# VALUING THE TAX BENEFIT OF DEBT - A SIMULATION APPROACH FOR SWEDISH FIRMS

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**Master Thesis in Corporate Finance**

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## Abstract

A heavily debated topic in corporate finance research concerns the impact of interest tax deductibility on firm value and, in extension, capital structure decisions. In 2014, the Swedish Committee on Corporate Taxation proposed that interest-deductibility should be abolished, making it relevant to quantify the value of these benefits in the Swedish context. This paper attempts to estimate the value of tax savings attributable to interest deductibility by extending a valuation approach developed by John R. Graham (2000) to simulate firm-specific tax benefit functions for a selected sample of Swedish firms. By integrating under the simulated benefit functions, we find that the capitalised tax-reducing benefit of interest averages around 9.8 per cent of book value and 9.0 per cent of market value for our sample. Moreover, we infer how aggressively firms use debt by observing the point of declining marginal tax benefits on each firm-specific marginal benefit function and conclude that Swedish firms are rather conservative in their use of debt.

**Keywords:** tax shield, capital structure, marginal tax rate, benefit curves, periodiseringsfond

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# 1 Introduction

TAXES ARE IN THE LIMELIGHT RIGHT NOW. The Panama scandal, still fresh in mind for most of us, sheds additional light on an already afloat Scandinavian debate on corporate taxation. Despite government efforts to remain internationally tax competitive[1], the discourse on tougher regulation has flourished recently, none the least fuelled by the fear of corporate tax evasion, inter alia viable through a rising number of tax-deductible internal high-interest loans. In 2014, the topic provoked a new legislative proposal by the Swedish Committee on Corporate Taxation suggesting that the current rules regulating tax-deductibility should be dismantled and replaced, primarily in order to decrease the systemic debt-equity bias.

Whichever stance is to be taken in this question, it raises the need for a solid, unbiased basis for discussion. Despite its topicality, there is to our knowledge no prior study that has tried to quantify the value of the tax shields for Swedish firms, which are currently under scrutiny. Our paper attempts to bridge this gap by quantifying the value of the interest tax shields for a selected sample of listed Swedish companies. Assuming a causal relationship between leverage and tax shields, the purpose of this thesis is to develop a valuation framework for interest tax shields adapted to the Swedish context and to use this framework to investigate to which extent interest deductibility is actually utilised by these firms.

Theoretically, corporate leverage choices are hypothesised to create value through an interest tax shield of debt (Miller and Modigliani, 1963). The proposition on how the tax benefit of debt increases firm value is firmly anchored among scholars as well as practitioners, despite limited and, to some degree, scattered empirical evidence. This gap in academic research is surprising, not only due to the fact that it constitutes a fundamental part of financial education but also because, from an investor point of view, the implications for firm value are expectedly substantial. Attempting to establish the value of the debt tax shield is thus pivotal for both debt- and shareholders, who need to make reliable valuations and capital cost determinations, as well as managers, whose task it is to make proper gearing decisions in order to maximise value for their stakeholders.

Several recognised studies investigating whether the debt tax shield promotes the use of debt over equity (the debt-equity bias), such as those made by Bradley et al. (1984) as well as Long and

[1] Inter alia through lowering the statutory tax rate from 28% to 22% over the past ten years.

Malitz (1985), do not find significant support when testing the substitutability between non-debt and debt tax shields[2]. Recent evidence on incremental financing decisions indicates that tax benefits affect financing choice, suggesting that high marginal tax rates promote the use of debt financing (e.g., MacKie-Mason (1990), Trezevant (1992) and Graham (1996, 1999)). In addition, data issues, tax code specifics and quantifying financial distress make the valuation of tax shields difficult, wherefore few attempts have been made; Mausulis (1980), Graham (2000, 2010) and Kortewag (2010) being exceptions.

There is, to our knowledge, no prior study valuing the interest tax shield in listed Swedish firms. We attempt to do so by adapting a simulation approach - initially brought forward by Graham (2000) - to the specifics of the Swedish tax code, including indefinite net operating loss carryforwards as well as a tax allocation reserve *(*Periodiseringsfond) acting as a carryback like feature*,* and investigate the capitalised size of the tax benefits of debt in 173 Swedish listed companies by using firm-level financial data.

The contribution of this paper includes three findings. First, we establish firm-level tax benefit functions and integrate under these to quantify the tax advantage of debt. We estimate that the tax benefit of interest deductibility on average equals 9.4 per cent of market value for our sample of Swedish firms. Second, by evaluating the point where the marginal benefit function begins to slope downwards, 'the kink' (as defined by Graham, 2000)[3], an assessment of how aggressively Swedish firms use debt can be made. Our results suggest that debt conservatism is persistent with most firms operating on the flat part of their benefit curve, i.e. these firms could still achieve full marginal benefits on increased interest payments. When standardising the kink with earnings volatility, we, moreover, find that more than 50 per cent of firms operate at least one standard deviation of earnings away from the sloped part of their benefit curve and may eminently be able to sustain substantial negative shocks to their earnings. Third, we find that country-specific tax features such as the Swedish tax allocation reserve have a large impact on the marginal tax rate. Furthermore, we believe that the 2005 observed decrease in usage of the tax allocation reserve illustrates rational firm-behaviour; the marginal tax rate is, as expected, negatively impacted by the tax on the imputed income.

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[2] Using various forms of debt/equity ratios, they test for the impact on debt usage in the presence of non-debt tax shields such as depreciation or investment tax.
[3] The kink is defined as the ratio of the amount of interest required to make the tax rate function slope downward (in the numerator) to actual interest expense (in the denominator).

The remaining parts of this paper are structured as followed. Section II gives a general overview of the most prevailing capital structure theories and establishes a theoretical foundation for valuing debt tax shields in the context of the trade-off theory of capital structures. Moreover, we introduce the concept of marginal tax benefit curves as a more sophisticated measure to determine the value of interest tax benefits. Lastly, the section aims to give an overview of current empirical research on the value of the above mentioned debt tax shields as well as their influence on corporate financing policies. Section III puts the presented theories into a Swedish context. Section IV briefly discusses the data selection process and provides a number of selected summary statistics. Section IV then introduces the simulation approach developed by Graham (2000) to estimate corporate marginal tax rates and presents how the approach can be adapted to a Swedish setting. In Section V, we give an overview of the main results of our study. We present 2015 marginal tax rates for the selected sample of firms and discuss the impact of the tax allocation reserve. Moreover, we present firm specific marginal benefit functions and integrate under these functions to derive the value of the benefit of interest deduction. We end the section with discussing prevailing debt conservatism in Swedish firms. Section VI concludes.

# 2 Literature Overview

Ever since Modigliani and Miller's published their ground breaking article 'The Cost of Capital, Corporation Finance and the Theory of Investment' in 1958, capital structure dynamics have attracted substantial attention in the world of financial research. Modigliani and Miller formulated their hypotheses under the very strict assumptions of no market frictions, that is; no corporate and personal taxes, transaction costs, or asymmetric information. A lot of subsequent research has focused on the importance of financial decisions when imperfections are introduced into the framework. This thesis investigates the consequences of relaxing the no tax assumption, underlining the role that corporate taxes play in corporate financing policies and, ultimately, firm value.

This chapter provides (1) theory about how interest tax benefits impact capital structure decisions, (2) an outline of the valuation approaches used for valuing the debt tax shields and, finally, (3) empirical evidence on the existence, impact and size of tax shields.

## 2.1 Three Theories of Capital Structure

Capital structure literature can broadly be divided into three lines of theory: (1) trade-off theory, (2) pecking order theory, and (3) market timing theory, whereof the third to a certain extent follows the rationale of the second. These are in turn based on three core assumptions: (1) the tax benefits of leverage, (2) existence of bankruptcy costs and (3) asymmetric information. Trade-off theory is based on the idea that firms maximise value by balancing tax benefits of debt against disadvantages of leverage; while the pecking order and market timing theories are based on capital structure choices in the presence of asymmetric information.

Trade-off theory assumes the existence of an optimum leverage level where firms strive to maximise value by optimising (trading off) between debt tax shields and bankruptcy costs. Hence, many empirical studies test leverage adjustments across time to research whether firms adapt their debt levels to achieve an optimal capital structure. Nevertheless, classic trade-off theory is considered to be incomprehensive as it only considers one benefit (the debt tax shield) and one cost (bankruptcy), despite that there are potentially many other benefits and costs.

Pecking order and market timing theories, on the other hand, do not support the existence of an optimal capital structure, but also do not neglect the importance of financing choices. Instead, the rationale is that firms increase value by reducing asymmetric information costs, often represented by the issuing costs for new securities. According to the pecking order theory firms strive to minimise issuing costs by following a strict order of internal and external financing choices. Due to adverse selection, companies first turn to retained earnings, then to debt, and only in extreme circumstances to equity financing (Myers, 1984). The market timing theory presumes that firms attempt to increase value by issuing stock at overvalued prices, or by avoiding undervalued issues (Baker and Wurgler, 2002). The focus of these two theories is limited to asymmetric information costs, disregarding other explanations such as the debt tax shield. Nonetheless, trade-off and pecking order theories share the same motives: increasing firm value. To summarise, firms are thought to maximise value through optimising their capital structures according to trade-off theory, or through minimising their asymmetric information costs according to the (complex) pecking order theory.

In conclusion, several theories aiming to explain corporate capital structures have evolved over time evidencing the importance of this topic. Nevertheless, only the trade-off theory recognises the tax benefits of debt as a key-determinant to capital structure decisions. Therefore, the scope of this thesis lies within this theory.

## 2.2 The Trade-Off Theory of Debt

Research on the tax benefits of debt is closely linked to trade-off theory, which assumes that the desire to limit tax payments motivates a firm's use of debt financing (Frank and Goyle, 2009). Conventionally, interest deductibility has been framed as one of the primary benefits of debt (Kraus, 1973). Over time, other imperfections such as bankruptcy costs (Baxter, 1967; Stiglitz, 1972; Kraus and Litzenberger, 1973; and Kim, 1978), agency costs (Jensen and Meckling, 1976), and gains from non-leverage-induced tax shields (DeAngelo and Masulis, 1980), have been incorporated into the analysis. The following section aims to outline the trade-off between benefits and costs of debt that impact on capital structure and, in extension, the interest tax shield.

As stated above, trade-off theory views the costs of debt as offsetting to its benefits. The optimisation of capital structure therefore always involves a trade off between 'the present value of the tax rebate associated with a marginal increase in leverage […] and the present value of the marginal cost of the disadvantages of leverage' permitting a definition of an optimal capital structure for a firm (Robichek and Myers, 1965 and Hirshleifer, 1966). The optimal capital structure is achieved when each additional unit of added tax and agency related benefit of debt is exactly offset by the increase in expected bankruptcy and agency costs of debt (e.g. Kraus, 1973). Hence, with increasing leverage, a firm faces increasing costs of financial distress[4], which offset the positive tax shield effects[5]. In addition, Jensen and Meckling (1976) argue that an optimal capital structure can be reached by trading off the agency costs of debt[6] against the benefit of debt, as previously described.

Financial distress and other debt related agency costs could vary greatly amongst firms. In other words, tax benefits of debt may not be equally valuable to all types of firms. Trade-off theory considers several firm specific and macroeconomic variables that are expected to serves as determinants of optimum leverage including but not limited to profitability, growth, size, nature of assets, taxation, as well as macroeconomic conditions (Frank and Goyle, 2009). The outlined factors are far from exhaustive and some may have better explanatory power than others when tested empirically. Similarly, it is important to consider which factors and models to deploy in an empirical analysis as the outcome may differ significantly.

Modern trade-off theory can generally be divided into two main categories: static trade-off theory and dynamic trade-off theory. Static trade-off theory assumes that a firm's leverage is determined by a single-period trade-off between tax benefits and costs of bankruptcy resulting in one single optimal capital structure for a firm[7]. In reality, however, random events may cause firms to deviate from the optimal capital structure. If, as predicted, the optimal debt ratio is stable, firms should show mean reverting behaviour and more or less immediately gravitate towards this ratio (Leary and Roberts, 2005).

First dynamic models were introduced by Hamada et al. (1984) and Brennan and Schwartz (1984). Both use continuous time models with uncertainty, taxes, and bankruptcy costs to arrive at an optimal financial policy. Even though this extension seems intuitive, a number of questions remain unanswered. Empirically, firms have not been proven to revert rapidly to their target capi-

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[4] Also referred to as bankruptcy costs. Those costs can be direct, i.e. in the form of restructuring fees, court costs, and advisory fees, or indirect in the form of lost profits suffered from and increased reluctance of customers, suppliers and employees to engage with the firm.

[5] Nevertheless, estimating these bankruptcy costs has proven to be difficult (e.g. Andrade and Kaplan, 1998 and Baxter, 1967).

[6] Clear agency costs of debt are what Myers (1977) describes as underinvestment and debt overhang problems. Underinvestment stems from the fact that equity holders in firms with high leverage are more prone to support risky projects as debt holders bear most of the downside risk while equity holders may profit from a larger upside potential. As a consequence, high-risk assets may substitute low risk assets increasing the overall risk profile of the firm. Moreover, debt overhang may negatively affect equity holders as in firms with large portions of debt debtholders will capture most of the profits from a project leaving equity holders with lower returns and no incentive to take on favourable projects.

[7] While this model has a rather simple solution, there is no room for the firm to ever be anywhere but the solution (Frank and Goyle, 2007). They claim that leverage exhibits target adjustment, is in fact neither necessary nor sufficient for a firm to be balancing tax savings against bankruptcy costs, rather target adjustment is better to be viewed as a separate hypothesis. They propose an alternative term i.e. static trade-off theory for the proposition that bankruptcy costs and taxes are the key factors that determine leverage within a static model.

tal structure (Fischer et al., 1989). Market frictions such as adjustment costs are one factor that could explain lasting deviations from the target (Jalivand and Harris, 1984). As companies weigh their adjustment costs against those of deploying a suboptimal capital structure, it may be reasonable to adjust only partially (Faulkender et al., 2012). Consequently, temporary deviations from a firm's target capital structure do not necessarily contradict the trade-off theory as long as convergence is observable in the long run. Fischer et al. (1989) propose a model of dynamic capital structure in the presence of recapitalisation costs. They argue that firms will readjust periodically within an upper and lower limit of acceptable capital structures (Fischer et al., 1989). This complicates the use of regression methods to assess interest tax benefits as one implicitly assumes that firms are optimally levered, which might not be the case in reality, as described above (Korteweg, 2010). In light of this issue, one may need to develop different approaches to value tax benefits (see for example Korteweg, 2010 and Graham, 1996).

To conclude, interest tax benefits must be viewed in the context of the trade-off theory. When quantifying the tax shield of debt one must, however, consider that firms may not always be able to fully realise interest tax benefits if the costs of doing so are too high. Importantly, as regressions are not found to be suitable method for measuring the tax shield, researchers have turned to other valuation techniques. The following section aims to lay a theoretical foundation for how the actual tax benefit of debt can be quantified.

### 2.3 Valuing the Tax Benefits of Debt

In 1963, Modigliani and Miller themselves relaxed the no tax assumption arguing that taxes do, in fact, represent additional value to a firm. Once imperfections were introduced, they argued, capital structure decisions would indeed affect firm value. As stated, tax savings due to the deductibility of interest were modelled as one of the primary benefits of debt (Kraus and Litzberger, 1973).

The traditional (text book) approach to valuing tax shields as the product of a firm's total debt and its tax rate is easy to grasp, but nevertheless overestimates the tax-shields as it fails to consider the fact that the corporate tax rate is not constant. Graham (2000) extends the traditional framework to account for time and firm-specific factors to provide more accurate estimates of the tax shield. Due to firm-specific earnings-volatility, increased bankruptcy risk from leverage as well as country-specific tax code features, the marginal corporate tax rate is not a constant, but a decreasing function of interest costs (e.g. Shevlin, 1990 and Graham, 1996). In other words, as incremental interest payments increase, their marginal benefit may be decreasing as income is already shielded by other factors such as net operating losses and other related features of the tax code. This in turn implies that the value of tax shields is lower than what is calculated under the traditional approach, as a firms will not make a full, but a decreasing, tax savings on each additional currency unit of interest.

This section describes the evolution of valuation approaches, beginning with the traditional valuation framework by Moldigiani and Miller (1963) and its consequent extensions, ultimately ending with a more modern approach by Graham (2000) based on marginal tax benefits.

*The Traditional Valuation Approach*

The tax benefit of debt is defined as the tax savings resulting from deducting interest from taxable earnings: for each additional currency unit of interest, taxes are reduced by the marginal corporate tax rate, $\tau_C$ (Shevlin 1990 and Graham 1996, 2000). For a firm, this represents a benefit of debt financing over equity financing. The annual benefit of the tax shield can be expressed as $\tau_C$ times the absolute amount of interest $r_d \times D$ where $r_d$ is the interest rate of debt.

In order to capitalise the benefits of debt, Modigliani and Miller (1963) stated that tax shields should be considered equally risky as the debt that generates them. The implicit discount rate would then be $r_d$ simplyfying the equation to $\tau_C \mathrm{D}$. Assuming a stylized setting of no financial distress costs from debt, no personal taxes, and a single corporate tax rate, this would imply a value of the levered firm ($V_l$) equal to the value of the market value of the unlevered firm ($V_u$) plus the value of the tax shield $\tau_C \mathrm{D}$.

This analysis was later extended by Miller (1977) who showed that the supply and demand of corporate debt depend on both corporate and personal taxes, and therefore included personal taxes in the analysis. By arguing that interest deductibility occurring at the firm level is partially off-set at the investor level, Miller hypothesized that personal investor taxes - which are levied on any received income whether it is distributed as interest income, dividends, or capital gains - play an important role in the financing decisions of companies. Under the assumption that the capital gains tax rate is lower than that of interest income, a capital structure with more leverage would lower corporate taxes while total personal taxes paid by investors would increase. Since investors should care about after-tax returns, a higher return would be demanded for corporate debt, thus reducing the benefits of debt financing compared to equity financing (Barclay and Smith, 1999).

Consequently, Miller reached the conclusion that the benefits of debt financing could be overstated if not accounting for personal taxes[8].

*Using Marginal Tax Rate Functions to Estimate Tax Benefits of Debt*

The traditional approach measures tax benefits directly as the product of the amount of debt and corporate tax rate (Miller Moldigiani, 1963; Brealey and Myers, 1996). Graham (2000), based on the simulation approach of Shevlin (1990), develops a new valuation framework: the tax benefit function. It is considered to be superior to the traditional approach as it allows $\tau_C$ to vary not only across firms and over time but also with incremental interest payments, rather than treating $\tau_C$ as a constant.

The tax benefit function is defined by a series of marginal tax rates, with each rate corresponding to a specific level of interest deductions (Graham, 2000). Graham (ibid) further defines the tax benefits of debt as the area under the tax benefit function. Talmor, Haugen, and Barnea (1985) plot benefit functions by modelling marginal tax rates on the vertical axis and absolute debt on the horizontal axis. However, as increasing the amount of debt can increase the interest rate and tax benefit faster than it increases the probability of bankruptcy, using debt as the independent variable allows for increasing marginal benefits to debt, i.e. upward sloping benefit functions. Graham (2000, 2010) circumvents this by plotting the benefit function with the marginal tax rate on the vertical axis for different levels of interest on the horizontal axis. Under the presumption that tax is progressive, benefit functions do not slope upward as the functions already incorporate the effect of interest rates changing as debt increases. Simply put, as the marginal tax rate is a declining function of interest deductions, the marginal benefit of incremental interest declines. Hence a firm can actually reduce its effective marginal tax rate by taking on debt.

The rationale behind this is that companies will not pay taxes in all states of nature. For example, losses are not taxed and firm have access to other tax shields provided by the tax code such as carryforwards. Therefore, $\tau_C$ should be weighted to incorporate the likelihood that a firm will either pay or not pay taxes in any given state of the future. There are several determinants such as the volatility of earnings and the level of debt that impact the firm-specific marginal tax rate dis-

[8] In the Swedish setting, interest income, dividends as well as capital gains are all classified as 'income from capital' and taxed at the same flat tax rate of 30 per cent. Hence, this scenario differs from that suggested by Miller (1977) as there is no offsetting effect from relatively higher private taxation costs on interest. Investors are neutral in choosing between securities, which, in the presence of interest tax-shields, would benefit debt over equity as described by Miller and Moldigiani (1963). With respect to this, we can refrain from including personal taxes in our analysis.

tribution. Graham (1996, 2000) adapts his simulation to account for these factors when valuing the tax-shield, stating that tax shields will otherwise be overestimated.

Furthermore, timing of payments related to features of the tax code impacts the value of tax-shields. Thus, $\tau_C$ must be adjusted to reflect the chances that taxes are paid in both current and future periods. Graham (1996) incorporates details of the tax code when measuring $\tau_C$, considering how these various tax code features interact with the time value of money to affect the present value of the tax burden (Lemmon and Graham, 1998). In Sweden, this implies including the infinite carryforwards and the tax allocation reserve.

Consequently, this interpretation is consistent with the definition of the marginal tax rate, being the present value of the tax obligation arising from earning an extra dollar of income today (Scholes and Wolfson (1992)). Accordingly, the current year's marginal tax rate is dependent on the firm's taxable income in prior as well as future years (Shevlin, 1990). Using the traditional approach, interest deductions would be valued at the full $\tau_C$ for all states of the world. Grahams (2000) valuation approach, on the other hand, accounts for the fact that interest tax shields are not always realisable, such as when a firm is unprofitable or when it can shield income in different ways independent from interest payments. As a result, when incorporating time-variant and firm-specific factors, the tax benefit function can be flat for initial interest deductions but, as a consequence of the dynamic features of the tax code, eventually becomes negatively sloped. In order to estimate the tax benefit of debt for a single firm-year, Graham (2000) integrates under the benefit function up to the point where it intersects the level of actual interest expense.

To summarise, while the traditional approach of valuing tax shields is easier to grasp and implement, the approach put forward by Graham (2000) gives a more accurate estimation of firm-specific tax shields.

## 2.4 Empirical Evidence

This empirical section aims to support the outlined theory by answering what are/is (1) the value of tax benefits of debt and their impact on firm value, (2) the influence of taxes on a firm's financing policy and lastly, (3) estimates and proxies for the marginal tax rate.

### 2.4.1 The Tax Benefit of Debt and Firm Value

Scholars have previously used market based as well as fundamental approaches to estimate the value of the debt tax shield. Market based approaches use stock market data and technical analysis when attempting to value the tax-shield, while fundamental approaches use firm-level accounting-based financial data to forecast firm-level values of the tax shield. Whereas market-based approaches work well in proving the existence of the tax shield, they are less suitable when it comes to measuring the firm-specific size of tax shields. In these cases, it is better to use fundamental approaches (Kortewag 2010). Historically, the empirical support for the existence and value of the tax-shield has been mixed. Nevertheless, among the market-based studies more recent papers, such as the one provided by Irvine and Rosenfeld (2000), have been regarded as important evidence for the existence of tax shields. Furthermore, fundamental valuation approaches, adjusted to reflect firm and time-specific variables (c.f. Graham 2000), have increased measurement accuracy, wherefore better valuations can now be obtained.

*Market-Based Approaches of Valuing Tax Shields*

Masulis (1980, 1983) research exchange offers between 1960s and 1970s. Exchange offers, by nature, are a direct reflection of changes in capital structure as they rely on the simultaneous issue and retirement of securities. Masulis (1980) finds that leverage increasing exchange offers increase firm value due to increased tax deductions – transactions that increase leverage increase equity value by 7.6 per cent, while leverage decreasing transactions decrease value by 5.4 per cent (Masulis 1980). In accordance with predictions, debt-for-common stock and debt-for-preferred stock issues show the largest price reactions. Furthermore, when stock returns are regressed on the change of debt in exchange offers, Masulis (1983) obtain a coefficient in line with the statutory tax rate of 0.40[9], confirming the Moldigiani and Miller (1963) hypothesis.

Nonetheless, the results obtained by Masulis (ibid) seem to reoccur for non-tax related events as well. Asquith and Mullins (1986), Masulis and Korwar (1986), and Mikkelson and Partch (1986) observe negative stock price reactions for straight equity issuance. Also, Mikkelson and Partch (1986) and Eckbo (1986) find that the stock price reaction is tantamount to zero in the case of straight debt issuance. Myers (1984) and Cornett and Travlos (1989) question the conclusions of Masulis (1980, 1983), saying that increasing debt should not always add to firm value, even if this implies that more interest is shielded. Instead, they argue that value-optimising firms can choose to increase or decrease either debt or equity; as long as the firm gravitates towards its optimal leverage ratio, firm value should increase. Nevertheless, it is important to note that even if non-tax reactions drive Masulis results, this does not conflict with the optimisation hypothesis.

[9] The retrieved coefficient implies near-zero personal tax and non-tax costs to debt.

Some scholars oppose that tax shields have a value at all and believe results are attributable to asymmetric information, as illustrated by Myers and Majluf (1984), or signalling (c.f. Ross (1977) and Leland and Pyle (1977)). Cornett and Travlos examine the change in debt in relation to two information effects; the ex-post change in inside ownership and ex-post abnormal earnings in relation to event stock returns. They find that the change-in-debt variable is insignificant while the other variables are significant, suggesting that the value increase in equity-for-debt exchanges reflects new positive information about the future rather than tax benefits.

Fama and French (1998) regress a proxy for the levered value of the firm ($V_L$)[10] on debt interest, dividends, and a proxy for the unlevered value ($V_U$)[11]. Using both level-form and first-difference specifications in several regressions on a cross section of firms, they find the coefficient on interest is either insignificant or negative. Their results cannot confirm that debt tax benefits have a first-order effect on firm value. Fama and French (ibid) therefore suggest that the $V_U$ –proxy is correlated with the error term, which results in the interest coefficient picking up a negative valuation effect related to distress costs or else.

Nevertheless, more recent, better-designed studies, such as those by Engel, Erickson, and Maydew (1999) and Irvine and Rosenfeld (2000) have been considered credible proof for the existence of the tax shield. Their papers investigate the exchange issues of traditional preferred stock for monthly income preferred stock (MIPS). These securities are identical in all legal and informational aspects differing only with respect to tax characteristics – enabling the required ceteris paribus setting. By comparing the yields on these securities pre- and post-exchange, Engel, Erickson, and Maydew (1999) show that the tax benefit of MIPS amounts to 0.28 dollars per dollar of face value. Irvine and Rosenfeld (2000) use abnormal announcement returns and arrive at a similar value of 0.26 dollars per dollar of face value. In a different approach, Kortewag (2010) estimates the market's valuation of net benefits of leverage using betas of a company's debt and equity. He estimates that the median firm captures net benefits of up to 5.5 per cent of firm value. He also finds that severely distressed firms have negative net benefits of -15 per cent up to -30 per cent of firm value.

*Fundamental approaches*

The most prominent studies estimating the size of the tax shield using a fundamental approach are those conducted by Graham (2000). He simulates benefit functions for interest tax deduc-

[10] Proxy 1 is the excess of market value over book assets.

[11] Proxy 2 is a collection of control variables including current earnings, assets, and R&D spending.

tions and estimates a gross tax benefit of debt amounting to 9-10 per cent of firm value among a sample of US firms using data from 1980-1994. This figure is smaller than theoretically expected, reflecting the reduced value of interest deductions under certain firm-specific and regulatory conditions. When personal taxes are considered, the tax benefit falls to 7-8 per cent of firm value. In a later study, Binsberger, Graham, and Yang (2010) use a large sample for firms they believe to be close to equilibrium leverage decisions to estimate marginal cost of debt functions. By integrating under and between the marginal cost and simulated tax benefit functions, they are able to derive net benefits of debt at around 4 per cent of asset value.

### 2.4.2 The Impact of Corporate Taxes on Capital Structure Decisions

There is a divergence in the literature as regards the impact of corporate taxes on capital structure decisions. The following section aims to provide examples from both sides – illustrating that even though tax shields are valuable, it is not certain that they are a key determinant of financing policy. Nevertheless, papers neglecting the impact of the tax shield have still not been able to provide robust evidence wherefore this paper assumes that there is a causal relationship between the value of tax shields and capital structures.

*Papers supporting the impact of corporate taxes on capital structure decisions*

MacKie-Mason (1990) examined debt versus equity issuance decisions in 1,747 issuances from 1977 to 1987. To avoid the endogenous effect of debt decisions on the marginal tax rate, he lagged the independent variable finding a positive relation between issuance and tax rates. Similarly, when regressing lagged simulated marginal tax rates on changes in the debt ratio, Graham (1996a) found a positive tax effect for a large sample of firms. Using the simulated corporate marginal tax rate, he documents a positive relation between tax rates and changes in debt ratios; as do Graham, Lemmon, and Schallheim (1998) and Graham and Smith (1999) for debt levels. These results are supported by Shum (1996), who investigates Canadian firms and obtains analogous evidence, Alworth and Arachi (2000), who research Italian firms, as well as Henderson (2001), who researches U.S. banks. Graham, Lemmon, and Schallheim (1998) measure tax rates based on income before interest expenses, and get a positive relation between debt-to-value and endogeneity-corrected but-for tax rates. Moreover, Graham (2003) and Booth et al. (2001) show that the tax rate is positively related to a firm's leverage ratio. Similarly, Desai et al. (2004) show, by using multinational affiliates, that the debt ratio rises by 2.8 per cent if local tax rates increase by 10 per cent.

Wang (2000) supports the thesis that tax shields are a capital structure determinant, but on the other hand, suggests that marginal tax rates should not be considered in incremental financing choices, arguing that it is the deviation from the optimal marginal tax rate that steers decisions. Holding tax rate levels fixed, firms with tax rates above the optimum are those that use debt financing which could be interpreted as an endogenous optimality adjustment. This means that firms would choose to lever up until the marginal benefit, which decreases as leverage increases, equals the marginal cost of debt.

*Papers neglecting the impact of corporate taxes on financing policy*

Bradley, Jarrell and Kim (1984) regressed firm-specific debt-to-value ratios on non-debt tax shields and found that debt is positively related to non-debt tax shields, contradicting the theory focusing on the substitutability between non-debt and debt tax-shields (De Angelo and Masulis 1980)[12]. Dammon and Senbet (1988) later suggest that the correlation between depreciation or investment tax credits and investment/profitability complicates using non-debt tax shields as explanatory variable for debt policy. If, for example, highly taxed profitable companies make large debt-funded investments, this would prompt a positive correlation between debt and non-debt tax shields dominating the tax substitution effect.

An additional consideration is that non-debt tax shields should affect leverage decisions exclusively if they impact a firm's marginal tax rate, which is only likely for modestly profitable firms, i.e. firms close to tax exhaustion (Ekman 1995; Trezevant 1992). Scholes and Wolfson (1992) defined the economic marginal tax rate as the present value of current and future taxes owed on an extra dollar of income earned today, which accounts for the probability that taxes paid today will be refunded in the near future. MacKie-Mason 1990; Dhaliwal, Trezevant, and Wang 1992 find a negative relationship between the non-debt tax shields and debt usage implying that tax-exhausted firms substitute away from debt in the presence of high non-debt tax shields. Graham (2003) criticises these findings, suggesting that the effects of non-debt tax shields, existing interest, and the probability of experiencing losses should be captured directly in the estimated marginal tax rate, rather than as stand-alone variables.

A similar issue exists with respect to using profitability as a measure of tax status. Profitable firms usually have high tax rates and therefore some articles argue that the tax hypothesis implies they should use more debt. Empirically, however, the use of debt declines with profitability, which is

[12] If a company borrows to invest heavily, a correlation between proxies for non-debt tax shield and debt may result as a consequence (Graham 2003) causing any substitution effects between debt and non-debt tax shields to be unobservable.

often interpreted as evidence against the tax hypothesis (Myers 1993). Grahams view is that profitability should only affect the tax incentive to use debt to the extent that it affects the corporate marginal tax rate; therefore, when testing for tax effects, the effects (if any) of profitability should be captured directly in the estimated marginal tax rate.

#### 2.4.3 Marginal Tax Rates

The difficulty of accurately estimating the marginal tax rate may be one of the potential reasons that it has not been possible to provide complete empirical support to the trade-off theory. The following section aims outline research on the marginal tax rate approach.

Using first-order Markov probabilities, Auerbach and Poterba (1987) and Altshuler and Auerbach (1990) simulate tax rates that weigh the probability of transition between taxable and non-taxable states. Shevlin (1987, 1990) incorporates the dynamic elements of the tax regulation such as the carrybacks and carryforwards in his simulation techniques. Graham (1996a) extends the approach to directly capture the effects of non-debt tax shields, investment tax credits, and the alternative minimum tax. Graham (1996b) demonstrates that simulated tax rates are the best commonly available proxy for the 'true' marginal tax rate. Two difficulties arise with simulated tax rates; (1) they require a time series of firm-specific data, and (2) they are based on financial statement data, even though tax return data would be preferable. With respect to the tax return issue, Plesko (2003) compares financial-statement-based simulated rates for 586 firms to a static tax variable calculated using actual tax return data. He finds that simulated rates (based on financial statements) are highly correlated with tax variables based on tax return data. Plesko's evidence implies that the simulated tax rates are a robust measure of corporate tax status.

#### 2.4.4 Empirical Summary

To conclude, we find that there is substantial evidence supporting the existence of the tax shield and observe improvements with regards to valuation methods, which are furthermore confirmed empirically. As regards the impact of debt tax shields on capital structure decisions, we acknowledge that the evidence is more scattered but, nonetheless, still dominantly in favour of a positive, causal effect. Hence, this empirical section has provided eminent evidence on the existence and size of tax shields; the impact of these on capital structure decisions as well as empirical findings support the simulation approach employed in this paper.

## 2.5 Concluding Remarks on the Literature Review

This chapter has provided (1) theory on how interest tax benefits impact on capital structure decisions, (2) an outline of the valuation approaches used for valuing the debt tax shields and, finally, (3) empirical evidence on the existence, value and capital structure impact of tax shields.

First, it is illustrated that debt tax shields must be viewed in a trade-off context, where the value is subject to cost constraints in the form of financial distress, agency costs and substitutable non-debt tax shields. Furthermore, it is shown that while the traditional textbook approach to valuing tax shields is easy to grasp, it overestimates the debt tax-shield as it fails to consider the fact that the corporate tax rate is time-variant and impacted by firm-specific factors. Therefore, a more modern approach based on Graham, 2000, that takes these factors into account was introduced. Finally, empirical evidence that supports the existence and capital structure impact of tax shields was provided, as well as prior tax shield value estimates and empirical literature confirming the chosen valuation method.

# 3 The Swedish Case

While the theoretical approaches are universal, the incentives to utilise the debt tax shield can be subject to country-specific factors such as regulation. In order to make a comprehensive assessment, the following chapter aims to outline the country-specific factors that should be considered when valuing tax shields for Swedish companies. For example, country-specific tax regulations impact the value of company tax shields explicitly, as can the tax rate. Furthermore, general market conditions such as the access to and the cost of debt financing are pivotal for capital structure decisions, and should therefore be considered (Englund et al., 2015).

In order to contextualise these concepts, this chapter begins with a description of the general indebtedness of listed Swedish companies and the access to debt financing in section 3.1. Thereafter, a description of the current and future interest rate environment is provided in section 3.2. The chapter is concluded in section 3.3 through a depiction of the Swedish taxation rules.

## 3.1 The Indebtedness of Swedish Companies

Much of contemporary capital structure literature has assumed that capital supply is perfectly elastic, meaning that capital structures are solely determined by corporate demand for debt. Several recent studies challenge this notion and suggest that capital market segmentation and supply conditions significantly influence observed financial structures (see e.g. Graham, 2011 and Faulkender and Petersen, 2006).

In Sweden, a large fraction of corporate investment is financed by internally generated funds. Nevertheless, these are insufficient to cover full investment costs and thus there is a need for external financing. According to a report published by the Swedish Centre for Business and Policy Studies, corporate balance sheets averaged a debt-to-equity ratio of 1.63 (equal to 62 per cent debt and 38 per cent equity) in the first quarter of 2014[13]. This conjures with the general situation in Europe; demand for debt is approximately six times as high as the demand for equity according to Eurostat Statistics.

The Swedish Committee on Corporate Taxation in 2014 issued a proposal suggesting that it should only be possible to offset interest and other financial costs against financial income. Exceeding financing costs would under this proposal not be tax deductible. The committee does not intend to increase total taxes but proposes that that the taxes on profits should instead be re-

[13] Based on data from Statistics Sweden.

duced so that the reform is income neutral from a tax stand point. The proposed changes aim to reduce the scope for companies using capital structure to reduce tax payments. The proposal is to be understood in the context of a strong, long-term global trend towards reduced tax rates and corporate tax income. This trend has to some extent been driven by the fugitive nature of corporate profits which extensively being subject to tax evasion. In addition, it seems to be more efficient to target income and consumption in favour of corporates. Thus, in conjunction with global trend, taxes are hypothesised to become less significant for capital structure decisions in the future (Englund et al., 2015).

The indebtedness of large Swedish companies is low in comparison to similar companies abroad. Alike Japan, Germany and Great Britain, Swedish companies have relatively low debt-incurrence. One possible explanation could be that the Swedish corporate taxation is relatively low. Albeit small, the correlation between tax rates and the size of corporate debt is positive across countries (Englund et al., 2015).

Gearing (based on book-values) for Swedish non-financial listed companies has been stable over time (Becker and Josephson, 2013). What distinguishes these companies, beyond the fact that they are known and covered by analysts, is that they have access to the bond markets. The underdevelopment of the Swedish bond markets has been one of the offered explanations of the comparatively low levels of indebtedness among Swedish firms (Englund et al., 2015). For Swedish companies, corporate bonds represent 28 per cent of the debt outstanding, which is below average and less than the observed levels in comparative countries such as Norway, Netherlands or France (Statistics Sweden, Englund et al., 2015). Furthermore, only 10 per cent of all corporate bonds outstanding are issued by non-financial companies.

Nevertheless, Sweden was no hit by a credit crunch in the same way as the rest of Europe during the most recent financial crisis. Total borrowings of companies increased by 28 per cent from August 2008 until August 2014[14]. According to Becker and Ivashina (2014b), this does not provide evidence that the credit supply to Swedish companies has not been tightened, but just illustrates that Sweden weathered the crisis better than the rest of Europe.

### 3.2 Interest Rate Environment

With exception for the tax rate, the interest rate level is the single most important component of the debt tax shield. This is confirmatory of Scholes and Wolfson (1992), who introduced the

[14] The Euro zone simultaneously experienced a decrease of 10%

concept of explicit and implicit taxes, stating that the relative advantage of debt is an explicit function of the interest rate – a higher interest rate would provide the same tax shield for a lower level of debt. According to theory (Miller & Modigliani 1963), the size of the net tax savings per currency unit of corporate debt is proportional to nominal interest rates[15]. Gordon and Lee (2007) therefore suggest that everything else equal, the size of tax incentives affecting the use of corporate debt should be high in years when nominal interest rates are high and low in periods when nominal interest rates are low. In addition, firms should shift towards more long-term debt as long-term interest rates rise relative to short-term interest rates. Gordon and Lee (ibid.) present evidence consistent with both predictions.

As of February 2016 Sweden's central bank, known as the Riksbank, followed the steps of Denmark and Switzerland and cut its main policy rate below zero, as a response to the low inflation rate. This low interest rate environment is not historically representative, but on the other hand the recovery has been slower than anticipated. At its monetary policy meeting in April 20016 the Executive Board decided to repurchase government bonds for an additional SEK 45 billion during the second half of 2016, reducing the risk that the krona would appreciate faster than forecast and break off the inflationary pick-up. The purchases include both real and nominal government bonds, equivalent to SEK 30 and 15 billion. The repo rate was also unchanged at -0.50 per cent.

Conditional on that the low interest rate environment is reflected in the lending rates to companies and on corporate bond yields, the historically low interest rate levels will impact the valuation of the tax shields in two aspects. Firstly, in order to realise the same value through tax shields firms would have to take on more debt. In reality a full adjustment is unlikely to occur – in accordance with Gordon and Lee (ibid) firm debt adjustment responsiveness is expected to be lower in a low interest rate environment. Consequently, the value of tax shields will, in expectation, be lower for lower rates. Secondly, there will be a counteracting effect through the discounting rate in the present value calculation, as this is also directly impacted by the interest rate level. Hence, for perpetuity calculations using low interest rates we can expect that the present value of the tax rate to be overstated. Which effect dominates will of course depend on debt adjustment responsiveness on the firm level, as well as the interest rate.

[15] Jaffe (1985) furthermore studies the relationship between interest rate levels and inflation

## 3.3 The Current Swedish Corporate Tax System

### 3.3.1 Interest Deductibility

Interest costs are generally fully deductible for tax purposes irrespective of their purpose, provided the loan is made on arm's length terms (for instance, not at a rate above the market interest rate). However, interest costs relating to intra-group loans are not deductible. There are two exemptions from this limitation. According to the so-called ten per cent rule the interest cost should be deductible if the interest income is taxed with at least 10 per cent in the hands of the beneficial owner of the interest and the predominant reason for the debt is not to obtain significant tax advantage within the group. From the second exemption, the so-called business reason rule, follows that the interest cost should be deductible if the underlying debt is predominantly motivated by business reasons and the beneficial owner of the interest income is resident within the EEA or, under certain circumstances, in a state with which Sweden has concluded a tax treaty. There are no thin-capitalisation restrictions for tax purposes. The fact that withholding tax is not levied on interest makes it favourable to create structures where the return on an investment is distributed as interest (provided the deductible interest limitation rules described above do not apply).

According to Swedish legislation, interest income, dividends as well as capital gains are all classified as 'income from capital' and taxed at the same flat tax rate of 30 per cent. Hence, this scenario differs from that suggested by Miller (1977) as there is no offsetting effect form relatively higher private taxation costs on interest. Investors are neutral in choosing between securities, which, in the presence of interest tax-shields, would benefit debt over equity as described by Miller and Moldigiani (1963). As already outlined in Chapter 2.3, we refrain from including personal taxes in our analysis. Also, for modelling purposes we further assume that all interest is tax deductible.

### 3.3.2 Net Operating Loss Carryforwards

A Swedish company is generally taxed on its worldwide income. If a company generates losses, they can be carried forward indefinitely and offset against future taxable profit. Restrictions on the use of losses may however apply when a change of ownership occurs. Companies and branches that conduct business (i.e., have a permanent establishment) in Sweden are liable to pay tax in Sweden. Each company within a group constitutes a separate taxable entity. There is no taxation on the consolidated level of a Swedish group of companies. However, generous rules permit the transfer of profits between companies within wholly owned domestic groups ('group contributions') mean that taxation of a consolidated income is effectively achievable.

### 3.3.3 Tax allocation reserve (Periodiseringsfond)

The effective rate can be even lower as companies have the option of making deductible annual appropriations to a tax allocation reserve of up to 25 per cent of their taxable income, the so called tax allocation reserve (Swedish *Periodiseringsfond)*. The aim of the rules is to offer a mechanism to allow companies to carry back losses to offset previous years' profits, since Swedish tax legislation does not contain any specific loss carryback provision. A company is allowed allocated a portion of its profits to a dedicated fund in each year provided that the allocation does not exceed 25 per cent of pre-tax profit for the year. Each year's appropriation creates a separate reserve that must be reversed to taxation within six years of appropriation and dissolved at the end of the period. Should a company not be able to offset the allocated profits with losses, these profits are fully taxed once the allocation is reversed.

In 2005, the Swedish government proposed that fund allocations should entail an interest cost framed as an annual imputed income (*'Schablonintäkt')*, subject to corporate net income taxation of 22 per cent. The interest rate corresponds to a flat statutory rate of 0.72 times the government-borrowing rate and is multiplied with the sum of the total opening balance of all tax allocation reserves to derive the imputed income figure. For financial year 2015, the interest rate is 0.65 per cent.

Before the introduction of the imputed income, companies had clear incentives to maximise tax allocations as this allowed them to defer taxes into the future without incurring any additional costs. Furthermore, the tax relief could be obtained instantly in case that the firm incurred losses. Immediately following the introduction of the imputed interest, the Confederation of Swedish Enterprise conducted a quantitative study on how companies responded to the imputed income. They found that a large fraction of companies refrained from making new provisions to tax allocation and resolved already existing funds. Hence, the new regulation on imputed income affected corporate behaviour and reduced the use of the tax allocation reserve. According to the survey made, 63.7 per cent of the companies that 'resolved some part of their fund allocation' answered that they entirely reversed their funds and 12.9 per cent revised them partially on account of the imputed income. Thus, over three quarters reversed their allocation partly or entirely due to this interest cost.

Recent studies have shown the use of tax allocation reserves has decreased slightly, but not on par with what was feared in earlier studies (c.f. Bergendahl & Johnson 2014, Bergström et al. 2008). Bergström et al. (2008) studied the effects of the imputed interest on large and small Swedish companies. The authors find that the introduction of imputed income made companies reconsider their tax allocation reserve policy, but could not conclude that companies consistently changed their behaviour. Instead, the reaction was to a higher extent dependent for what purpose of the tax allocation was before the introduction of imputed income. Finally, as no pattern of action could be discerned with respect to company size, the authors concluded that the continued use of tax allocation reserves is more dependent on firm-specific economic conditions rather than size. The importance of economic conditions was furthermore confirmed by Bergendahl and Johnson (2014), who showed that companies increased the use of tax allocation reserves during the financial crisis, as business confidence and risk appetite was affected.

In conclusion, the evidence on tax allocations in presence of imputed income is scattered, which complicates assumptions. As the tax effect from imputed income is small, this is not likely to have material effect on the valuation of the tax shield. At the same time, it would be of substantive interest to explore how this imputed income affects the marginal tax rate, as it, for some states of the world, may be what causes companies to refrain from this option.

# 4 Data

Data is collected from Thomson Reuters Worldscope. Since Graham's simulation approach has never been implemented for a Swedish sample, we chose to the size of our sample rather small in order to better control and understand the output of the simulation. As a basis for our analysis we use Swedish companies listed on the main market of the NASDAQ OMX Sweden. From an initial set of unique 284 companies, we excluded all foreign companies with a double listing on the Swedish market or with headquarters outside of Sweden since these entities' primary tax home is typically not Sweden and their marginal tax rate is therefore a function of their home country's tax regime. From this group, we exclude both financial and utility firms in accordance with existing capital structure literature as their choice of leverage structure is usually regulated and the dynamics of these can be quite different (e.g. Halling et al., 2014 and Flannery and Rangan, 2006). Moreover, we exclude all firms with missing data in the years 2009 – 2015 in order to ensure a sufficient ramp up period of the tax allocation reserve. We also exclude firms with less than 10 years of historic data in order to ensure covering a complete business cycle when calculating mean and standard deviation of changes in taxable income. For the remaining 173 firms, we collect EBIT and accumulated deferred taxes to calculate estimated taxable income, as well as interest expenses on debt. Furthermore, we collect a number of balance sheet items such as total debt, total equity, cash, and total assets in order to get a better general understanding of the leverage dynamics within the selected sample. To distinguish between firm sizes we divide all companies into small, mid, and large cap as indicated by NASDAQ Nordics. In Table 1 and 2, we report summary statistics for the data sample based on both size and industry. We define the book leverage ratio as the ratio of total debt to total assets. Similarly, market leverage is defined as the ratio of total debt to market value of equity plus book value of debt given the lack of market values for these assets. Size of assets and market capitalisation vary significantly between the firms in each size bracket while both average book and market leverage are at fairly similar levels with larger firms being slightly higher leveraged. From an industry perspective, each bucket is fairly similar in terms of average size and market capitalisation with companies within the telecommunications bucket being slightly larger and firms from the technology and healthcare sector being somewhat smaller. Firms from the Oil & Gas sector appear higher levered than the rest of the sample. In terms of profitability, all categories shown similar profitability levels with Oil & Gas firms being the only negative outliers. However, profitability levels can vary greatly between firms in each panel. A sign of caution should be the small sample size of Oil & Gas and Telecommunication companies. Results for these industries may not be representative.

**Table 1: Summary Statistics by Size**

The following table presents a summary of the sample data. The sample is based on 173 firm observations. All data has been downloaded from Thomson Reuters Worldscope. Balance sheet items as well as leverage metrics are based on 2015 year-end data. Book Leverage is defined as the ratio of Total Debt over Total Assets. Market Leverage is defined as the ratio of Total Debt over Total Debt plus Market Capitalisation. Indication in the table is given in thousands of SEK. Profitability figures have been calculated based on the years 2009 – 2015.

| **Panel A: Large Cap** | **Mean** | **Std. Dev.** | **Median** | **Min** | **Max** |
|---|---|---|---|---|---|
| **n=44** | | | | | |
| Total Assets | 58 654 114 | 73 656 596 | 35 093 500 | 964 742 | 360 715 000 |
| Total Debt | 15 343 470 | 24 632 644 | 7 441 000 | 0 | 133 231 000 |
| Market Capitalisation | 65 092 095 | 80 295 294 | 36 499 655 | 6 877 580 | 441 269 100 |
| Book Leverage | 23% | 16% | 23% | 0% | 80% |
| Market Leverage | 18% | 15% | 17% | 0% | 80% |
| Interest Coverage | 185,9x | 558,0x | 14,6x | 2,2x | 2725,2x |
| 5-yr average EBIT margin | 8% | 18% | 9% | -86% | 31% |
| 5-year Sales CAGR | 12% | 36% | 6% | -12% | 155% |
| 5-year EBIT CAGR | 16% | 52% | 8% | -39% | 304% |
| **Panel B: Mid Cap** | **Mean** | **Std. Dev.** | **Median** | **Min** | **Max** |
| **n=48** | | | | | |
| Total Assets | 4 050 097 | 4 674 860 | 2 855 367 | 111 653 | 29 891 000 |
| Total Debt | 956 548 | 1 542 280 | 407 842 | 0 | 9 359 000 |
| Market Capitalisation | 4 939 200 | 2 743 857 | 4 609 170 | 1 124 030 | 11 280 000 |
| Book Leverage | 18,7% | 14,4% | 15,5% | 0,0% | 48,6% |
| Market Leverage | 13,3% | 13,1% | 9,5% | 0,0% | 56,6% |
| Interest Coverage | 77,9x | 195,2x | 19,5x | 0,8x | 1136,4x |
| 5-yr average EBIT margin | -1237% | 8514% | 8% | -58990% | 40% |
| 5-year Sales CAGR | -422% | 5022% | 8% | -49% | 110% |
| 5-year EBIT CAGR | 15% | 28% | 6% | -19% | 149% |
| **Panel C: Small Cap** | **Mean** | **Std. Dev.** | **Median** | **Min** | **Max** |
| **n=81** | | | | | |
| Total Assets | 791 892 | 901 732 | 536 700 | 54 447 | 4 354 500 |
| Total Debt | 140 880 | 346 249 | 19 000 | 0 | 2 087 400 |
| Market Capitalisation | 734 813 | 624 532 | 498 690 | 21 860 | 3 228 140 |
| Book Leverage | 13,2% | 17,0% | 5,2% | 0,0% | 71,6% |
| Market Leverage | 14,7% | 20,7% | 3,6% | 0,0% | 82,4% |
| Interest Coverage | 284,8x | 1016,1x | 14,6x | 0,5x | 6556,3x |
| 5-yr average EBIT margin | -168% | 1056% | 2% | -9308% | 51% |
| 5-year Sales CAGR | -55% | 639% | 5% | -40% | 94% |
| 5-year EBIT CAGR | 13% | 35% | 6% | -46% | 115% |

**Table 2: Summary Statistics by Industry**

All data has been downloaded from Thomson Reuters Worldscope. Industry classifications are according to Worldscope industry identifiers Level 2. Balance sheet items as well as leverage metrics are based on 2015 year-end data. Book Leverage is defined as the ratio of Total Debt over Total Assets. Market Leverage is defined as the ratio of Total Debt over Total Debt plus Market Capitalisation. Indication in the table is given in thousands of SEK.

| **Panel A: Basic Materials** | **Mean** | **Std. Dev.** | **Median** | **Min** | **Max** |
|---|---|---|---|---|---|
| n=10 | | | | | |
| Total Assets | 19 909 671 | 27 583 075 | 5 000 000 | 254 103 | 83 666 000 |
| Total Debt | 4 278 710 | 8 349 925 | 324 800 | 0 | 27 111 000 |
| Market Capitalisation | 12 733 273 | 15 605 282 | 4 063 870 | 214 970 | 39 084 700 |
| Book Leverage | 14% | 13% | 13% | 0% | 33% |
| Market Leverage | 19% | 24% | 12% | 0% | 80% |
| Interest Coverage | 31,6x | 38,5x | 17,0x | 1,0x | 108,9x |
| 5-yr average EBIT margin | 5% | 22% | 5% | -41% | 51% |
| 5-year Sales CAGR | 8% | 28% | 4% | -7% | 24% |
| 5-year EBIT CAGR | 17% | 49% | 10% | -39% | 115% |
| **Panel B: Consumer Goods** | **Mean** | **Std. Dev.** | **Median** | **Min** | **Max** |
| n=18 | | | | | |
| Total Assets | 18 146 156 | 37 893 369 | 4 694 000 | 142 664 | 151 309 000 |
| Total Debt | 4 039 253 | 8 071 387 | 680 000 | 0 | 33 275 000 |
| Market Capitalisation | 21 149 347 | 38 979 922 | 4 863 060 | 222 030 | 157 185 200 |
| Book Leverage | 18% | 16% | 15% | 0% | 60% |
| Market Leverage | 15% | 14% | 11% | 0% | 57% |
| Interest Coverage | 24,4x | 29,4x | 14,1x | 3,3x | 122,5x |
| 5-yr average EBIT margin | 5% | 13% | 6% | -42% | 30% |
| 5-year Sales CAGR | 9% | 25% | 4% | -25% | 57% |
| 5-year EBIT CAGR | 18% | 38% | 4% | -12% | 149% |
| **Panel C: Consumer Services** | **Mean** | **Std. Dev.** | **Median** | **Min** | **Max** |
| n=21 | | | | | |
| Total Assets | 12 685 914 | 23 162 930 | 3 730 300 | 428 933 | 83 475 000 |
| Total Debt | 1 669 057 | 3 248 540 | 328 000 | 0 | 12 433 000 |
| Market Capitalisation | 29 038 725 | 94 995 108 | 5 284 120 | 147 730 | 441 269 100 |
| Book Leverage | 18% | 16% | 15% | 0% | 52% |
| Market Leverage | 22% | 24% | 15% | 0% | 80% |
| Interest Coverage | 292,4x | 674,8x | 26,5x | 0,5x | 2725,2x |
| 5-yr average EBIT margin | 6% | 10% | 3% | -11% | 31% |
| 5-year Sales CAGR | 11% | 25% | 5% | -13% | 152% |
| 5-year EBIT CAGR | 17% | 26% | 10% | -5% | 102% |
| **Panel D: Healthcare** | **Mean** | **Std. Dev.** | **Median** | **Min** | **Max** |
| n=32 | | | | | |
| Total Assets | 5 232 762 | 13 853 347 | 499 501 | 54 447 | 59 034 000 |
| Total Debt | 1 879 561 | 5 711 837 | 52 426 | 0 | 24 862 000 |
| Market Capitalisation | 6 180 284 | 12 706 135 | 1 182 380 | 69 580 | 49 480 290 |
| Book Leverage | 18% | 21% | 14% | 0% | 72% |
| Market Leverage | 12% | 15% | 3% | 0% | 41% |
| Interest Coverage | 572,2x | 1683,0x | 10,8x | 1,7x | 6556,3x |
| 5-yr average EBIT margin | -2286% | 10480% | 2% | -58990% | 40% |
| 5-year Sales CAGR | -832% | 6390% | 11% | -49% | 110% |
| 5-year EBIT CAGR | 14% | 31% | 12% | -38% | 84% |

| Panel E: Industrials | Mean | Std. Dev. | Median | Min | Max |
|---|---|---|---|---|---|
| n=59 | | | | | |
| Total Assets | 20 241 642 | 52 095 391 | 3 189 000 | 76 100 | 360 715 000 |
| Total Debt | 5 726 078 | 18 243 215 | 593 000 | 0 | 133 231 000 |
| Market Capitalisation | 19 771 555 | 39 113 781 | 4 585 210 | 111 660 | 187 798 800 |
| Book Leverage | 20% | 14% | 21% | 0% | 52% |
| Market Leverage | 17% | 18% | 14% | 0% | 82% |
| Interest Coverage | 119,2x | 370,4x | 15,5x | 1,1x | 2276,0x |
| 5-yr average EBIT margin | 3% | 21% | 7% | -116% | 20% |
| 5-year Sales CAGR | 7% | 31% | 7% | -23% | 155% |
| 5-year EBIT CAGR | 10% | 44% | 6% | -46% | 304% |
| **Panel F: Oil & Gas** | **Mean** | **Std. Dev.** | **Median** | **Min** | **Max** |
| n=2 | | | | | |
| Total Assets | 20 785 758 | 27 616 314 | 20 785 758 | 1 258 075 | 40 313 441 |
| Total Debt | 16 292 837 | 22 774 353 | 16 292 837 | 188 937 | 32 396 736 |
| Market Capitalisation | 19 352 060 | 26 566 214 | 19 352 060 | 566 910 | 38 137 210 |
| Book Leverage | 48% | 46% | 48% | 15% | 80% |
| Market Leverage | 35% | 15% | 35% | 25% | 46% |
| Interest Coverage | 5,5x | - | 5,5x | 5,5x | 5,5x |
| 5-yr average EBIT margin | -16% | 33% | -16% | -39% | 8% |
| 5-year Sales CAGR | -13% | 18% | -7% | -12% | -2% |
| 5-year EBIT CAGR | -18% | - | -18% | -18% | -18% |
| **Panel G: Technology** | **Mean** | **Std. Dev.** | **Median** | **Min** | **Max** |
| n=27 | | | | | |
| Total Assets | 13 328 796 | 53 114 607 | 594 109 | 70 500 | 271 180 000 |
| Total Debt | 1 604 775 | 5 708 676 | 1 800 | 0 | 25 120 000 |
| Market Capitalisation | 15 528 692 | 51 399 952 | 1 440 770 | 21 860 | 250 461 300 |
| Book Leverage | 7% | 11% | 1% | 0% | 42% |
| Market Leverage | 6% | 11% | 0% | 0% | 44% |
| Interest Coverage | 186,5x | 352,0x | 31,3x | 1,5x | 1245,1x |
| 5-yr average EBIT margin | 2% | 20% | 7% | -72% | 20% |
| 5-year Sales CAGR | 12% | 28% | 7% | -19% | 94% |
| 5-year EBIT CAGR | 21% | 39% | 8% | -20% | 110% |
| **Panel H: Telecommunications** | **Mean** | **Std. Dev.** | **Median** | **Min** | **Max** |
| n=4 | | | | | |
| Total Assets | 71 010 733 | 119 696 135 | 17 324 731 | 430 469 | 248 963 000 |
| Total Debt | 26 998 812 | 47 926 361 | 4 679 663 | 44 920 | 98 591 000 |
| Market Capitalisation | 55 137 445 | 86 672 665 | 18 711 485 | 440 610 | 182 686 200 |
| Book Leverage | 23% | 13% | 21% | 10% | 40% |
| Market Leverage | 18% | 13% | 17% | 4% | 35% |
| Interest Coverage | 17,8x | 21,3x | 6,2x | 4,8x | 42,3x |
| 5-yr average EBIT margin | 12% | 10% | 12% | 0% | 24% |
| 5-year Sales CAGR | 6% | 18% | 1% | -10% | 13% |
| 5-year EBIT CAGR | 4% | 30% | -3% | -23% | 44% |

# 5 Method

## 5.1 A Simulation Approach to Marginal Tax Rates

As shown in the chapters before, it is difficult to make an accurate assessment of a firm's marginal tax rate based on only current-period financial data, as dynamic features of tax code are not properly reflected. Instead, it is more appropriate to use forecasted streams of future taxable income and then calculate the estimated tax bill over the entire forecasting horizon. To estimate marginal tax benefit curves for our sample of Swedish firms, we extend the approach developed by Graham (1996, 2000) and Shevlin (1990), in order to reflect the specific features of the Swedish tax code such as unlimited net operating loss carryforwards and the tax allocation reserve, which have not been mimicked in prior studies.

Firstly, pre-financing future taxable income ($TI_{it}$) is forecasted using a random walk with drift model based on the historic mean and standard deviation of $\Delta TI_{it}$. 100 forecasts are made for each firm. Secondly, interest expenses are deducted to arrive at post-financing taxable income. In the third step, overall tax payments for each of the taxable income streams are calculated accounting for the dynamic features of the Swedish tax code such as tax loss carryforward and allocations to the tax allocation reserve. As the Swedish taxation system does not incorporate any alternative minimum tax or investment tax credits, these are omitted from the analysis. The fourth step adds 1,000 SEK[16] to the current-year income and recalculates the tax liabilities for each year, keeping forecasted taxable income constant. The calculated difference between the tax liabilities can then be discounted to arrive at the present value of the incremental tax liability from earning an additional 1,000 SEK; i.e. the economic marginal tax rate. Following standard corporate finance literature (e.g. Shevlin, 1990), an average corporate bond yield is used as a discount rate. In this paper, the weighted 2015 average of Bloomberg's SEK investment grade Scandinavian Corporate Bond Index is used. By repeating this procedure 100 times for each simulated taxable income stream, the different tax situations a firm might experience are captured. In a final step, the 100 firm-specific marginal tax rate estimates are averaged to obtain the expected economic tax rate for 2015. Still, these first five steps only simulate one point on the benefit curve. In order to arrive at an entire curve, the procedure is replicated assuming different levels of interest deductions. This is implemented by assuming different levels of interest deductions in our starting year - with 100 per cent being the actual interest expense - and a constant interest

[16] The smallest possible increment on Wordscope

coverage ratio for subsequent years. In particular, 45 different levels are used to derive distinct points of the benefit function for a given firm, which can then be connected to form the entire curve. In the following sections of this chapter, the core assumptions of each step are presented individually.

## 5.2 Forecasting Taxable Income

The simulation runs for each company are based on historical data running from 1995-2015. The valuation of the tax shield should be forward-looking on account of the legislative treatment of untaxed reserves and carryforwards. Theoretically, the forecast period should reflect the indefinite time horizon of loss carry forwards. Following the logic of Graham (1996) the forecasted period should equal the sum, i.e. the total permitted time period, of both carrybacks and carryforwards. If firms would be unprofitable across multiple time periods, this would allow the carryforward to be consumed up until the final permitted year, T, in the simulation. Nevertheless, in the Swedish case this is impracticable from a modelling standpoint, as we cannot model into infinity. To counterbalance this, the forecast period is set to 40 years, which - when considering that diminishing time value - is sufficient to properly reflect the impact of carry forwards on the marginal tax rate the over time.

In conjunction with Graham (2000), taxable income ($TI_{it}$) is defined as pre-financing taxable income for firm i in period t, that is

$$\mathrm{TI}_{it} = \mathrm{EBIT}_{it} - \frac{\text{Timing Differences Estimated Using Deferred Taxes as stated on the Balance Sheet}}{\text{Appropriate Statutory Tax Rate}}$$

As can be seen an adjustment is made for deferred tax expenses on a pre-tax basis, to account for the temporary differences in taxable income that may arise. Timing differences are approximated using balance sheet data to obtain the net effect: in the data set used, deferred taxes are stated as a netted liability account wherefore we add increases and subtract decreases (a positive change in liabilities implies an increased profit and vice versa). This is done in order to properly capture the earnings pattern as well as to account for the implicit tax deductions stemming from hidden depreciation (Graham, 1996b). Extraordinary and discontinued items do not affect the drift and volatility calculations.

$\mathrm{TI_t}$ is forecasted to follow a pseudo-random walk with drift: $\Delta\,\mathrm{TI_{it}} = \mu_i + \varepsilon_{it}$, where $\Delta\mathrm{TI_{it}}$ is the first difference in earnings before taxes, $\mu_{\Delta\,\mathrm{TI},i}$ is the sample mean of $\Delta\mathrm{TI_t}$ and zero, $\varepsilon_{it}$ is distributed normally with mean zero and a standard deviation, $\sigma_{\Delta\,TI,i}$, that equals that of $\Delta\,TI_t$ over the sample. The drift is constrained to be non-negative, as this yields a better prediction of the true marginal tax rate better than an unconstrained version (Graham 1996b).

The simulation is conducted as follows: In year t=0 the marginal tax rate for firm i (henceforth denoted $MTR_{it}$) is obtained by replacing historical income streams with forecasted income streams ($TI_{it}$) for period $t = t + 1, t + 2, \dots, t + 40$. As stated, the time period should be sufficient to cover the maximum permitted time to utilise both net operating loss carrybacks – or, in this case, the tax allocation funds – and loss carryforwards. In order to forecast, historical data reaching up to t-1 is used to obtain estimates of the average, $\mu_{\Delta\,TI,i}$, and the standard deviation, $\sigma_{\Delta\,TI,i}$, over the period. Next, 40 normal realisations of $\varepsilon_{it}$ are drawn. Using these and the actual pre-financing taxable income, $TI_{it}$, for t=0 as input, the forecasted pre-financing taxable incomes can now be obtained in accordance with: $TI_{it} = TI_0 + \mu_i + \varepsilon_{it}$.

For period t=0 the interest coverage ratio is calculated as interest through pre-taxable income, using realised values. The interest coverage ratio is held constant for profitable years, while the interest level from the year before, t-1, is maintained when the company experiences losses. Imagine a company with an income of SEK 100 in year t with an interest expense of SEK 10. If income is increases to 120 in the following year, interest increases accordingly to SEK 12. Similarly, a decrease in income to SEK 80 would imply an interest of SEK 8. However, if income is negative, interest is forecasted to remain at the same level as in the year before, which is SEK 10 in this case. This is consistent with the assumption made by Graham (2000), implying that in unprofitable years companies are not likely to desire or have sufficient funds to retire debt. Estimated interest streams are deducted from pre-financing taxable income to obtain taxable income for which the specific dynamic features of the Swedish tax code are then applied.

This approach may lead to an under or over statement of tax benefits in certain cases. For example, if firms also retire debt in unprofitable states of the future, interest deductions in year t would have fewer future deductions to compete with. Similarly, if pecking-order theory holds, profitable firms are likely to allow their coverage ratio to increase as they realise future profits and, as a result, issue less debt. Moreover, transaction costs may keep a firm from issuing new debt immediately. All of these factors mentioned above increase the likelihood that interest deductions in year t will be used in the near term and consequently tax advantages of debt policy in year t may be understated. Should a firm, on the contrary, issue more debt as expected, tax benefits may be overstated. Graham (2000) tested the impact of these findings on his assumptions about future debt policy, namely the constant interest coverage ratio, and found that there is no eminent effect. Hence, we feel save to make the same assumptions about interest coverage for our sample of Swedish firms.

## 5.3 Incorporating Features of the Swedish Corporate Tax Code

### 5.3.1 Loss Carryforwards

Contrary to intuition, due to the carryforward, the marginal tax rate can be high in periods when a firm experiences losses and low in periods when a firm experiences substantial gains. Consider a carryforward that exactly offsets current profits, implying that the company pays zero tax. Under this scenario, additional profits will increase tax payments, and, consecutively, the marginal tax rate. This is graspable: as there is no shield left any incremental profit will be fully taxed and hence, on the margin, the tax rate on additional profits will be equivalent to the statutory tax rate. Equivalently, the marginal tax rate decreases in increasing profits as long as accumulated loss carryforwards can be consumed.

Consider the taxation treatment of the taxable income, $\mathrm{TI_t}$, for year $\mathrm{t} = 1,2,\dots,\infty$. When a firm is profitable, $\mathrm{TI_t} \geq 0$, the firm pays corporate tax on the amount exceeding zero: $(\mathrm{TI_t} - 0)\,\tau$. When, on the other hand, the firm is unprofitable, $\mathrm{TI_t} < 0$, the full net operating loss, amounting to $0 - \mathrm{TI_t}$, can be forwarded to off-set a future profit up to the size of $\mathrm{TI_t} - 0$, implying a tax shield of $(\mathrm{TI_t} - 0)\,\tau$ in the profitable year that the loss carry forward is consumed. According to Swedish taxation law, net operating losses can be forwarded infinitely, meaning that they are transferrable for all periods $\mathrm{t} = \mathrm{t}, \mathrm{t}+1, \mathrm{t}+2, \dots, \mathrm{T}$ , where $\mathrm{T} = \infty$.

In case that the accumulated conserved losses exceed taxable income in a given period, the surplus remains to be used for off-setting profits in the subsequent periods. Hence, there are no requirements that a loss carryforward should be consumed immediately. Rather, losses in consecutive periods accumulate over time and can be used to shield profits from tax in multiple periods. As the tax law permits carryforwards to be used discretionary, these can (theoretically) be deferred to bypass current profits in favour of subsequent ones. Due to the time value of money the use of this feature is nevertheless unlikely, and therefore it is assumed that carry forwards are consumed as profits are incurred. This view is also supported by Shevlin (1989) and Graham (1996a, 1998b, 2000). In addition, as the tax allocation reserve is anticipative in its nature and can, in contrast to the carryforward feature, only be used for six years, untaxed reserves are assumed to take precedence (see section 5.3.2 for further details).

Furthermore, due to the lack of data on net operating losses in the Worldscope database, we extend the Altshuler and Auerbach (1990) model as concerns the net operating loss carryforward by setting them to zero in the six years ahead of the first simulation year t = -6 – analogous to the ramp-up period of the tax allocation reserve – whereafter they accumulate and are consumed (as described above) based on realised historical figures. Over this period, net operating loss carryforwards are assumed to equal realised losses over this period. By doing so, we manage to better mimic the actual situation at outset, which increases reliability.

### 5.3.2 Tax Allocation Reserves – The Swedish Periodiseringsfond

Once net operating loss carryforwards have been netted out, companies can make their tax allocation reserves based on the remaining taxable income. In Swedish legislation these reserves are somewhat similar to a carryback feature, and are, when maximised, modelled as follows: 25.0 per cent of taxable income after carryforward adjustments can be reserved in a separate fund for each year. As the time period until required reversal is regulated to be at most six years, firms can maximally make allocations to six funds at the same time. Due to the mentioned time constraint it is logical to assume that the reversal of these funds always follow the First In First Out – principle and that, conditional on that the firm remains profitable, the allocation is always deferred as far into the future as possible as the tax shield can be considered.

We use a six-year ramp up period prior to year t to ensure a full ramp up of the tax allocation reserve. Starting in year t, the sampled firms would then have to reverse the allocation made to fund t-6. We believe that this assumption is reasonable as allocations to untaxed reserves should be viewed on a going concern basis and firms are therefore likely to have existing untaxed reserves prior to year t.

Furthermore, in conjunction with the 2005 amendment of the Swedish Tax Code, a standard income (*Schablonintäkt*), calculated as 0.65 per cent[17] times the opening balance of kept funds, is levied on the firm, increasing total tax payments by 0.22 per cent times 0.65 per cent the opening balance of existing funds. This income is not added to the pre-taxable income in the estimation, as it would then run the risk of being recycled in the current year's tax allowance, but is instead added directly to the tax base.

The overall tax bill for each year is then defined as:

[17] Calculated as the current government-borrowing rate times 0.72.

$$\text{TI}_{t} \text{ after carryforward} - \text{Allocation to } Periodiseringsfond_t + \text{Reversal of } Periodiseringsfond_{t-6} + Schablonintäkt_t$$

As regards the size and timing of allocations, empirical evidence on tax allocations reserves in the presence of imputed income is scattered, which in turn complicates assumptions. As the tax effect from imputed income is small, this is not likely to have material effect on the valuation of the tax shield. At the same time, it would be of substantive interest to explore how this imputed income affects the marginal tax rate as it, for some states of the world, may be what causes companies to refrain from this option. Hence, for the purpose of investigation, we assume that companies are value maximising and always allocate 25 per cent of their post-financing taxable income after reversal of any carryforwards to the tax allocation reserve of a given year. In a separate analysis, we then compare the difference between zero per cent allocation and maximum allocation.

### 5.4 Calculating the Entire Benefit Curve

Calculating the tax benefits of debt requires information about not only the marginal tax rate but the entire tax benefit function. This is defined by a series of marginal tax rates, with each rate corresponding to a specific level of interest deductions (calculations of the marginal tax rates are conducted as described above).

For small interest deductions, the tax function is generally flat but, because tax rates fall as interest expense increases, it eventually becomes downward sloping as interest increases. This occurs because interest deductions reduce taxable income, which decreases the probability that a firm will be fully taxable in all current and future states, in turn reducing the tax benefit from the incremental deductions. Integrating to determine the area under the entire tax benefit function allows a quantification of the gross tax advantage of debt.

To estimate a benefit function, marginal tax rates are calculated based on different interest levels. For example: for a company that pays no interest, the $\text{MTR}_{\text{it}}^{0\%}$ for firm i in year t and is thus the marginal tax rate that would apply if the firm's tax liability was based on before-financing income.

Using this method marginal tax rates are estimated based on interest deductions equal to 0 – 500 per cent of actual interest expense with 20 per cent intervals and then 500 – 10,000 per cent of actual interest expense with 500 per cent intervals. Interest deductions are varied ceteris paribus, whereafter the sequence of marginal tax rates are used to map out a tax benefit curve that is a function of the level of interest deductions. We set these steps partially based on the approach put forward by Graham (2000) and partially based on a trial and error approach to capture as much of the relevant parts of the benefit curves as possible, i.e. chose interest deduction levels that allow us to calculate 'kinks' for most of the firms in our sample.

### 5.5 Present Value of the Tax Benefit of Debt

Having mapped out the tax benefit curves, we integrate below the benefit curves until the point where the 100 per cent interest to obtain an estimate of this years tax benefit. To calculate the full value we, in accordance with Graham (2010) assume that the tax benefit for the current year is expected to be perpetual; in other words, for a gross benefit of 5 per cent of book value would occur if the annual benefit was 0.5 per cent and the discount rate was 0.10. Again, we use the weighted 2015 average of Bloomberg's SEK investment grade Scandinavian Corporate Bond Index.

# 6 Results and Discussion

In the following section we will provide an overview of the main results derived when simulating marginal tax rates for our selected sample of Swedish firms. Each marginal tax rate across the benefit curve is based on 100 simulations per firm, which is double the amount of simulations that Graham (2000) uses for the original study. Nonetheless, some variation among the simulated tax rates is observed when re-running simulations. Thus, a trade-off between simulation time and accuracy should be established.

## 6.1 Corporate Marginal Tax Rate Estimates

Taxable income for 2015 is used as a starting point to deduct 100 per cent of interest, i.e. the actual interest expense faced in 2015, to simulate 100 distinct taxable income streams 40 years into the future. Each forecast of taxable income is based upon the firm-specific mean and variance of changes in taxable income. Consequently, a firm with volatile earnings will experience net operating losses and utilise the allocation in the tax allocation reserve to shield income more frequently across the 100 estimates, than would a company with stable positive earnings. In other words, firms with volatile earnings are likely to have a marginal tax rate lower than the top statutory tax rate as the interest deduction is substituted by these non-debt tax shields. At the same time, firms with higher marginal tax rates will, in theory, have greater incentives to issue debt, relative to low marginal tax rate firms as they can take full advantage of interest deductibility (Graham, 1996a).

Furthermore, a ramp up period of six years based on the historical taxable income from 2009 – 2014 is used to accumulate net operating losses and make six full allocations to the tax allocation reserve. It is important to note that due to the lack of a geographical split, the estimated taxable income reflects a firm's worldwide taxable income as assumed by Shevlin (1990) and Graham (1996a). Tax payables are estimated by applying the Swedish statutory tax rate. Consequently, this assumes that both domestic and foreign income is subject to the same rate. This is a potential caveat to consider in relation to the results, as some firms included in the sample may have overseas operations subject to other tax regimes.

Figure 1 illustrates the empirical distribution of the marginal tax rate. Overall, we find that approximately 62 per cent of the firms in our sample have a marginal tax rate close to the statutory tax rate (within the range of 20 – 22 per cent). Around 8 per cent of the sampled firms have a marginal tax rate of or close to zero. This bracket mainly represents unprofitable firms with negative historical taxable income. The remaining firms in the sample, approximately 29 per cent, operate with a marginal tax rate of less than the top statutory tax rate meaning that these firms are expected to be profitable in some scenarios of the future and loss making in others. The implication is that these firms experience increased probabilities of not being able to realise full interest tax shields even when earning only an increment extra.

**Figure 1: Empirical Distribution of the Marginal Tax Rate**

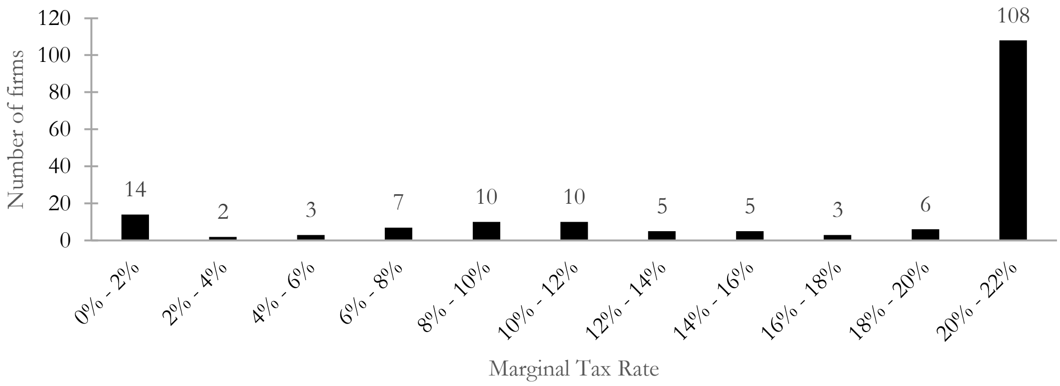



Table 3 presents selected percentile, mean and standard deviation of the cross-sectional distribution of estimates. Effective tax rates are mainly included for descriptive purposes following Shevlin (1990). These rates are sometimes used as proxies by researchers for the marginal tax rate – with mixed results as Graham (1996b) demonstrates. Furthermore, the bottom part of Table 3 breaks down the calculated marginal tax rates based on size and industry groups. From a firm size perspective, average marginal tax rate seems to be declining with firm size, indicating that the benefits of debt may be less valuable for smaller firms given that they are not able to realise full benefits. This is due to the carryforward and tax allocation features of the Swedish tax code, which imply that the full interest tax shields are not going to be realised in some states of the future. Smaller firms that experience volatile earnings will thus, on average, not be able to realise the full tax benefit when adding an additional krona of interest. Large Cap firms, on the other hand, are more likely to realise the full benefits of debt. As they exhibit more stable earnings, the likeliness of being profitable in future states increases, wherefore they, on the margin, can expect to realise a higher fraction of the tax shields for each additional krona[18].

[18] Comparing this to the summary statistics provided earlier, one could assume that debt levels and marginal tax rates are correlated. However, one needs to be careful with this inference, as it may be subject to endogeneity. Rather, Graham (1996a) argues that one should look at incremental financing decisions in favour of absolute debt levels.

Average marginal tax rates across industries differ substantially. For this scenario, Consumer Goods exhibit the highest average marginal tax rate of 19.22 per cent, while Health Care shows the lowest value of 13.52 per cent (excluding the Oil and Gas of 2.03 per cent, which is assumed to be skewed on account of only including two companies). In declining order Consumer Services show 15.51 per cent followed by Basic Materials of 15.27 per cent, Industrials of 18.22 per cent, Telecommunications of 17.98 per cent, and finally Technology of 17.68 per cent. Overall we see that volatile industries such as Technology and Healthcare, which in the Swedish case includes a number of early stage pharmaceutical and biotech firms, on average, tend to exhibit lower marginal tax rates. Firms in more stable industries such as Consumer Goods and Consumer Services have the highest tax rates, on average. This in line with Graham and Lemmon's findings (1998)[19]. Researchers have proposed several different explanations for this phenomenon. DeAngelo and Masulis (1980) state that firms experience unique cash flow distributions and capital structures because they utilise different amounts of non-debt tax shields, which can in turn be industry-related. Important to note, is that this explanation assumes that non-debt and debt tax shields[20] are substitutable. Alternatively, Graham (1996a) suggests that the primary explanation to the cross-sectional variation in debt tax shields is the cross-sectional differences in income distributions (i.e. the firm-specific volatility of earnings).

In conclusion, these figures provide an interesting contribution when reviewing whether industries experience industry-specific "optimal" capital structures. According to Graham (2010) an upward-sloping marginal cost curve intersecting the benefit function on its downward sloping portion in the point where marginal tax benefits equal marginal costs. This would imply that the industry-specific capital structure would be based on how fast its tax benefit function would slope downwards; which would in turn be based on the cash-flow characteristics of that industry. To the extent that cash-flow distributions experience different patterns across industries, but similar patterns within industries, industries can have industry-specific "optimal" capital structures.

[19] Even though their Compustat industry codes do not exactly match our Worldscope industry classification.
[20] As has been stated throughout this paper, debt-tax shields are exclusively the tax shields that arise when interest payments shield positive income from taxes. Non-debt tax shields are all other applicable tax shields, including net operating losses, tax allocations and the depreciation of other assets.

**Table 3: 2015 Corporate Marginal Tax Rate Estimates**

Effective tax rate is defined as income tax payable/pre-tax book income (TP/PTBI). If TP < 0 or PTBI < 0, the effective tax rate is set to zero. All data was downloaded from Thomson Reuters Worldscope. Firms with missing values for income tax payable are excluded from the effective tax rate calculation.

**Panel A: All firms pooled**

| Tax rate estimate | N | 25th Percent. | Median | 75th Percent. | Mean | St. Dev. |
|---|---|---|---|---|---|---|
| Effective | 110 | 1.83% | 9.01% | 17.63% | 11.84% | 12.72% |
| Marginal | 173 | 11.39% | 20.67% | 21.59% | 16.68% | 7.05% |

**Panel B: Firms classified by Size**

| Large Cap Firms | N | 25th Percent. | Median | 75th Percent. | Mean | St. Dev. |
|---|---|---|---|---|---|---|
| Effective | 42 | 2.98% | 9.51% | 20.01% | 14.38% | 14.80% |
| Marginal | 44 | 20.36% | 21.27% | 21.78% | 19.33% | 5.47% |
| **Mid Cap Firms** | **N** | **25th Percent.** | **Median** | **75th Percent.** | **Mean** | **St. Dev.** |
| Effective | 36 | 5.82% | 11.59% | 18.73% | 13.66% | 10.55% |
| Marginal | 48 | 20.15% | 21.21% | 21.74% | 18.88% | 5.57% |
| **Small Cap Firms** | **N** | **25th Percent.** | **Median** | **75th Percent.** | **Mean** | **St. Dev.** |
| Effective | 32 | 0.00% | 0.60% | 11.04% | 6.46% | 10.53% |
| Marginal | 81 | 8.73% | 15.31% | 21.25% | 13.93% | 7.62% |

**Panel C: Firms classified by Industry**

| Basic Materials | N | 25th Percent. | Median | 75th Percent. | Mean | St. Dev. |
|---|---|---|---|---|---|---|
| Effective | 6 | 1.28% | 4.88% | 12.99% | 6.83% | 7.04% |
| Marginal | 10 | 10.39% | 17.66% | 21.18% | 15.27% | 7.21% |
| **Consumer Goods** | **N** | **25th Percent.** | **Median** | **75th Percent.** | **Mean** | **St. Dev.** |
| Effective | 14 | 4.41% | 10.96% | 27.69% | 16.86% | 16.32% |
| Marginal | 18 | 20.50% | 21.21% | 21.52% | 19.22% | 5.73% |
| **Consumer Services** | **N** | **25th Percent.** | **Median** | **75th Percent.** | **Mean** | **St. Dev.** |
| Effective | 15 | 0.00% | 2.34% | 16.13% | 11.20% | 18.12% |
| Marginal | 21 | 9.51% | 20.34% | 21.79% | 15.51% | 7.59% |
| **Healthcare** | **N** | **25th Percent.** | **Median** | **75th Percent.** | **Mean** | **St. Dev.** |
| Effective | 15 | 0.00% | 3.15% | 17.41% | 11.43% | 13.91% |
| Marginal | 32 | 7.78% | 13.89% | 20.88% | 13.52% | 7.62% |
| **Industrials** | **N** | **25th Percent.** | **Median** | **75th Percent.** | **Mean** | **St. Dev.** |
| Effective | 42 | 6.69% | 10.92% | 19.63% | 13.50% | 9.90% |
| Marginal | 59 | 19.81% | 21.34% | 21.79% | 18.22% | 6.74% |
| **Oil & Gas** | **N** | **25th Percent.** | **Median** | **75th Percent.** | **Mean** | **St. Dev.** |
| Effective | 2 | - | - | - | 0.04% | 0.06% |
| Marginal | 2 | - | - | - | 2.03% | 2.87% |
| **Technology** | **N** | **25th Percent.** | **Median** | **75th Percent.** | **Mean** | **St. Dev.** |
| Effective | 13 | 0.00% | 2.47% | 14.30% | 7.49% | 9.89% |
| Marginal | 27 | 11.89% | 20.93% | 21.59% | 17.68% | 5.35% |
| **Telecommunications** | **N** | **25th Percent.** | **Median** | **75th Percent.** | **Mean** | **St. Dev.** |
| Effective | 3 | 0.73% | 2.00% | 18.74% | 7.16% | 10.05% |
| Marginal | 4 | 12.15% | 20.31% | 21.48% | 17.98% | 5.69% |

## 6.2 Tax Impact of the Periodiseringsfond

Despite the simplicity of its design, the impact from the untaxed reserve allocation on the marginal tax rate is not straightforward. Even the simplest allocation scenario has implications on the marginal tax rate. The key to this feature of the tax code lies in understanding that it provides two types of value attributes for the firm. First, due to the time value of money, it is valuable to the firm as it enables it to defer tax payments into the future, implying that the present value of the tax liability decreases. Secondly, this represents a value as firms are enabled to shield its allocations entirely from taxes if reversed during loss-making years. In order to illustrate the tax rate mechanisms provoked by the use of this feature we quantify the value maximising '*Periodiseringsfond'* strategy under four settings; (a) a profitable non-growing firm, (b) a profitable growing firm, (c) a profitable stagnating firm and (d) a profitable firm that becomes unprofitable.

Assume a firm in steady state with no growth that adopts a policy to allocate 25 per cent yearly (denoted $r_{allocation,t,}$ which is assumed to be constant over time, corresponding to $r_{allocation}$) to a '*Periodiseringsfond'*, which, if not utilised, is then held to maturity. The firm is profitable, with stable long-run earnings[21], $TI_t > 0$, that in expectation grow at the same rate *g* (which might take on any value) for each year and are taxed at a corporate tax rate, $\tau_{c,t}$ , that is assumed to be constant over time at rate $\tau_c$.

During the ramp-up period of six years, it will benefit from the allocation through a tax relief of: $\tau_c * r_{allocation} * TI_t$ per year. In the sixth year, when the first fund is due to be resolved, the firm will need to pay tax on its first allocation amounting to a face value of $\tau_c * r_{allocation} * TI_t$. Starting in year t=0, the net tax shielded in year $t \geq 6$ will thus be the current year's allocation less the current year's reversal; $Allocation_t$ - $Reversal_t$ = $(\tau_c * r_{allocation} * TI_t) - (\tau_c * r_{allocation} * TI_{t-6})$. The net present value of the strategy would thus be expressed as: $\sum((\tau_c * r_{allocation} * TI_t) - (\tau_c * r_{allocation} * TI_t))/(1+r_d)^6))/(1+r_d)^t$ , summing from t=0 to infinity.

Before continuing, it is important to note that taxes deferred into the future in the years *t = 0, 1, 2,…, 5* represent *actual cash value* for the firm, which is permanent *if the strategy is continued in infinity*, in the sense that their corresponding reversals in years t≥6 will be offset by new allocations. This value is realised in all of the following scenarios, and would, ceteris paribus, persist over time if the firm pursued its tax allocation strategy to infinity. Standing in *t=0*, it would thus be a value

[21] Earnings are in this case the taxable income of period t, TIt

maximising strategy for all companies to allocate a maximal amount to the untaxed reserve allocation[22,23].

(a) **Profitable non-growing firm:** Assuming that *g* equals zero, $TI_t$ will equal $TI_{t-6}$ for $t \geq 6$. As $r_{allocation}$ and $\tau_c$ are constants the net tax shielded due to tax allocations for $t=6$ is $Allocation_t$ - $Reversal_t$ = ($\tau_c$ * $r_{allocation}$ * $TI_t$) - ($\tau_c$ * $r_{allocation}$ * $TI_{t-6}$) = 0. As new allocations are always paired with reversals of the equivalent size, no new tax is shielded in the following periods and thus no additional value is created for the firm.

(b) **Profitable growing firm:** If $TI_t$ grows with rate *g* for each period, and $g > 0$, the tax shielded in $t \geq 6$ (assuming $r_{allocation}$ and $T_c$ are constant) is $Allocation_t$ - $Reversal_t$ = ($\tau_c$ * $r_{allocation}$ * $TI_t$) - ($T_c$ * $r_{allocation}$ * $TI_{t-6}$) = $\tau_c r_{allocation} TI_{t-6}$ * $((1+g)^6-1)$. This difference would be an actual positive cash realisation for the firm, which would hold for every following period. In a growing firm, the value of deferring taxes would therefore increase over time.

(c) **Profitable stagnating firm:** If $TI_t$ grows with rate *g* for each period, and $g < 0$, the tax shielded in $t \geq 6$ (assuming $r_{allocation}$ and $\tau_c$ are constant) is $Allocation_t$ - $Reversal_t$ = ($\tau_c$ * $r_{allocation}$ * $TI_t$) - ($\tau_c$ * $r_{allocation}$ * $TI_{t-6}$) = $T_c r_{allocation}$ ($TI_{t-6}$ * $(1+g)^6$)-1). This difference would be an actual negative cash realisation for the firm, which would hold for every following period. In a firm with positive but stagnating earnings, the value of deferring taxes would therefore decrease over time.

Lastly, we illustrate a scenario under which the firm in unprofitable, i.e. $TI_t < 0$.

(d) **Profitable firm that becomes unprofitable:** In the case of no growth, i.e. given that $TI_t = TI_{t-6}$ and $r_{allocation}$ and $T_c$ are constants the net tax shielded due to tax allocations for $t=6$ in the case that a firm suffers from losses, would imply full tax saving of ($\tau_{c,t}$ * $r_{allocation,t-6}$ * $TI_t$)/$(1+ r_d)^t$.

Hence, the impact from the untaxed reserve allocation on the simulated marginal tax rates is twofold. On one hand, the marginal tax rate is initially reduced as 25 per cent of taxable income (1) remains untaxed until the allocation is dissolved six years later or (2) is never taxed as it can be used to offset future losses. This means that even the most profitable firm is able to reduce its

[22] Assuming there are no costs of doing so. When the imputed income is introduced, the net present value is sometimes negative for profitable firms.

[23] The proof for this is provided in Appendix 2.

marginal tax rate by allocating to the untaxed reserve and making use of the time value of money simply by deferring 25% of its tax payment six years into the future.

We find that, on average, firms are able to reduce their marginal tax rate by 0.72 percentage points by strictly allocating 25 per cent of their taxable income to the fund for each year they are profitable. However, this effect is partially offset by the tax (*'Schablonintäkt')* that has to be paid on funds allocated to the *'Periodiseringsfond'*. Overall, assuming a '*Schablonintäkt'* of 0.65 per cent and keeping it constant over the forecasting period, we find that the net benefit of allocating to the '*Periodiseringsfond'* is reduced to 0.57 percentage points, on average. When adding an additional 1,000 SEK to determine the marginal tax rate, 25 per cent of these 1,000 SEK are, in our model, immediately allocated to the '*Periodiseringsfond'* if the respective firm has positive taxable income for 2015. Consequently, this additional allocation is taxed with 0.65 per cent times the statutory tax rate of 22 per cent increasing the overall tax bill again.

Regardless, the findings above are based on averages for the full sample of firms. When scrutinising specific companies, it becomes clear that with the *'Schablonintäkt'* it is not always a value maximising strategy to allocate to the untaxed reserve. This is especially true for profitable companies, which are not likely to utilise losses to shield these allocations, but only realise the time value of deferring taxes. The current *'Schablonintäkt'* fully offsets the time value gained from deferring taxes, which was illustrated in the examples.

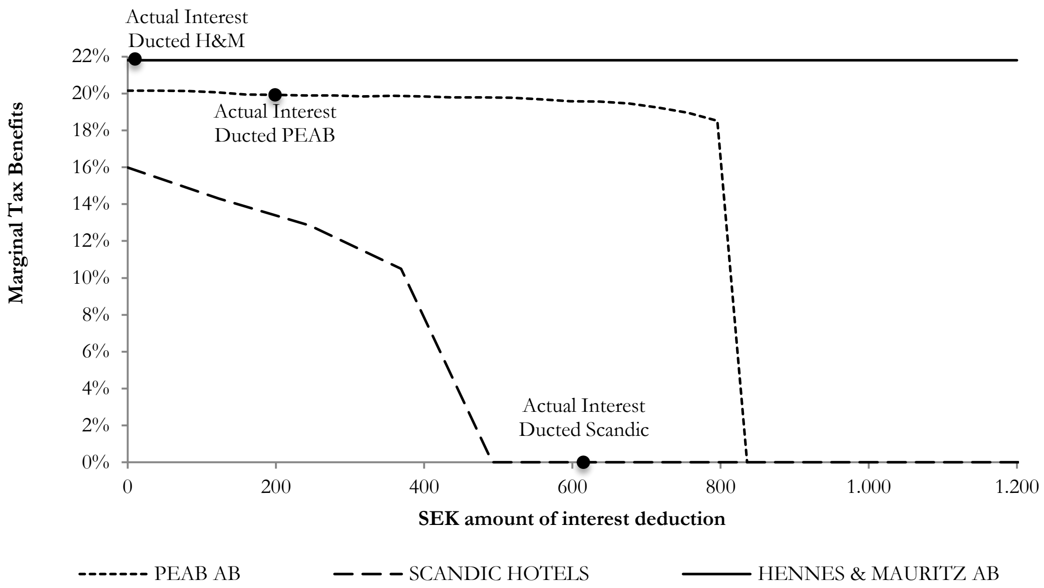
This holds for the marginal tax rate calculations as well – on the margin, tax payments increase due to the '*Schablonintäkt'*. 25 per cent of the incremental SEK 1,000 of taxable income added to calculate the marginal tax rate is allocated to the *'Periodiseringsfond'* in our calculations. This additional allocation increases the opening balance of the fund, which, in turn, increases the tax base through the *'Schablonintäkt'*. This effect is transmitted over time, as, the, now larger, fund is not consumed as fast in the first scenario. What can be noted is that the *'Schablonintäkt',* despite being categorised as income, is never recycled into the untaxed reserve, but added directly to the tax base.

The standard setter introduced imputed income to target profitable firms using the *'Periodiseringsfond'* as cheap financing. Our findings prove that the marginal tax increase caused by the Schablonintäkt, offsets the positive effects from the *'Periodiseringsfond'* for stable, profitable firms. Thus, this policy is successful in fulfilling its purpose of discriminating between profitable and unprofitable using the '*Periodiseringsfond'*.

### 6.3 Firm Specific Benefit Functions

As previously outlined, by calculating marginal tax rates for different levels of interest deduction, we are able to plot firm specific benefit functions of the marginal tax rate. To illustrate this, we plot full marginal benefit curves for a small sample of selected firms. Figure 2, shows the marginal benefit functions in 2015 for three distinct firms to illustrate that the value of the debt tax shield as well as debt conservatism can vary greatly across firms. For each firm we show their entire benefit function and highlight the actual level of interest deduction.

**Figure 2: Marginal Benefit Functions for Selected Firms**




We chose the clothing retailer H&M as an example for a company with a relatively low level of interest deductions, the civil engineering firm PEAB as an example of a firm with a fairly conservative deployment of debt financing (PEAB had an interest coverage ratio of 5.6x EBIT in 2015) and finally Nordic hotel chain Scandic as an example for a firm that uses debt more or less aggressively considering a very low interest coverage ratio of 0.8x EBIT. One should also note that Scandic underwent a leveraged buyout not too long ago.

Scandic Hotels had about SEK 615m in interest deduction in 2015. The firm's benefit function illustrates that it was, however, never able to realise full marginal benefits even starting from the first krona of interest. Once interest expenses went beyond SEK 490m, the marginal benefit for each additional krona even reached the zero benefit point. Furthermore, one can see that the benefit function is declining rather quickly the more interest is added. This occurs because as more interest is added, the likelihood of scenarios where Scandic is unable to use the tax benefit of incremental interest is increasing, therefore reducing its marginal tax rate. Moreover, there might be scenarios where the additional benefit is not realised in period 0 but in period one, two or later as existing carryforwards and allocations to the tax allocation reserve serve as tax shields. Averaging across the present value benefits of all of these scenarios, one arrives at expected marginal benefits below the statutory tax rate. To determine the value interest tax benefits, we integrate under the benefit function up to the point where it intersects with Scandic's actual interest payment. From this we derive that the tax benefit of SEK 615m of interest was worth about SEK 56m to Scandic in 2015. To derive a value for the overall tax benefit of debt if Scandic were to deploy the same financing policy, i.e. taking on SEK 615m of interest, in perpetuity, we use the perpetuity formula and find that this would add around SEK 4.3bn of value to Scandic in 2015. Given that Scandic had a market valuation of SEK 10.6bn in the end of 2015, the tax benefits of debt were worth approximately 41 per cent of firm value. While this number appears to be fairly high, Graham provides figures of the same range for e.g. Safeway, which also underwent a leveraged buyout (Graham, 2001).

Figure 2 also shows the marginal benefit function for PEAB. Performing the same calculations as before for this firm, we derive that the tax benefit of SEK 199m in interest was SEK 40m in 2015 or around SEK 3.0bn in perpetuity. We also note that in contrast to Scandic, PEAB's marginal benefit function is only marginally downward sloping and only starts to significantly drop at a value of SEK 796m in interest payments, which is around 4 times PEAB's current interest payment. Nonetheless, despite a higher y-axis intersect (i.e. a higher pre-financing marginal tax rate) than Scandic, PEAB is also not able to realise full interest benefits of the top statutory tax rate implicating that there might still be some scenarios for the firm where it turns unprofitable in the future.

The last benefit curve we present in the graph is for H&M in 2015. Despite being much larger and more profitable than the two firms presented before, H&M took only SEK 10m in interest deduction, which basically means zero leverage. Yet, its marginal benefit curve is virtually flat implying that H&M could enjoy full marginal benefits even if it increased its interest payments by 10 or even twenty times. The low use of the interest deductions is also illustrated in the total value of the debt tax shield, which in H&M's case is less than one per cent of the market value of the firm.

The three tax benefit curves presented above are a good example for how debt conservatism can vary greatly across firms. The trade-off theory of capital structure choice would tell us that e.g. PEAB and H&M must face higher costs of debt, which causes them to choose a more conservative debt policy than for example Scandic. However, especially H&M also serves as a good initial reference point for that debt conservatism is in fact most prevalent amongst the most profitable firms, a finding also confirmed in Graham's 1996a research. This could be a reflection of that firms do not use debt if they have sufficient profits to fund their operations as suggested by the pecking order theory. This phenomenon is also sometimes dubbed the 'zero-leverage mystery', see for example Strebulaev and Yang, 2013.

In the next two sections, we expand our analysis presented above to our entire sample and give an overview on how big the tax value benefits of debt are in our sample. We also use the point where the benefit function visibly begins to decline – the point that Graham (2000) calls the kink of the function – to assess how aggressively the sampled firms use debt.

## 6.4 Aggregate Tax Benefits of Debt

As illustrated in the previous section, the value of the tax benefit of debt is equal to the area under a firm's benefit function up to the point of actual interest expense. Overall the annual reduction in taxes due to interest deductibility for our sample of 173 firms is estimated to be 4.4bn SEK in 2015. Capitalising this benefit leads to a value of 335.4Bn SEK across all firms. This understates the savings for the entire Swedish economy by far as our sample of firms is far from reflection the entire universe of Swedish firms. On average, the gross benefit of debt is around 9.8 per cent of book value and 9.0 per cent of market value for our selected sample. These findings are very much in line with Graham (2000) who estimates a gross benefit of 9.7 per cent of firm value**Error! Reference source not found.** further breaks down the calculated tax benefits by firm size and industry groups. When looking at averages across firm size, we find no major difference in terms of book leverage. Benefits measured as of market value are slightly more spread out ranging between 7.6 per cent for Large Cap firms, 8.5 per cent for Mid Cap firms to 10.3 per cent for Small Cap firms. From an industry perspective, gross tax benefits are highest for firms operating in the Telecommunication, Consumer Goods, and Consumer services industries and lowest for firms within the Technology and Oil & Gas[24] sector.

[24] Again keeping in mind that the Oil&Gas sample is not representative

**Table 4: The Aggregate Gross Tax Benefit of Debt**

Gross benefit equals the area under each firm's gross benefit curve up to the point of actual interest expense aggregated across firms. All values in '000 SEK.

**Panel A: Aggregate Gross Tax Benefit all firms**

| | 2015 | | | Perpetuity | | |
|---|---|---|---|---|---|---|
| | **2015 Benefit** | **% of Assets** | **% of MV** | **PV Benefit** | **% of Assets** | **% of MV** |
| Mean | 25,399 | 0.13% | 0.12% | 1,938,850 | 9.76% | 8.98% |
| St. Dev | 77,466 | 0.16% | 0.16% | 5,913,463 | 11.97% | 12.12% |
| Median | 1,351 | 0.09% | 0.07% | 103,150 | 6.63% | 5.22% |

**Panel B: Aggregate Gross Tax Benefit by Size**

| | 2015 | | | Perpetuity | | |
|---|---|---|---|---|---|---|
| | **2015 Benefit** | **% of Assets** | **% of MV** | **PV Benefit** | **% of Assets** | **% of MV** |
| | | | **Large Cap** | | | |
| Mean | 87,491 | 0.13% | 0.10% | 6,678,684 | 10.18% | 7.58% |
| St. Dev | 134,609 | 0.12% | 0.08% | 10,275,514 | 8.84% | 6.05% |
| Median | 38,783 | 0.12% | 0.09% | 2,960,541 | 9.47% | 6.68% |
| | | | **Mid Cap** | | | |
| Mean | 9,405 | 0.14% | 0.11% | 717,974 | 10.81% | 8.48% |
| St. Dev | 22,072 | 0.19% | 0.16% | 1,684,873 | 14.32% | 12.21% |
| Median | 2,403 | 0.11% | 0.06% | 183,403 | 8.06% | 4.36% |
| | | | **Small Cap** | | | |
| Mean | 1,148 | 0.12% | 0.13% | 87,607 | 8.91% | 10.03% |
| St. Dev | 2,700 | 0.16% | 0.19% | 206,130 | 12.00% | 14.36% |
| Median | 318 | 0.07% | 0.07% | 24,257 | 5.22% | 4.98% |

**Panel C: Aggregate Gross Tax Benefit by Industry**

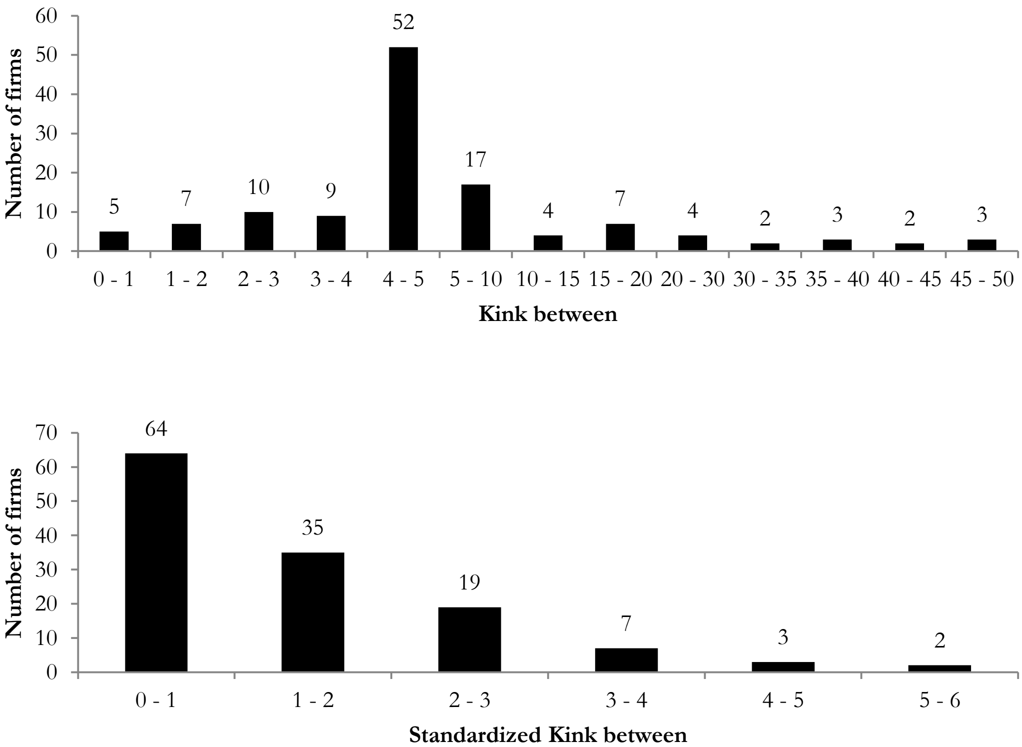
| | 2015 | | | Perpetuity | | |
|---|---|---|---|---|---|---|
| | **2015 Benefit** | **% of Assets** | **% of MV** | **PV Benefit** | **% of Assets** | **% of MV** |
| | | | **Basic Materials** | | | |
| Mean | 16,883 | 0.12% | 0.17% | 1,288,765 | 9.46% | 13.05% |
| St. Dev | 26,322 | 0.07% | 0.13% | 2,009,317 | 5.59% | 10.17% |
| Median | 2,767 | 0.12% | 0.11% | 211,220 | 8.80% | 8.64% |
| | | | **Consumer Goods** | | | |
| Mean | 27,799 | 0.16% | 0.13% | 2,122,037 | 12.23% | 10.22% |
| St. Dev | 55,781 | 0.15% | 0.12% | 4,258,063 | 11.27% | 9.09% |
| Median | 4,344 | 0.12% | 0.09% | 331,586 | 9.08% | 6.78% |
| | | | **Consumer Services** | | | |
| Mean | 13,854 | 0.14% | 0.19% | 1,057,594 | 10.84% | 14.32% |
| St. Dev | 27,405 | 0.15% | 0.23% | 2,092,013 | 11.76% | 17.88% |
| Median | 2,179 | 0.09% | 0.07% | 166,370 | 6.51% | 4.98% |
| | | | **Healthcare** | | | |
| Mean | 10,246 | 0.13% | 0.09% | 782,114 | 9.64% | 6.52% |
| St. Dev | 32,912 | 0.23% | 0.15% | 2,512,391 | 17.60% | 11.51% |
| Median | 281 | 0.06% | 0.02% | 21,468 | 4.76% | 1.61% |
| | | | **Industrials** | | | |
| Mean | 34,200 | 0.13% | 0.12% | 2,610,695 | 10.00% | 9.16% |
| St. Dev | 87,596 | 0.14% | 0.16% | 6,686,701 | 10.99% | 12.50% |
| Median | 4,446 | 0.12% | 0.08% | 339,389 | 9.11% | 5.74% |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Oil & Gas** | | | | | | |
| Mean | 14,718 | 0.05% | 0.04% | 1,123,502 | 3.77% | 3.26% |
| St. Dev | 20,341 | 0.03% | 0.00% | 1,552,768 | 2.46% | 0.16% |
| Median | 14,718 | 0.05% | 0.04% | 1,123,502 | 3.77% | 3.26% |
| **Technology** | | | | | | |
| Mean | 12,750 | 0.09% | 0.07% | 973,265 | 7.09% | 5.36% |
| St. Dev | 55,920 | 0.12% | 0.11% | 4,268,668 | 9.26% | 8.39% |
| Median | 372 | 0.06% | 0.04% | 28,426 | 4.46% | 3.11% |
| **Telecommunications** | | | | | | |
| Mean | 178,630 | 0.16% | 0.12% | 13,635,845 | 12.06% | 9.42% |
| St. Dev | 307,508 | 0.10% | 0.09% | 23,473,881 | 7.36% | 6.91% |
| Median | 38,760 | 0.15% | 0.12% | 2,958,766 | 11.75% | 9.12% |

## 6.5 Debt Conservatism in Swedish Firms

To quantify how aggressive Swedish firms make use of debt, one can use what Graham (2000) describes as the kink in the tax benefit function, i.e. the point where marginal benefits begin to decline and therefore the function begins to slope downward. More specifically, he defines the kink as 'the ration of the amount of interest required to make the tax rate function slope downward to the actual interest expense'. Intuitively, the kink is the level of interest expense expressed as a multiple of current interest expense where a company begins to realise less than its maximum tax shield on an incremental SEK of interest. This means, if the kink is greater than one, a firm operates on the flat part of the benefit curve and is able to achieve full marginal benefits when increasing its debt levels. At this point, note however that the firm-specific full marginal benefits do not necessarily have to be at the top statutory tax rate as illustrated earlier in section 6.3. A kink smaller than one implies that a firm is operating on the downward-sloping part of its tax benefit function and is therefore using debt more aggressively because it is already experiencing reduced tax benefits. More practically, Graham (2000) defines the kink as the point where the tax benefit first declines by at least 50 basis points from one interest increment to the next. Graham (2000) also notes that firms have large kink values if they use debt conservatively. For this to be true, he argues, firms with large kinks should remain on the flat part of their benefit function even if earnings are impacted by a negative shock. To estimate the length of the flat part of the benefit curve per unit of earnings volatility, Graham (2000) therefore uses a standardised measure of the kink dividing interest expense at the kink by the standard deviation of earnings. The interpretation of this measure is fairly straightforward. A firm with a current interest deduction of 1,000 SEK, a kink of 4 and an earnings standard deviation of 2,000 SEK would have a standardised kink of 2 meaning that earnings can deviate by up to two standard deviations before the firm operates on the downward sloping part of the curve. Figure 5 illustrates that the large majority of firms in our sample have kinks between 4 – 5, meaning that they could increase their interest expense up to 4 - 5 times before leaving the maximum marginal benefits part of the curve. However, this does not mean that they could necessarily sustain a large negative shock to their earnings and still operate on this part of the curve as illustrated by the bottom part of Figure 5, which shows the kink measure standardised by earning volatility. By far more than half of the sampled firms have benefit functions with less than two standard deviations in length.

**Figure 3: Empirical Distribution of Kink and Standardised Kink Values**




Yet, as illustrated by Figure 6, we do not find a clear correlation between kink and standardised kink. When regressing standardised kinks from our sample on the rank kink measure, we compute a $R^2$ coefficient of c. 23 per cent. However, it can be seen in the chart that kinks are rather concentrated at the bottom of the chart and firms with a kink value of less than five are very likely to have a standardised kink between 0 and 2.5.

**Figure 4: Correlation between Kinks and Standardised Kinks**

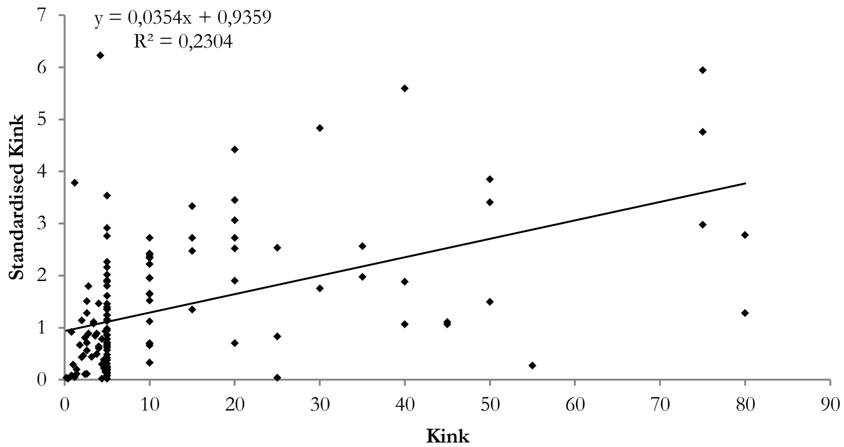



Table 5 **Error! Reference source not found.**provides a more detailed overview of the sample by size and industry classification. Overall we find that, on average, firms of all sizes and from all industries could add a substantial amount of debt and still realise full benefits as illustrated by an average kink of 12.8 for our sample, i.e. the average firm could use 12.8 times its current interest deduction before marginal benefits begin to decline. This number is substantially higher for our sample of Swedish firms compared to Graham's (2000) finding of 2.4 for the average US firm. One should note at this point that Graham caps the value of the kink at 8 for computational reasons, i.e. he does not simulate curves beyond that point and simply allocates a kink of 8 to any firm that does not show a downward sloping benefit curve by then (Graham, 2001). Consequently, one could assume that his sample may be potentially skewed downward as c. 13 per cent of his observations take on a value of 8. Furthermore, we find that around 3 per cent of the sampled firms already operate on the downward sloping part of the curve and can therefore be seen as using debt aggressively as they already cannot realise full marginal benefits. Compared to Graham's findings for the US, Swedish firms appear to be slightly more conservative as he finds around 33 per cent of the sampled US firms to be operating on the downward sloping part. Overall, our results are, however, in line with Graham's results suggesting that a substantial fraction of firms could add significant amounts of debt to their capital structure and receive incremental interest tax benefits at their top marginal tax rates. Table 5 breaks down our findings again by firm size as well as industry groups. Here we find that Mid and Small Cap firms, on average, appear to be more conservative regarding their debt policy when looking at it from an interest cost perspective. The standardised kink suggests, however, that small cap firms operate closest to the kink once it is standardised by volatility of earnings. This is somewhat contradictory as it would suggest that they are the least conservative when it comes to facing negative shocks to

earnings. From an industry perspective, the technology companies in our sample appear to be using debt the most conservatively. At the same time, this is also the industry that achieves the smallest benefits measured by a percentage of book and market value. On average, firms within Basic Materials and Oil & Gas use debt the least conservatively.

**Table 5: Summary Statistics the 'Kink'**

Kink is calculated by dividing the interest expense level at the point where the benefit becomes downward sloping by actual interest expenses. The benefit function is said to be downward sloping at the point where it first declines by at least 50 basis points from one interest increment to the next. Standardised Kink is SEK of interest associated with the kink divided by the standard deviation of earnings. Analysis excludes firms (n=15) with interest payments of less than 100,000 SEK as their benefit curves are likely to be distorted due to the low interest payments.

| **Panel A: All Firms** | | | | |
|---|---|---|---|---|
| | **All Firms** | | | |
| | **Mean** | **Median** | **Min** | **Max** |
| Kink | 12.8 | 5.0 | 0.2 | 80.0 |
| Standardized Kink | 1.4 | 1.1 | 0.0 | 6.2 |
| **Panel B: 'Kink' by Size** | | | | |
| | **Large Cap** | | | |
| | **Mean** | **Median** | **Min** | **Max** |
| Kink | 10.4 | 5.0 | 2.2 | 75.0 |
| Standardized Kink | 1.7 | 1.5 | 0.3 | 4.8 |
| | **Mid Cap** | | | |
| | **Mean** | **Median** | **Min** | **Max** |
| Kink | 15.7 | 5.0 | 1.2 | 75.0 |
| Standardized Kink | 1.6 | 1.1 | 0.0 | 4.8 |
| | **Small Cap** | | | |
| | **Mean** | **Median** | **Min** | **Max** |
| Kink | 12.1 | 5.0 | 0.2 | 80.0 |
| Standardized Kink | 1.1 | 0.6 | 0.0 | 6.2 |
| **Panel B: 'Kink' by Industry** | | | | |
| | **Basic Materials** | | | |
| | **Mean** | **Median** | **Min** | **Max** |
| Kink | 8.0 | 5.0 | 0.4 | 20.0 |
| Standardized Kink | 0.9 | 0.7 | 0.0 | 3.3 |
| | **Consumer Goods** | | | |
| | **Mean** | **Median** | **Min** | **Max** |
| Kink | 8.0 | 5.0 | 1.2 | 40.0 |
| Standardized Kink | 1.3 | 1.3 | 0.0 | 3.5 |
| | **Consumer Services** | | | |
| | **Mean** | **Median** | **Min** | **Max** |
| Kink | 10.6 | 5.0 | 0.2 | 75.0 |
| Standardized Kink | 1.0 | 0.7 | 0.0 | 3.1 |
| | **Healthcare** | | | |
| | **Mean** | **Median** | **Min** | **Max** |
| Kink | 13.8 | 5.0 | 1.2 | 75.0 |
| Standardized Kink | 1.3 | 0.9 | 0.1 | 5.6 |

| | Industrials | | | |
|---|---|---|---|---|
| | **Mean** | **Median** | **Min** | **Max** |
| Kink | 12.4 | 5.0 | 1.4 | 50.0 |
| Standardized Kink | 1.7 | 1.5 | 0.1 | 6.2 |
| | **Oil & Gas** | | | |
| | **Mean** | **Median** | **Min** | **Max** |
| Kink | 20.0 | 20.0 | 20.0 | 20.0 |
| Standardized Kink | 3.4 | 3.4 | 3.4 | 3.4 |
| | **Technology** | | | |
| | **Mean** | **Median** | **Min** | **Max** |
| Kink | 19.4 | 5.0 | 1.0 | 80.0 |
| Standardized Kink | 1.5 | 0.8 | 0.1 | 5.9 |
| | **Telecommunications** | | | |
| | **Mean** | **Median** | **Min** | **Max** |
| Kink | 16.3 | 5.0 | 5.0 | 50.0 |
| Standardized Kink | 1.5 | 1.1 | 0.6 | 3.4 |

## 6.6 Areas of Further Research

The main aim and contribution of this paper is to translate the Swedish tax code into a set of clear rules making it possible to apply Graham's simulation approach to ultimately determine the value of tax shields provided to Swedish firms. After this initial step has been taken, we see room for a substantial amount of further research. Firstly, as was outlined in the literature review, the benefits of debt should reviewed in relation to the associated costs. Given the complexity of the task to value the benefits, we have factored out firm specific costs from the analysis at this point. However, it would of course be valuable to perform a firm specific analysis to determine what types of firms have the largest tax benefits of debt considering firm-specific cost of debt factors.

Furthermore, Sweden has undergone substantial tax reforms in the course of the 1990's. While this thesis assesses the benefits as of 2015, it could also be of interest to see how the benefits have changed over time mimicking the changes in the Swedish tax code such as the elimination of investment allowances and declining corporate statutory tax rates.

Finally, further research of value maximising strategies for tax allocation to the Tax Allocation Reserve that explicitly accounts for imputed income is potentially worth exploring.

# 7 Conclusion

This paper attempts to determine the value of tax savings provided to Swedish firms through the tax deductibility of interest payments. While the existence of such benefits was acknowledged by Modigliani and Miller as early as 1963, valuing them properly has proven to be much more difficult and their contribution to the decision to issue corporate debt has yet to be fully confirmed. Using a simulation approach based on accounting data, originally brought forward by Graham (2000), we calculate firm-specific marginal tax benefit functions to value interest tax shields. In the context of the proposed changes to the Swedish corporate tax code, which would abolish interest deductibility, this approach is particularly interesting as it allows inference on a firm and industry level.

By integrating under the derived firm-specific benefit functions, tax savings due to interest deductibility for the selected sample of firms is estimated to approximately SEK 4.4bn for 2015 alone. Nevertheless, this figure is not aiming to be representative for the entire Swedish economy as our sample of selected firms does not reflect the entire universe of Swedish firms. Importantly, we find that the capitalised tax-reducing benefit of interest amounts to 9.8 per cent of book value and 9.0 per cent of market value, in line with Graham's (2000) findings for US firms. Moreover, it is found that marginal tax rates and associated tax benefits vary along the dimensions of firm size and across industries. Finally, we infer how aggressively firms use debt by observing where they are located on their interest benefit functions. We find that a majority of the sampled firms deploy debt conservatively and operate on the flat part of their tax benefit function meaning that they could increase the amount of their interest payments on average by 13 times without experiencing a decline in marginal benefits. Conversely, these findings are less pronounced when standardising earnings volatility showing that the average firm only operates approximately 1.4 standard deviations of earnings away from the downward sloping part of their benefit curve.

One of the key contributions is the adaption of Graham's (2000) approach into the Swedish setting as tax credits provided under the Swedish tax code differ from the US setting. In particular, unlimited net operating loss carryforwards as well as tax allocation reserves are incorporated in order to accurately determine the fraction of tax savings attributed to interest deductibility. Furthermore, subject to a set of constraints, optimal allocation strategies for the Tax Allocation Reserve are derived. Especially, we show how the effects of imputed income impacts on marginal tax rates, limiting the use of this tax feature among stable, non-loss making firms. This confirms the adequacy of the imputed income feature, as the effects are in line with what is desired by the standard setter.

Nonetheless, as outlined in the literature review, there are costs as well as non-tax benefits associated with debt financing that were not factored into the presented analysis. To fully understand the prevailing debt conservatism, it would be interesting to determine the net contribution of debt financing to firm value after accounting for these costs and benefits.

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# 9 Appendix

### Appendix 1: Comparison of Key Assumptions of the Simulation Approach

The following table gives a detailed summary of how the approach applied in this thesis differs from the simulation approach developed by Graham (2000). Most alterations are due to differing features of the US and Swedish tax code.

| | Graham's Approach | Swedish Context |
|---|---|---|
| **Carryback Features of the tax code** | - Losses can be carried back to offset positive taxable income of the preceding 3 years and are made as soon as possible<br>- If current losses more than offset taxable income of the previous 3 years, the excess loss is carried forward | - No full carryback feature but ability to allocate up to 25% of taxable income after exhaustion of NOLs to a year-specific untaxed reserve fund (Periodiseringsfond)<br>- Income allocated to each fund can be used to shield future profits<br>- Individual funds must be dissolved after 6 years if not partially or fully used<br>- Imputed income tax of 0.65 on the opening balance of each reserve fund |
| **Carryforward features of the tax code** | - Carryforward of losses up to 15 years in the future<br>- Carryback feature takes priority | - Unlimited loss carryforward feature<br>- Income first shielded by untaxed reserve allocations; once these are exhausted, accumulated NOLs are used to shield excess positive taxable income |
| **Investment Tax Credit** | - Accumulation of investment tax credit of c. 7% of capital investment until 1986<br>- Ability to carryforward/-back ICT of 15 respectively 3 years | - Not applicable in Sweden |
| **Alternative Minimum Tax (ATM)** | - Flat alternative minimum tax of 20% for firms with taxes owned as the minimum of taxes determined from regular formulas and those determined by the ATM formula | - Not applicable in Sweden |
| **Tax Rate** | - Progressive statutory US tax schedule of each year | - Flat 22% statutory tax rate |

| Cont'd | Graham's Approach | Swedish Context |
|---|---|---|
| **Discount Rate** | - Moody's average corporate bond yield | - Bloomberg's SEK investment grade Scandinavian Corporate Bond Index |
| **Forecasted taxable income** | - Forecast of 18 years into the future considering the 15 year carryforward and 3 year carryback period | - Forecast of up to 40 years considering diminishing present value of unlimited carrryforward feature |
| **Historic NOLs** | - 7-year ramp up period to accumulate NOLs<br>- Use of Computstat data where available otherwise zero | - 6-year ramp up period to accumulate NOLs matching Periodiseringsfond ramp-up<br>- Initial year set to zero due to lack of data |
| **Simulation runs** | - 50 | - 100 to improve stability of results |
| **Percentage levels of interest deduction** | - 15 distinct levels of interest deduction reaching up to 80 times interest deduction<br>- Cap of 'kink' at 8 | - 45 distinct levels of interest deduction reaching up to 1,000 times actual interest deduction to fully capture the downward sloping part of the benefit curves for most of the sample firms |

## Appendix 2: Derivation of the Net Present Value of the a Tax Allocation Reserve

In the following section we derive the net present value of a tax allocation reserve, showing that for each possible state the net present value is positive.

*Assuming that*

$$\tau_{c,t} = \tau_c;\ r_{allocation,t} = r_{all}$$

*and given that*

$$TI_t = TI_0(1+g)^t \textit{ for all } TI_t \geq 0$$

*The following applies*

$$\sum_{t=0}^{\infty} \frac{\tau_c r_{all} TI_t - (\tau r_{all} TI_t)/(1+r_d)^6}{(1+r_d)^t} =$$

$$= \tau_c r_{all} \sum_{t=0}^{\infty} \frac{TI_t\left(1 - \frac{1}{(1+r_d)^6}\right)}{(1+r_d)^t} =$$

$$= \tau_c r_{all} \sum_{t=0}^{\infty} \frac{TI_t}{(1+r_d)^t} =$$

$$= \tau_c r_{all} TI_t \left(1 - \frac{1}{(1+r_d)^6}\right) \sum_{t=0}^{\infty} \frac{(1+g)^t}{(1+r_d)^t} =$$

$$= \tau_c r_{all} TI_t \left(1 - \frac{1}{(1+r_d)^6}\right) \frac{1}{1 - \frac{(1+g)^t}{(1+r_d)^t}} =$$

$$= \tau_c r_{all} TI_t \left(1 - \frac{1}{(1+r_d)^6}\right) \frac{1+r_d}{r_d - g}$$

*Conditional on*

$$\left|\frac{1+y}{1+r_d}\right| < 1 \textit{, since } \sum_{k=0}^{\infty} z_k = \frac{1}{1-z} \quad \textit{if} \quad |z| < 1\textit{, as} \quad \sum_{k=0}^{\infty} z_k = \frac{1-z^{n+1}}{1-z}$$