dropped)
D1995	− 0.016 (− 5.13) [0.00]	− 0.006 (− 1.72) [0.09]	− 0.010 (− 3.16) [0.00]
D1996	0.038 (− 12.33) [0.00]	− 0.028 (− 8.14) [0.00]	− 0.011 (− 3.48) [0.00]
D1997	0.044 (− 14.97) [0.00]	− 0.042 (− 12.90) [0.00]	− 0.003 (− 0.91) [0.362]
D1998	− 0.052 (− 17.79)[0.00]	− 0.038 (− 11.54) [0.00]	0.003 (1.61) [0.11]
D1999	− 0.060 (− 20.17) [0.00]	− 0.046 (− 14.08) [000]	− 0.001 (− 2.91) [0.01]
D2000	− 0.073 (− 24.33) [0.017]	− 0.061 (− 18.38) [0.00]	0.060 (2.39) [0.017]

Notes: Base year is 1992. (*t*-statistics) [*p*-value].

The contradicting results may indicate that there exist unobserved factors that determine leverage in both countries, but that they have opposite effects in Sweden compared to UK.

7. Conclusions

This study investigated the determinants of capital structure of a sample of Swedish firms utilizing panel data analysis. Three different leverage measures based on book values have been applied: total debt ratio, long-term debt ratio, and short-term debt ratio. The empirical evidences provide that there exist significant differences in the determinants of these three leverage measures. While all three forms of debt ratio are significantly related to tangibility, profitability, size, and income variability, non-debt tax shield is only related to the short and long-term forms of debt. Uniqueness and growth are not related to any of the three debt measures.

The most interesting finding in this study is though that there exist significant differences between short-term and long-term debt ratios in three cases. While tangibility is positively related to long-term debt (and total debt as well), it is negatively related to short-term debt. Furthermore, while non-debt tax shield has a positive effect on short-term debt ratio, it is negatively correlated with long-term debt ratio. Finally, while size is positively related to both total debt and short-term debt ratio, it is negatively correlated with long-term debt ratio.

These findings suggest that future analysis of leverage determinants should be based on not only long-term or total debt ratios, but on short-term debt ratios as well. This may be of particular interest and importance for the Swedish case, since short-term debt constitutes a major part of total debt – short-term debt ratio amounts to almost 50% (see table 3 above). Due to data limitations, we have not been able to decompose short-term debt to its basic elements. Only when we have data on for instance trade credit and equivalent, short-term securitized debt and short-term bank borrowing, we may find answers to why Swedish firms have such large short-term debt ratios. Indeed, Bevan and Danbolt (2000) argue that a fuller understanding of capital structure and its determinants requires a detailed analysis of all forms of corporate debt.[15]

There exist other limitations to this paper as well that should be relaxed in future works. In particular, the data is based on book values and not market figures, which may be a major drawback in some cases, for instance when estimating the effect of expected growth opportunities

[15] For instance, they find that while size is positively correlated with both trade credit and equivalent and short-term securitized debt, it is negatively correlated with short-term bank borrowing. This may, according to Bevan and Danbolt (2000) indicate that small firms are supply constrained, in that they do not have sufficient credit ranking to allow them to long-term borrowing.

on leverage, since stock markets usually capitalize the present value of growth opportunities. Finally, applying dynamic panel data regression in future research may make it possible to reveal interesting relationships between short- and long-term leverage, from which important discussions on the relationship between financial systems, corporate debt structure and growth may be based upon.

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Appendix I

Random effects estimation

Table A.I below reveals that results are in general identical to those obtained above when FE estimation was applied.

Table A.I. Estimation results of random effects panel data regression.

Explanatory variables	Total debt ratio	Short-term debt ratio	Long-term debt ratio
Tangibility	0.131 (18.09) [0.00]	− 0.270 (− 35.02) [0.00]	0.398 (57.51)[0.00]
Non-debt tax shield	0.049 (2.15) [0.03]	0.317 (12.72) [0.00]	− 0.285 (− 12.58) [0.00]
Profitability	− 0.054 (− 17.46) [0.00]	− 0.024 (− 6.96) [0.00]	− 0.055 (− 17.67) [0.00]
Size sales	0.019 (15.78) [0.00]	0.021 (16.45) [0.00]	− 0.004 (− 3.83) [0.00]
Growth	0.000 (− 2.11) [0.03]	− 0.000 (− 2.45) [0.01]	0.000 (0.67) [0.51]
Uniqueness	− 0.001 (− 0.62) [0.53]	− 0.005 (− 2.10) [0.04]	0.003 (1.60) [0.11]
Income variability	0.000 (0.18) [0.85]	0.001 (2.55) [0.01]	− 0.001 (− 3.12) [0.00]
Time dummies (D1993 to D2000)	Individually and jointly significant. D94 dropped.	Individually significant (not 1993 and 1995) and jointly significant. D94 dropped.	Individually (not 1997) and jointly significant. D94 dropped.

Notes: (*t*-statistics) [*p*-value].