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The Zero Leverage Mystery

An Empirical Study of Norwegian Firms

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Abstract

The objective of this thesis is to document the puzzling evidence of Norwegian firms, both public and private, following a zero leverage policy. We have examined accounting data for all Norwegian firms in the period from 1993 to 2010. One of the most interesting findings from our study is that 19.1% of all private firms in the whole period had zero outstanding debt, which is more than twice as high when compared to public companies. Our results show that 29.2% of the private firms also had less than 5% book leverage, which is almost three times the rate for public firms. We found that zero leverage firms are smaller, more profitable, have larger cash balances, pay more dividends, have higher ratings, less tangible assets and they pay more taxes compared to firms with leverage. Firms are most profitable in the year they become zero leveraged, which is also the year they have the largest cash balances (as a ratio of total assets). Further on we find that zero leveraged firms differ quite substantially among themselves, especially when we compare dividend payers versus non-dividend payers. Our results indicate that zero leverage may be a persistent phenomenon, with almost 26% of zero leverage firms refraining from debt for at least 8 consecutive years.

Keywords: Leverage, low/zero leverage, debt, capital structure, finance, financing.

Preface

This thesis was written as a part of our master degrees at the Norwegian School of Economics (NHH), and corresponds to one semester of full-time studies.

Our interest for the particular theme of the thesis started as a curiosity of why Apple Inc. chose to have zero debt while all the capital structure theories we knew about at the time would suggest a higher debt ratio for such a company. Our supervisor showed us some recent articles on the theme, which started our fascination for the zero leverage mystery.

Our work with this thesis has been both challenging and rewarding, not to mention a huge learning experience. The choice of working together was an easy one to make, as we have known each other for some time and are both interested in the same fields within financial economics. We believe our collaboration, through discussions and mutual feedback, has strengthened our work, and been especially beneficial when we have met difficult challenges along the way.

We hope this thesis will contribute to the interesting field of corporate finance, and that it will shed light on the zero leverage mystery with regard to Norwegian firms.

We would like to thank SNF (Institute for Research in Economics and Business Administration) for providing us with the necessary data.

Last, but not least, we would to like express our sincere gratitude to our supervisor Michal Kisser for support and valuable feedback throughout the process.

Bergen, June 14th 2013.

Fredrik Bruskeland **Alexander C. C. Johansen**

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1 Introduction

In 1958 Franco Modigliani and Merton H. Miller published a well known, and often cited, article called *"The Cost of Capital, Corporation Finance and the Theory of Investment"*. The model outlined in this article suggested that capital structure is irrelevant for the value of a firm in perfect capital markets. However, when they include corporate taxes they find that an increase in debt will increase the firm value due to the fact that interest payments are tax deductible, and dividends are not.[1] This article formed the basis for modern thinking on capital structure and has been an important inspiration for other famous capital structure theories such as the trade-off theory and the pecking order theory. These theories have received different kinds of criticism, but perhaps the most important being the observation that firms seem to be too conservative in their use of debt. Graham (2000) finds for instance that the typical firm could double its tax benefits by issuing more debt.

Although this low leverage puzzle is interesting, recent studies of capital structure have shed light on a nother puzzling phenomenon, which we find even more interesting. Strebulaev and Yang (2013) call this phenomenon *"the zero-leverage puzzle"*, and the puzzle is that a high fraction of firms choose to have zero outstanding debt. Such extreme debt conservatism cannot be explained by existing capital structure theories, and a study of this puzzle is therefore important to get a better understanding of financing decisions. Strebulaev and Yang (2013) find that between 1962 and 2009, on average 10.2% of large public non-financial US firms had zero outstanding debt, and 32% had zero or negative net debt. This is surprisingly high. They also find that 61% of firms with zero outstanding debt show no propensity to issue debt in the next year. Because the fraction of zero-leveraged firms is so high, they argue that the low-leverage puzzle can be replaced by the zero-leveraged puzzle. They back up this claim by showing that if you exclude all firms with a book leverage of less than 5% the average book leverage increases from 25% to 32%. Dang (2012) did a similar study on UK-firms and found that in the period between 1980 and 2007 the fraction of zero-levered firms was on average 12.18%.

[1] see MM (1958) and MM (1963)

Strebulaev and Yang (2013) also argue that studying zero-leverage behaviour can be advantageous from an empirical perspective, because the factors that lead firms to become low-levered are more likely to be dominating for zero-leverage firms.

1.1 Problems to address

In this thesis we focus on Norwegian companies and try to replicate parts of the study in Strebulaev and Yang (2013) and Dang (2012). To our knowledge, such an analysis has never been done on Norwegian companies before. In addition to studying public companies, we have extended the study to also include private companies in order to see whether there exists a difference between these two groups.

Throughout the thesis we will try to find out if there are significant differences in characteristics between levered and zero-levered firms, and we will also try to find economic mechanisms that drive companies to become zero-levered.

1.2 Limitations

One of the most important differences between this thesis and similar studies on zero-leverage firms is the use of proxies. Strebulaev and Yang (2013) construct a set of proxies for each zero-leverage observation, which they find by identifying up to four firms that have the same industry code and are the closest to the observed firm in size. They have no restriction on leverage, meaning that the proxies may also be firms with zero outstanding debt. They then compare characteristics between zero-levered firms and their proxies. A big advantage by using such kind of proxies is that they can conclude that differences in characteristics are not caused by differences in size or industry. Dang's (2012) study is similar; like Strebulaev and Yang (2013) he creates proxy firms, but at the same time he also compares zero-leverage firms with levered firms. Constructing these kinds of proxies is a complex process and beyond our knowledge. We have therefore chosen to only compare zero-/low- leveraged firms with levered firms. As a consequence we cannot make the same conclusions as Strebulaev and Yang (2013) and Dang (2012), but we still believe a comparison between levered and zero-levered firms can reveal important factors that may lead firms to adopt a zero-leverage policy.

Another limitation in our thesis is that our dataset does not provide us with market information such as market values and share repurchases. Both Strebulaev and Yang (2013) and Dang (2012) use the market-to-book ratio to reflect a firm's growth opportunities. Several theories such as Myers (1977) and DeAngelo et al. (2011) say that firms with high growth opportunities have less incentive to take on debt. This is therefore an interesting measure when comparing levered and unlevered firms. Share repurchases is an important measure to get an overview of a firm's total payout. Information about a firm's total payout is important to see whether zero-leveraged firms retain a higher fraction of their earnings to be able to fund future investments. Our dataset only provides us with dividends and we are therefore forced to use this as an approximation of total payout.

Finally we see it as a small limitation that there are few publicly listed companies in Norway. While Strebulaev and Yang (2013) have on average 4,129 firm observations in each year between 1987 and 2009, we have an average of 117 in our period. This makes it more difficult to find significant differences between leveraged and zero-leveraged public firms. However, as we will show, the most interesting part of our thesis is the study on private firms, and here we have a yearly average of 19,187 firm observations.

1.3 Structure

The thesis is structured as follows: Section 2 provides a presentation of some of the most important existing theories on capital structure. This section is meant to give an insight into why such a large fraction of firms choose to have zero outstanding debt can be called a mystery. Section 3 describes the methodology we have used in parts of our analysis, and section 4 explains the data set we have used. In section 5 we present the results of our analysis and section 6 concludes. Appendices are found at the end of the thesis.

2 Capital structure theory

The relative proportions of a firm's outstanding securities constitute its capital structure. When a firm needs new funds to undertake its investments it has to decide which type of security to issue to potential investors, the most common choices of financing being debt and equity. Even without the need for new capital a firm might still decide to acquire financing and use the raised funds to either repay debt or repurchase shares. In this section we present existing capital structure theory, research and empirical evidence to outline some of the most important considerations and choices firms have to make when deciding a capital structure, e.g. how such choices affect the valuation of the firm and its profitability. This section will then serve as a theoretical background in understanding why the decision to have zero leverage is in fact a mystery.

2.1 Capital structure irrelevance: Modigliani-Miller

Modigliani and Miller (from now: MM) (1958) argued that capital structure was irrelevant and would not affect a firm's value under a set of conditions referred to as perfect capital markets: 1) There are no taxes, transaction costs, issuance costs or arbitrage opportunities. 2) Commodities which can be regarded as perfect substitutes must sell at the same price in equilibrium. 3) The financing decisions of a firm do not change the underlying cash flows of its investments, nor do they reveal new information about them.

Under these conditions MM (1958) set forth a couple of propositions regarding firm value and the cost of capital.

2.1.1 Modigliani-Miller I

MM Proposition I: *"The market value of any firm is independent of its capital structure and is given by capitalizing its expected return at the rate p_k appropriate to its class." (Modigliani and Miller, 1958 p. 8)*

MM (1958) assumed that firms could be divided into equivalent return classes, denoted by *k*. The expected rate of return for each class is then denoted by p_k. Further

on, MM (1958) argued that the total cash flow generated by a firm's assets should equal the total cash flow paid out to the security holders of the firm. By the law of one price, the firm's outstanding securities and its assets must have the same market value. As the issuance of any type of security in a perfect capital market does not change the underlying cash flows of a firm's assets, the capital structure of the firm is irrelevant.

Should investors, for some reason, prefer a different capital structure than the firm, MM (1958) showed that they could create their own capital structure by borrowing or lending money on their own. This is called homemade leverage. Under the condition that the investors can borrow and lend money at the same interest rates as the firm, homemade leverage will act as a perfect substitute for any capital structure of the firm.

2.1.2 Modigliani-Miller II

MM Proposition II: *"The expected yield of a share of stock is equal to the appropriate capitalization rate p_k for a pure equity stream in the class, plus a premium related to financial risk equal to the debt-equity ratio times the spread between p_k and r." (Modigliani and Miller, 1958 p. 11)*

MM (1958) proposition II states that an all equity firm has an expected return, i_j, equal to p_k, while a leveraged firm has an expected return equal to $p_{k,}$ plus p_k minus the cost of debt, r, times that firm's debt to equity ratio, D_j/S_j. As the proposition holds for realized returns it also holds for expected return.

$$i_j = p_k + (p_k - r)D_j/S_j \qquad (1)$$

With proposition I MM (1958) showed that the value of a firm does not depend upon its choice of capital structure, rather it comes from the underlying cash flows of the firm's assets and the firm's cost of capital. The cost of debt and the cost of equity often differ quite a bit, the cost of debt usually being lowest. One might therefore think that increasing a firm's leverage ratio would lower the cost of capital and increase the value of the firm. MM (1958) proved that this is not the case, as adding

more debt (D_j) will increase the risk and therefore the cost the firm's equity (i_j). They showed that the savings gained from the lower cost of debt will be perfectly offset by the increased cost of equity, and subsequently the firm's weighted average cost of capital (WACC) will stay unchanged.

2.2 The effect of the interest tax shield: Modigliani-Miller

MM's propositions (I and II) provide useful insights into the world of corporate finance, however there is no such thing as a perfect capital market. Two market imperfections that are essential for firms are corporate taxes and the tax deductibility of interest payments. Combined, these two imperfections play a large role in determining the capital structure of firms.

Firms have to pay taxes on their earnings, but only after interest payments are deducted. This interest tax deduction will lower the amount of taxes the firm has to pay, assuming the firm has positive earnings, and thus there exists an incentive to use debt. Although interest payments will reduce the amount of cash available to the equity holders of the firm, the total amount of cash the firm can pay out to all its investors, the free cash flow to the firm (FCFF), will be higher due to the interest tax shield. A consequence of the firm's ability to pay out more cash to its investors is that it will have increased its value. This increase in value exactly matches the gain arising from the interest tax shield, which can be calculated each year as follows:

$$Interest\ tax\ shield = corporate\ tax\ rate * interest\ payments \quad (2)$$

The cash flow from a firm with leverage is equal to the cash flow from a firm without leverage plus the interest tax shield. By the law of one price the same must be true for the present values of these cash flows. In the presence of taxes MM (1958, 1963) showed that the value of a levered firm, V^L, would exceed the value of the firm without leverage, V^U, due to the present value of the tax savings from debt, *PV(TS)*.

$$V^L = V^U + PV(TS) \quad (3)$$

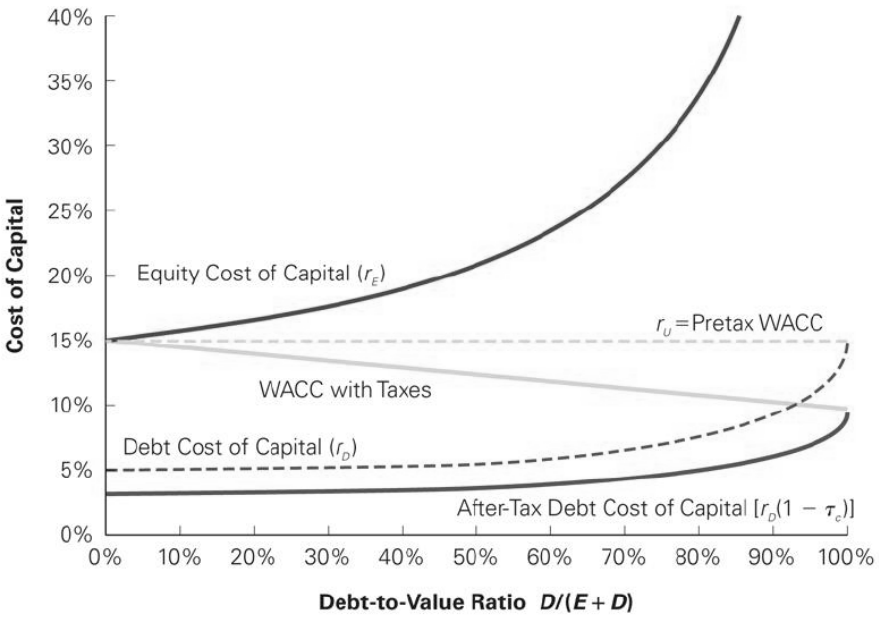

Figure 1: The WACC with and without corporate taxes

Figure 1 shows the weighted average cost of capital with and without taxes. The equity cost of capital increases with leverage, so does the debt cost of capital, but it does so at a lower rate. Without taxes the WACC is constant for all debt levels, and it equals the debt cost of capital when the firm is 100% debt financed. Taxes lower the debt cost of capital due to the interest tax shield, subsequently the WACC declines with increasing leverage. Source: (Berk and DeMarzo, 2011).

Equations (1) and (3) have become the building block of capital structure theory in most modern Corporate Finance Textbooks. Figure 1 illustrates the effect of leverage and corporate taxes on a firm's overall cost of capital. When computing the increase in a firm's value due to the interest tax shield one needs to make assumptions about future debt levels. As the debt policies of many companies often change these computations vary in their reliability. In order to simplify matters let us consider the case of a firm with permanent debt operating in a world with a constant marginal corporate tax rate. If we also assume that the debt is fairly priced, the value of the interest tax shield simply becomes the corporate tax rate times the market value of debt. With a corporate tax rate of 30% a firm which takes on $10 0m in new permanent debt will have increased its value by $30m.

Another way to look at the benefit of leverage is to calculate its effect on the firm's weighted average cost of capital. Since interest payments are tax deductible debt will in reality have a lower cost than the explicit rate at which the firm can borrow money.

This insight implies that an increase in the debt ratio of a firm will lower a firm's WACC. Consequently future cash flows will have a higher present value, which will match the present value of the interest tax shield.

2.3 Trade-off theory

As shown in the section above, Modigliani and Miller's (1963) model created a benefit for debt when corporate income tax was included. Since the model assumes that there are no costs associated with a change in leverage it suggests extreme debt levels. Such extreme debt levels are not observed in the real world and the model therefore needs to include some sort of offsetting cost of debt to be more realistic. Several different authors have presented theories that include different forms of such costs. The term trade-off theory has been used to describe these theories. They all have in common that the costs and benefits of alternative financing methods are evaluated by a decision maker who runs the firm. The optimal solution is found where the marginal costs equal the marginal benefits.

In this paper we divide the trade-off theories into two main categories; Static- and Dynamic trade-off theory. The former category consists of single period trade-off theories that do not recognize the role of time and assume that a firm's leverage is determined by a t rade-off between tax benefits and costs of bankruptcy. Dynamic trade-off theory also considers such a trade-off. However, at the same time, it recognises adjustment costs associated with refinancing and fluctuations in asset values over time.

2.3.1 Static Trade-off Theory

Kraus and Litzenberger (1973) provide a classic trade-off model where corporate taxes and bankruptcy costs are put into a single-period valuation model in a complete capital market. Their intuition is that for a certain level of leverage, the bankruptcy costs will equal the advantage of decreased taxes, and the value of the company is therefore maximised at this level. A simple mathematical explanation of their model is presented in equation (4).

$$V^L = V^U + PV(TS) - PV(BC) \qquad (4)$$

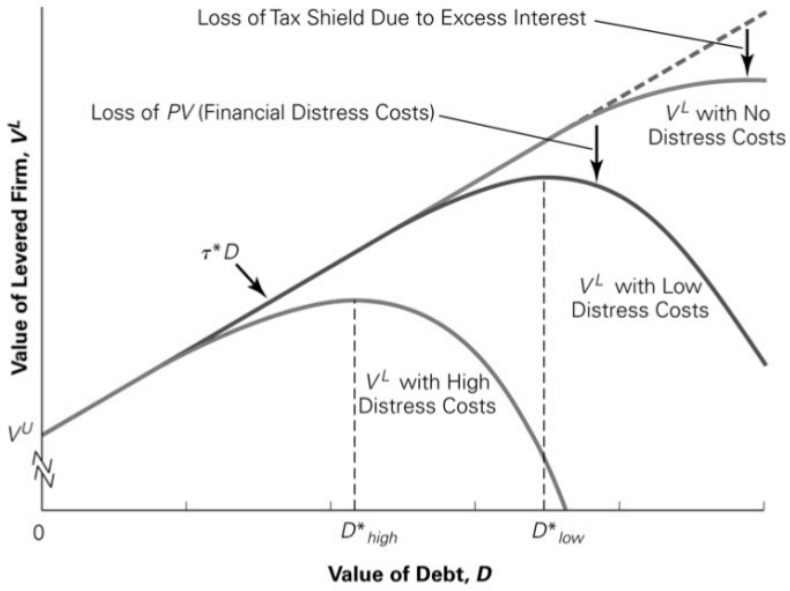

Figure 2: Optimal leverage with taxes and bankruptcy costs

Figure 2 shows that for a certain level of leverage (D^*) for each firm the gains from increasing debt are completely offset by the increase in bankruptcy costs. This is the level of leverage that maximises the company value. It also shows that the company with high bankruptcy costs (distress costs) has a lower optimal level of leverage than the company with low bankruptcy costs. Source: (Berk and DeMarzo, 2011).

Equation (4) states that the total value of a leveraged company (V^L) is given by the value of the company if it has no leverage (V^U) plus the present value of the interest tax shield (*PV(TS)*) minus the present value of bankruptcy costs (*PV(BC)*). An increase in leverage is associated with an increase in the tax shield, which increases the firm value, but such an increase also leads to an increase in bankruptcy costs, which again lowers the firm value. The firm value is maximised when the marginal benefits of the tax shield equals the marginal cost of bankruptcy.

To calculate a precise value of the bankruptcy costs is complicated and this has been done in different ways by different authors. Weiss (1990) classifies the bankruptcy costs as either direct or indirect bankruptcy costs, where direct costs are related to the

costs of an actual bankruptcy, while indirect costs are costs that arise before a possible bankruptcy. Examples of the latter are loss of competiveness, poor credit terms or

broken contracts, while direct bankruptcy costs can be legal- and audit expenses or cost of liquidating assets (because they are often sold at fire sale prices).

Since companies face different tax rates and levels of bankruptcy costs, this theory implies that each company has a distinctive optimal level of leverage. Figure 2 shows different optimal levels of leverage for three firms with different levels of bankruptcy costs. Logically, a firm with high bankruptcy costs has a lower optimal level of leverage than a firm with low bankruptcy costs.

2.3.2 Dynamic Trade-off models

In contrast to static trade-off models, dynamic models recognise the role of time. Fischer, Heinkel and Zechner (1989) were the first to develop a dynamic trade-off model that recognises that a firm's optimal structural choices are dependent on transaction costs and the fluctuations in asset values over time. In their model firms still consider a trade-off between tax benefits and bankruptcy. However, because there are transaction costs associated with a recapitalisation, firms will refinance only occasionally. In other words, a firm will not refinance until the benefit of the refinancing outweighs the cost. This implies that there is not one distinctive optimal leverage ratio, but an optimal range. As long as a firm's leverage stays within this range, it has no incentive to recapitalise. The size of this range is dependent on the variables included in the model. They argue that a decrease in the corporate tax rate or bankruptcy costs will widen the range. The same counts for an increase in the variance of asset values.

Strebulaev (2007) provides a similar model as the one in Fischer, Heinkel and Zechner (1989). An important aspect with this model is that it highlights the difficulties in interpreting the relationship between leverage and profitability; an aspect in which empirical studies have found the trade-off model to fail. As previously shown, an increase in a firm's profitability will in the trade-off model reduce the expected bankruptcy costs and therefore gives the firm the opportunity to increase its tax benefits by increasing leverage. The model therefore states that the leverage-profitability relationship should be positive. However, empirical studies such as Myers (1993) have found this relation to be negative. This observed negative

relation has been perhaps the most important criticism raised against the trade-off model.

The model in Strebulaev (2007) shows that economy dynamics can explain the negative relationship. His model suggests that expected profitability and leverage is positively correlated at a refinance point. This is consistent with the traditional trade-off models, but the model also suggests that in a dynamic economy the relationship is negative. The intuition behind this is that when firms do not refinance, an increase in profitability will increase the future profitability and therefore also the value of the firms. This results in a lower market and book leverage, ceteris paribus. In the simulations of the model, there are firms that refinance in any period, but the firms that do not do so dominate. Consequently the model shows a negative relationship between profitability and leverage.

2.4 Agency cost theories

Agency cost theory defines corporate managers as agents for shareholders and analyses the conflicting interest between them. This conflict exists because shareholders want the company to be run in a way that maximises their value, but management has incentives to maximise their personal power and wealth. This may not be in the best interests of the shareholders. Since they cannot control all the decisions made by the managers there exists informational asymmetries between them, and this can lead to agency costs.

Jensen (1986) points out that the conflicting interest between the shareholders and management are particularly severe when the company has a substantial amount of free cash flow. This is mainly because there is a greater possibility that the management will, for personal reasons, invest some of this free cash flow in projects that generate returns below the company's cost of capital. The idea behind the agency cost theory is that shareholders can constrain management by increasing the company leverage, and thereby decrease the amount of free cash flow. However, under the section *"The Role of Debt in Motivating Organizational Efficiency"* Jensen (1986) also points out that an increase in leverage will not always have a positive control effect. For instance fast growing companies with many high profitable investment

opportunities, but with a low amount of free cash flow, will commonly need to turn to the financial markets to obtain capital. For each capital raise, the markets have the option to evaluate the proposed projects and the company management. As long as this option is used in an efficient manner the gains of increasing leverage for control purposes is petite.

2.5 Pecking order theory

Pecking order theory suggests that there exists asymmetric information between the managers of a firm and the stockholders, and that both parties are aware of this. Myers and Majulf (1984) argue that as long as this asymmetric information exists, managers will prefer internal- to external financing. T he logic being that this condition will lead to an under-pricing of the firm's equity because managers will always have incentives to issue new equity when the stock is overpriced. However, as long as external investors are aware of this, an equity issue sends a strong pessimistic signal to the market. The managers will also try to avoid an equity issue if the stock is under-priced, and if this happens at the same time as the firm has an investment opportunity managers might disregard the investment even if it has a positive NPV. This is called "the underinvestment problem".

Myers and Majulf (1984) go on by defining a rating of the different financing options where the idea is that managers will chose the best-rated option first. More precise; the managers will choose internal financing (financial slack) first, then debt. Hybrid securities (as convertible bonds) are the third option, and finally issue of new equity.

The pecking order theory therefore violates the other theories presented earlier as managers are not trying to achieve a certain level of leverage, but rather issue debt and equity when financing is required. In other words, according to this theory, if a firm has enough cash to undertake all of its possible investments (with a positive NPV) the managers of the firm will not issue any debt or new equity.

2.6 Dynamic Financing and Investment Models

Although traditional capital structure theory suggests that the optimal debt ratio is the one that maximizes the value of a firm, evidence has shown that firms typically hold

debt levels below this optimal point. Dynamic financing and investment models (starting with Hennessy and Whited, 2005) combine elements of both trade-off and pecking order theories and generally produce more "realistic" leverage ratios.

According to DeAngelo, DeAngelo and Whited (2011) optimal leverage targets include the option to issue transitory debt, thus allowing firms to handle (unexpected) investment needs, referred to as investment shocks. To fund such shocks firms often, deliberately – but temporarily – deviate from their leverage targets by issuing transitory debt.

Transitory debt refers to the difference between actual and target debt levels, and is not necessarily all of a firm's short term debt; it is simply debt that managers intend to pay off in the short to intermediate term to free up debt capacity. Rather than the duration of the debt, it is managerial intent that defines whether or not the debt is transitory.

In DeAngelo et al.'s (2011) dynamic capital structure model the target capital structure of firms and their use of transitory debt is directly related to the nature of their investment opportunities because "*(i) borrowing is a cost-efficient means of raising capital when a given shock to investment opportunities dictates a funding need, and (ii) the option to issue debt is a scarce resource whose optimal intertemporal utilization depends on both current and prospective shocks*." (DeAngelo et al. 2011, p. 1). The option to issue debt is valuable since the model, in contrast to extant trade-off models, assumes that investment decisions are endogenous, and that all forms of financing are costly. Other dynamic capital structure studies also state the importance of endogenous investment, see for example Tserlukevich (2008), Morreles and Schürnoff (2010), and Sundaresan and Wang (2006), who study the leverage impact of real options. The assumption of endogenous investment policy is critical to the model, with variation in investment opportunity attributes being the main driver behind the models predictions.

The takeaway here is that debt capacity is a finite – and limited – resource, while at the same time being the cheapest form of external financing for a firm (where cheapest is defined as involving the lowest financing costs). It therefore stands to

reason that firms would prefer to issue debt to fund investment shocks. As a result they would have to keep their debt levels below target, and retain the option to issue debt.

If a firm issues debt today it also must include the opportunity cost of its consequent future inability to borrow when calculating the relevant leverage-related cost. This opportunity cost implies that target capital structures are even more conservative. A firm's long run target debt level, when viewed ex ante, is then the level that optimally balances the tax shield from debt, distress costs of debt and the opportunity cost of using debt capacity now.

Further on, the model shows that the amount of outstanding debt of firms is inversely related to the volatility of unexpected investment shocks, meaning that firms who experience unpredicted investment needs tend to have less debt. While, on the other hand, firms that have more predictable future investment needs, or lower volatility of investment shocks, tend to have more debt outstanding. The conclusion being that the higher the degree of investment shock volatility the more valuable it is for firms to preserve debt capacity. On average, the benefit of preserving debt capacity outweighs the negative impact of the loss of the interest tax shield due to lower debt ratios. DeAngelo et al. (2011) also show that firms who face high investment shock volatility rely more on (tax disadvantaged) cash balances to fund investment, as unused debt capacity might not suffice, thus reducing their net debt even further. In such cases maintaining cash balances is the preferable option compared to costlier equity financing.

2.7 Empirical evidence and research

In this section we will outline literature that reviews how the traditional capital structure theories hold up empirically. We will also give an insight on research into the zero-leverage mystery.

2.7.1 The trade-off model

As previously mentioned, the static trade-off model, building on the results of Modigliani and Miller (1958), suggests that firms choose their capital structure to

balance the costs and benefits of debt financing. In their review of empirical capital structure studies Graham and Leary (2011) find that "*...several cross-sectional patterns in leverage are broadly consistent with this view.*" (Graham and Leary, 2011 p. 9).

According to the trade-off model, within-firm deviations from leverage targets are costly and should be corrected. Jalilvand and Harris (1984) present evidence of within-firm mean-reversion of leverage ratios, which is consistent with the trade-off view. However, Graham and Leary (2011) find important shortcomings in empirical studies of the trade-off model. According to the model more profitable firms, ceteris paribus, should value the tax-shield benefits of debt higher. Nonetheless, many authors point out that there is a negative relation between leverage and profitability, which goes against the view of the trade-off model.

Further, Graham and Leary (2011) point out that many firms have low leverage despite facing low distress risk and heavy tax burdens. Other studies, e.g. Fama and French (2002) and Iliev and Welch (2010), suggest that the observed speed of adjustment towards leverage target is too slow to be consistent with the static trade-off model. According to Myers (1993) the aforementioned model may be a weak guide to average firm behaviour, and he states that it doesn't help much in understanding the decisions of any given firm.

2.7.2 Pecking order

The pecking order theory of Myers and Majluf (1984) is a traditional alternative to the trade-off theories. Like the trade-off model it discusses the costs and benefits of capital structure decisions (all capital structure theory does), but the theories differ with regards to which market frictions are most important.

Graham and Leary (2011) state that the promise of the pecking order theory lies within its consistency with two main empirical findings: "*(i) there is a significant negative market reaction to the announcement of seasoned equity issues; and (ii) in aggregate, firms fund the majority of investments with retained earnings while aggregate net equity issues often are small or even negative.*" (Graham and Leary 2011, p. 11).

In support of the pecking order theory, studies by Shyam-Sunders and Myers (1999) and Helwege and Liang (1996) have shown a strong correlation between the retirement/issuance of debt and a firm's need for external financing. A study by Frank and Goyal (2003) has provided different results, they show that smaller and younger firms prefer equity issues when they are in need external financing. Fama and French (2005) report similar results, they find that small and high growth firms prefer equity issues over debt.

In support of the pecking order Lemmon and Zender (2010) point out that small firms may be constrained by limited debt capacity, and therefore the findings of Fama and French (2005) may not be inconsistent with the traditional theory.

A study by Leary and Roberts (2010) finds that the pecking order struggles to predict capital structure decisions, over a range of subsamples. While Myers (2001) finds, overall, that the pecking order might be a useful conditional theory. However it still leaves many financing decisions unexplained.

2.7.3 The low/zero leverage mystery

Although some of the models we have mentioned might explain why some firms have low leverage, or at least lower leverage than "target", none of them are able to explain why such a large portion of firms take their capital structure decisions to the extreme and choose almost zero, or zero, leverage.

In a recent empirical study, Strebulaev and Yang (2013) document the puzzling evidence that a large fraction of U.S. publicly traded firms follow a zero leverage policy. They find that, on average, over the period from 1962 to 2009 10.2% of these firms have zero debt, and almost 22% have less than a 5% book leverage ratio. Further on they find that as firms become less and less leveraged they effectively replace interest costs with dividend payments, thus keeping the total payout of firms relatively stable across the leverage spectrum.

A decision by a firm to have zero leverage is also not a short term deviation from target leverage. The evidence suggests that it is a persistent phenomenon. 61% of

firms with no debt, in any given year, show no inclination of acquiring debt the following year, and as much as 30% of zero leverage firms follow such a policy for at least 5 consecutive years.

To understand the nature of zero leverage behaviour better Strebulaev and Yang (2013) construct a set of proxy firms, chosen by industry and size, for each zero leverage firm-year observation. These proxy firms then serve as control observations. The evidence shows that ZL firms and their proxies differ significantly along a number of dimensions: on average ZL firms are more profitable, pay more dividends, pay more income taxes, have less tangible assets, have higher cash balances, and they are smaller.

They also find that ZL firms give up a substantial amount of tax benefits of debt, on average they leave 7.6% of their market values on the table by choosing not to lever up. This only reinforces the mystery of why some firms chose such an extreme debt policy.

According to their study, neither industry nor size can explain this puzzling phenomenon. However, they find that family owned firms and firms with higher CEO ownership and longer CEO tenure are more likely to adopt a ZL policy. Their results suggest "*that managerial and governance characteristics are related to the zero-leverage phenomenon in an important way.*" (Strebulaev and Yang, 2013, pp 2)

In a similar study, concentrating on UK firms, Dang (2012) finds comparable results. Over a sample period between 1980 and 2007 he finds that 12.18% of publicly listed, non-financial, firms in the UK have zero outstanding debt, which is even higher than Strebulaev and Yang (2013). In the period between 2000 and 2007 almost 20% of such firms followed a zero leverage policy.

He finds that ZL firms are smaller and younger, that they have less tangible assets, pay higher dividends and have larger cash holdings, compared to their proxy firms. Also firms with higher growth opportunities are more likely to become zero leveraged. In contrast to Strebulaev and Yang (2013) he finds that ZL firms are less profitable then their proxies. The evidence also shows that ZL firms with less cash

holdings and growth opportunities, but more capital expenditures, are more likely to become leveraged.

Even though ZL firms differ from their proxy firms and from leveraged firms among many dimensions, both studies, Strebulaev and Yang (2013) and Dang (2012), agree that zero leverage behaviour remains a mystery. A model which can fully explain this phenomenon remains to be found.

3 Methodology

This section will be used to discuss the methodology used in parts of the upcoming analysis. Since there has been little empirical research earlier on the theme of this thesis a large part of the analysis will be descriptive data, which has a fairly straightforward methodology. This type of analysis will not be discussed in this section.

3.1 T-Test

In one part of the analysis we present a comparison between zero leveraged- and leveraged firms across different dimensions. To get a better understanding of the difference between the two samples, for each reported variable, we first perform an F-test to check for either equal or unequal variances. Then we perform an independent two sample pairwise T-test, for either equal or unequal variances, both samples with unequal sample sizes. The T-test shows whether there is a significant difference between the average values of the two categories (i.e. zero leveraged and leveraged) for the variable in interest.

3.2 Binary logistic regression

We are interested in exploring the properties of zero-leveraged (ZL) firms and we will therefore run a regression with ZL as the dependent variable. Since ZL is a binary variable (i.e. can only take on two possible values) a standard linear regression model will in this case have certain shortcomings. The two most important being that the coefficient's marginal partial effects are constant and that the predicted probabilities can take on values that are not within the range of zero to one. Instead, we will therefore use a binary response model (hereafter referred to as "logit-model"), which is shown in equation (5). (Wooldridge, 2009)

$$P(y = 1|x) = G(\beta_0 + \beta_1 x_1 + \cdots + \beta_k x_k) \quad (5)$$

where

$$G(\cdot) = G(z) = \frac{e^z}{1 + e^z}$$

This model estimates the probability (P) of the dependent binary variable (y) to have an outcome of 1, given the explanatory variables (x_1-x_k). The explanatory variables have coefficients ($\beta_1 - \beta_k$) and $G(z)$ is a function which ensures that the predicted probabilities are always between zero and one for all real numbers z.

Aldrich and Nelson (1984) discuss two important assumptions, in addition to what is already mentioned, that need to be fulfilled for the logit-regression to be valid. The first one being that the observations of the explanatory variables need to be independent from each other. Since we are using panel data, observations for each firm in different years are highly correlated. This violates the mentioned assumption. To adjust for this we run the regression with standard errors clustered at the firm level. The second assumption is that there cannot be a strong linear connection between two or more of the explanatory variables. We have therefore carefully chosen explanatory variables that are not expected to have this kind of relationship. The pairwise correlations between the selected variables are presented in Appendix 5. The level of correlation is similar to other studies on the same theme, as for instance Dang (2011).

A weakness with the logit-model is that the coefficients are not as easily interpreted as in a standard linear regression. Whereas the coefficients in a linear regression will show how much a one unit increase in the independent variable will change the outcome of the dependent variable, the interpretation of coefficients in the logit-model are a little more defuse. Since the function G is non-linear, the marginal partial effects of the coefficients are not constant. Consequently, if the value of one independent variable is changed, or another one is included, the coefficients and the marginal partial effects of all the other variables will change as well.

Wooldridge (2009) suggests mainly two different methods for presenting the independent variables' effect on the dependent variable; the partial effect of the average (PEA) and average partial effect (APE).

The PEA method replaces the independent variables with their average and then reports the marginal effects of the average observation in the sample. Unfortunately, this method does not work well if some of the dependent variables included in the

regression are discrete- or dummy variables. If for instance a dummy variable recognises whether a company is listed on a public exchange and 35% of the companies in the sample are listed it would not make any sense to use a value of .35 for the average company, as this is an impossible value to obtain.

To get around this problem it is possible to use the APE method instead. In this method a coefficient represents the average marginal effect for all the values of the corresponding explanatory variable in the sample. We will use this method when we present our results in the coming analysis.

3.3 The models

Since the coefficients for each explanatory variable of the binary logistic regression are dependent on the level of the other explanatory variables included in the model we run two different regressions, both with standard errors clustered at firm level. The models are shown in equation (6) and (7).

$$Logit\ (ZL) = \alpha_0 + \alpha_1 Size + \alpha_2 Profitability + \alpha_3 Cash + \alpha_4 Age + \alpha_5 Tangibility + \alpha_6 Initial\ ZL + \varepsilon \quad (6)$$

$$Logit\ (ZL) = \beta_0 + \beta_1 Size + \beta_2 Profitability + \beta_3 Cash + \beta_4 Age + \beta_5 Tangibility + \beta_6 Initial\ ZL + \beta_7 R\&D + \beta_8 CEO\ comp\ abs + \beta_9 Ind.Frac\ ZL + \varepsilon \quad (7)$$

All the variables used in the two models are explained in Appendix 1.

4 The Data Source

We use accounting data for all Norwegian companies, both public and private, for the years 1993 – 2010. The data set is divided into single company accounts and consolidated group accounts for all years. The data set is made available by SNF (Institute for Research in Economics and Business Administration) and NHH (Norwegian School of Economics) through Aksel Mjøs and Karoline Øksnes.

All Norwegian companies owning subsidiaries, with ownership being above 50%, have to file both company accounts and consolidated accounts. This results in partially overlapping data sets. We merged the data sets and excluded single company filings for parent companies, using only their consolidated accounts. We have also excluded subsidiaries, as we assume that any major decision regarding debt and capital structure is made by the parent company. The indication of subsidiary status is only given for the years 2005 – 2010, and thus these years will be most accurate since subsidiary companies will be included in the years before 2005. We have divided the total sample into three categories: *1)* private firms (including private consolidated groups), *2)* private consolidated groups and *3)* public firms (listed on the Oslo stock exchange).

In line with most capital structure research, this paper focuses on the debt structure of mostly non-financial private and public companies. We have therefore excluded the following industries, which are mainly financial companies, according to the classification of NACE: 65 Financial intermediation, except insurance and pension funding; 66 Insurance and pension funding, except compulsory social security; 75 Public administration and defence & compulsory social security; 91 A ctivities of business, employers and professional organizations; 95 A ctivities of households as employers of domestic staff. After this exclusion we are still left with a group of some financial firms; even so, we believe we have excluded the most problematic, when viewed in the light of capital structure research.

The data source includes all Norwegian companies, including sole proprietorships and single person holding companies. We believe that many of these small firms may not

be representative for the data sample as a whole as their borrowing capacity is tied to the personal wealth of the entrepreneur. We therefore exclude all observations (firm-years) with either total revenues or total assets below NOK 5 million. Any firm-years with missing values for total revenue or total assets have also been excluded, as we will be using these variables in most of our study. Since we are only interested in domestic Norwegian firms we have also excluded any non-Norwegian firms.

We are then left with a data set with varying degrees of firm-year observations for each of our three categories: *1)* private firms – 345,363 observations, *2)* private consolidated groups – 63,124 observations and *3)* public firms – 2,112 observations.

5 Analysis

In this section we will report the results of our analyses. Many of the following subsections are similar to Strebulaev and Yang (2013), i.e. the reporting of fractions of various categories of low-leveraged firms, descriptive statistics, persistence studies and logit regressions. Nonetheless our analyses still differ in many regards, for instance we examine exclusively Norwegian firms. Whereas Strebulaev and Yang (2013) only analyse publicly listed firms, we analyse both public and private firms. We have also performed an event study focusing on the evolution of firms in the years prior and posterior to the year in which they become zero leveraged.

5.1 Leverage definitions

As previously explained, our dataset has been divided into three sub-categories; public companies, private companies and private consolidated groups. For all three categories we report the fraction of zero leveraged (ZL) firms. In line with Strebulaev and Yang (2013), we have classified firms with zero or low leverage into four partly overlapping categories. A firm is defined as a ZL firm in any given year if its amount of interest bearing debt equals zero in that year.

As Strebulaev and Yang (2013), we compute the fraction of firms with zero long-term debt for the sake of comparison. A firm is defined as a ZLTD firm in a given year if that firm has zero long term debt outstanding. A difference in the fraction of ZL and ZLTD will then indicate that some ZLTD firms carry some form of short-term debt. The fraction of firms with zero long term debt will then almost always be higher than that of zero leveraged firms.

If a firm in any given year has a book leverage of less than five percent it is classified as an almost zero leverage (AZL) firm. Strebulaev and Yang (2013) point out several reasons for why it might be interesting to look at AZL firms as well, the main reason being that the existing theoretical models on capital structure suggest leverage ratios that are well above zero:

"From a theoretical standpoint, a number of models (e.g., Fisher, Heinkel, and Zechner (1989), Leland (1994), Leland and Toft (1996), Leland (1998), Goldstein, Ju,

and Leland (2001), Ju, Parrino, Poteshman, and Weisbach (2005)) produce leverage ratios that are well above zero. Cross-sectional dynamics modelled by Strebulaev (2007) may produce firms that are almost zero-leverage but in his benchmark case their fraction is very low. Practically, the finance nature of various liabilities assigned by accounting conventions to debt is ambiguous (for example, advances to finance construction or instalment obligations)" (Strebulaev & Yang, 2013, p. 6)

And lastly, like Strebulaev and Yang (2013) we calculate the fraction of firms with non-positive net debt (NPND). If a firm's book value of interest bearing debt minus cash is less than zero, in any given year, we define it as an NPND firm. Cash can in some circumstances be viewed as negative debt, at least if one receives the same interest rate on ones cash holdings as one pays on ones outstanding debt. If this is the case, some portion, or all, of the tax benefits received from debt may be negated by taxes paid due to cash holdings.

5.2 Fraction of zero/almost zero leveraged firms

We divide section 5.2 into three parts; starting with public companies, then private consolidated groups, and lastly private companies. The reason we do this is to compare the three different samples and to see if there are any major differences between public and private firms.

5.2.1 Public companies

The fraction of public ZL firms relative to the total size of the sample are reported in respectively column 1 and 2 in table 1 for each year between 1993 and 2010.

We find that, on average, 7.4% of the total firm-years follow a ZL policy, but there is a considerable variation across years with a minimum of 0% in 1993 and a maximum of 12% in 2004. The average fraction of ZLTD is 10.3%, which indicates that almost 30% of these firms carry liabilities classified as short-term debt in our dataset.

Column 3 of table 1 shows an average fraction of AZL firms as high as 19.3%. As a comparison the dynamic model by Strebulaev (2007) suggests that less than 1% of

Table 1

Fraction of ZL/AZL firms – Public companies

The table shows the fraction of ZL and AZL firms and also the fraction of ZLTD and NPND firms for public companies. ZL firms are firms with zero outstanding interest bearing debt. AZL firms are firms with book leverage below 5%. ZLTD firms have zero long term interest bearing debt and NPND firms are firms with non-positive net debt (i.e. have more cash than interest bearing debt).

Year	ZL	ZLTD	AZL	NPND	N
1993	0.0	0.0	3.5	15.8	67
1994	0.0	1.3	6.5	15.6	77
1995	2.4	2.4	10.6	16.5	85
1996	5.0	5.9	17.8	28.7	101
1997	8.0	10.4	20.8	32.8	125
1998	3.9	5.2	20.1	27.3	154
1999	5.6	7.0	16.9	28.2	142
2000	5.4	10.1	19.6	28.4	148
2001	6.2	10.3	15.8	27.4	146
2002	9.3	15.0	20.0	26.4	140
2003	10.7	15.2	25.0	32.1	112
2004	12.0	14.5	25.6	37.6	117
2005	10.7	19.4	29.1	48.5	103
2006	10.9	13.9	20.8	38.6	101
2007	8.7	11.8	19.7	38.6	127
2008	7.5	9.0	17.2	30.6	134
2009	10.8	11.7	20.0	28.3	120
2010	11.5	15.0	26.5	34.5	113
Total	**7.4**	**10.3**	**19.3**	**30.4**	**2,112**

firms have a book leverage ratio below 5%. In other words, the existing theoretical models on capital structure cannot justify this large fraction of AZL firms.

Table 1 shows that 30.4% of the firms in the sample have non-positive net debt on average. In light of the trade-off model we find it peculiar that such a large fraction of public firms do not seem to care about the tax benefits of debt.

Strebulaev and Yang (2013) report similar statistics for their sample of public firms. They find that the average frequency of ZL firms is 10.6%, ZLTD 15.3%, AZL 22.6% and NPND 33.1%. Although these fractions are slightly higher than the ones we found, they are still within a similar range. Our sample of public firms is also smaller than theirs, which may partially account for the difference.

Table 2

Fraction of ZL/AZL firms – Private consolidated groups

The table shows the fraction of ZL and AZL firms and also the fraction of ZLTD and NPND firms for private consolidated groups. ZL firms are firms with zero outstanding interest bearing debt. AZL firms are firms with book leverage below 5%. ZLTD firms have zero long term interest bearing debt and NPND firms are firms with non-positive net debt (i.e. have more cash than interest bearing debt).

Year	ZL	ZLTD	AZL	NPND	N
1993	5.7	8.9	14.1	28.0	4,189
1994	6.2	9.4	14.3	28.2	4,401
1995	7.6	12.3	15.5	28.0	4,762
1996	8.0	12.3	15.7	28.3	5,157
1997	8.4	12.9	16.2	28.6	5,885
1998	8.3	12.7	15.5	27.7	6,297
1999	7.9	14.2	15.8	28.2	2,785
2000	7.4	12.5	15.4	25.7	2,744
2001	7.3	12.1	15.0	25.5	2,825
2002	7.5	12.2	14.5	26.2	2,751
2003	8.9	13.3	15.7	27.5	2,661
2004	8.8	12.7	15.6	28.1	2,601
2005	8.9	12.6	15.5	27.1	2,557
2006	8.9	12.9	16.1	28.9	2,402
2007	9.4	13.5	18.3	31.8	2,646
2008	8.9	13.4	16.8	29.1	2,783
2009	9.6	13.5	17.0	30.3	2,854
2010	9.2	13.7	17.3	30.2	2,824
Total	**8.0**	**12.3**	**15.7**	**28.2**	**63,124**

5.2.2 Private consolidated groups

Our data sample includes observations for public firms, private firms and private consolidated groups. The data sample for private consolidated groups is significantly larger than for public companies (63,124 vs. 2,112 firm-year observations), although smaller than the sample of all private companies. There are mainly two reasons we have performed the same analysis for this category. First, it serves as comparison to the study of public firms, as we find it reasonable to assume that the average private consolidated group has more similar characteristics to public firms than the average private firm has. Second, the sample of private consolidated groups is unbiased with regards to subsidiary companies prior to 2005 (as mentioned in section 4).

The same fractions as discussed in the previous section are presented for private consolidated groups in table 2.

We observe somewhat similar results as for public companies with an average fraction of ZL (AZL) firms of 8.0% (15.7%). The average fractions of firms with zero long-term debt and non-positive net debt are respectively 12.3% and 28.2%. Comparing table 2 to table 1 we see that the difference across years is far less volatile, which likely is due to the larger data sample.

5.2.3 Private companies

Since we have access to a large data sample of private companies (345,363 firm-year observations) we want to perform the same analysis for this group, and check whether or not there are any differences between public and private firms. To our knowledge no other study concerning zero leverage has analysed private firms, which, to us, makes this study more interesting than for public companies. Table 3 reports the results for private companies.

Perhaps the most interesting finding in our study is that the fraction of private firms following a ZL policy is over twice as high compared to both public companies and private consolidated groups with an average of 19.1%. As mentioned earlier, the data for private companies between 1993 and 2005 might be somewhat biased as it contains subsidiaries as well as consolidated groups, but this cannot explain these extreme values as the average fraction for the data from 2005 till 2010 (which are corrected for the mentioned bias) are even higher (24.6%). The difference in AZL observations is not as extreme but an average of 26.2% tells us that more than one out of four private companies have a book leverage of less than 5% on average.

In addition, when we examine the fraction of NPND firms for the most recent period (2005-2010), we find that nearly every second firm (43.3%) had no net debt outstanding. This is surprisingly high as it tells us that nearly one out of every two firms foregoes the tax benefits of debt, as long as we assume that the interest rate received on cash holdings equals the interest rate paid on debt.

Table 3

Fraction of ZL/AZL firms - Private companies

The table shows the fraction of ZL and AZL firms and also the fraction of ZLTD and NPND firms for private companies. ZL firms are firms with zero outstanding interest bearing debt. AZL firms are firms with book leverage below 5%. ZLTD firms have zero long term interest bearing debt and NPND firms are firms with non-positive net debt (i.e. have more cash than interest bearing debt).

Year	ZL	ZLTD	AZL	NPND	N
1993	12.5	22.9	21.0	33.5	13,593
1994	13.2	23.9	21.3	33.8	14,473
1995	13.6	25.8	21.4	33.1	15,906
1996	14.5	26.7	22.1	34.0	17,386
1997	15.0	26.9	23.0	34.8	20,008
1998	15.0	27.4	23.0	34.7	21,551
1999	18.0	31.3	25.2	36.0	20,791
2000	17.4	31.2	24.5	34.7	22,548
2001	17.9	31.4	25.0	35.6	23,911
2002	16.8	31.1	24.2	35.5	23,087
2003	20.4	31.2	26.6	37.6	24,199
2004	21.1	31.6	27.8	39.2	26,011
2005	21.8	26.4	27.5	39.5	13,635
2006	22.5	28.1	28.7	41.2	16,145
2007	25.3	30.0	32.4	44.8	17,673
2008	25.7	31.1	32.2	43.8	18,823
2009	25.7	30.5	32.4	44.8	17,694
2010	26.5	31.7	33.5	45.7	17,929
Total	**19.1**	**29.2**	**26.2**	**37.8**	**345,363**
93-04	**16.3**	**28.4**	**23.8**	**35.2**	**243,464**
05-10	**24.6**	**29.6**	**31.1**	**43.3**	**101,899**

5.3 Descriptive statistics

With capital structure theory close in mind we find the consistently large fraction of zero- and low leverage firms surprising. Moving on, the natural question would be to ask if there are any interesting differences between firms with zero leverage (almost zero leverage) and firms with leverage (book leverage over 5%). To be more precise we have compared firm-years which are ZL and AZL with firm-years that are not zero leveraged (NZL) and firm-years which have book leverage above 5% (NAZL).

Tables 4, 5 and 6 report a range of descriptive statistics for ZL, AZL, NZL and NAZL firm-years. For each variable we have conducted a t-test for equality of means where ZL (AZL) firm-years is one sample and NZL (NAZL) firm-years is the other sample.

In section 5.2 we found the most interesting part of our study to be the sample of private firms, as this sample had by far the largest portion of zero leveraged companies. The sample of public firms is quite small, which often makes it difficult to draw clear conclusions. We will, from now, therefore focus primarily on private firms and partly private consolidated groups, although we will sometimes still analyse public firms. Subsequently, from this section (5.3) we have changed the sequence in which we present the results from the different samples. We will start with describing private firms (table 4), then private consolidated groups (table 5), and lastly public firms (table 6). Definitions of all the variables used can be found in appendix 1.

5.3.1 Private companies

As expected, table 4 demonstrates that NZL (NAZL) firms have relatively high leverage compared to ZL (AZL) firms. For the 1993-2010 period, an NZL firm has an average book leverage ratio of 40.6% and a NAZL firm has an average book leverage ratio of 44.3%. Both are significantly different from zero by a wide margin; with t-statistics of 588 and 364.7 respectively. ZL (AZL) and NZL (NAZL) firms also differ along a number of other dimensions. They are significantly smaller when comparing the natural logarithm of total assets, adjusted for inflation and converted into 1998 Norwegian Kroner. To get a sense of how much smaller they are we have also tested size in absolute terms (NOK million). ZL firms have on average total assets of 45 mNOK compared to 170 mNOK for NZL firms. AZL firms have an average of 95 mNOK in total assets compared to 164 mNOK for NAZL firms. ZL (AZL) firms also pay higher dividends (as a ratio of total assets), spend less on R&D, pay their CEO's higher salaries (both in absolute terms and as a ratio of total revenue), and pay a higher amount of taxes relative to total assets.

ZL (AZL) firms have a significantly lower amount of tangible assets than NZL (NAZL) firms, 11.66% (12.69%) versus 34.38% (36.21%). Strebulaev and Yang (2013) also show that ZL (AZL) firms have lower tangibility than their proxies, although the differences are smaller, 21.3% (23.4%) versus 26.2% (26.7%)

Table 4

Descriptive statistics for ZL and AZL firms (Private companies)

The table reports descriptive statistics for ZL and AZL firms and NZL and NAZL firms. NZL firms are firms with an outstanding interest bearing debt above zero and NAZL firms are firms with book leverage above 5%. All variables are defined in Appendix 1 and they show the average value for the different groups in the period 1993 to 2010. The T-statistics show whether there is a significant difference between the groups.

	ZL	AZL	NZL	NAZL	T-stat	T-stat
Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(1) vs. (3)**	**(2) vs. (4)**
Book leverage	0.00	0.56	40.61	44.33	587.99	364.71
Log (Size)	9.46	9.61	10.04	10.05	101.04	84.60
Size abs	44.97	95.24	170.21	164.44	7.58	4.69
Age	15.08	16.11	15.41	15.08	4.48	-14.83
Profitability	21.59	20.47	12.57	12.09	-73.74	-82.75
Tangibility	11.66	12.69	34.38	36.21	187.77	221.49
Cash	35.43	32.53	13.23	12.12	-230.00	-250.00
Dividend	8.21	7.49	2.28	1.97	-110.00	-120.00
R&D	0.20	0.25	0.45	0.46	3.45	3.20
CEO comp	2.32	2.15	1.62	1.61	-57.60	-51.73
CEO comp abs	415.51	437.43	357.92	344.18	-5.36	-5.91
Rating	4.12	4.11	3.71	3.67	-56.98	-66.65
Tax	5.62	5.27	2.04	1.82	-130.00	-150.00

While Strebulaev and Yang (2012) find no significant difference in age, we find that ZL firms are on average slightly, but significantly, younger than NZL firms. Interestingly, on the other hand, AZL firms are significantly older than NAZL firms.

In light of the pecking order theory one might be tempted to think that firms chose a zero/low leverage policy because they may face difficulties in obtaining debt and are consequently forced to finance their investments through equity issues. However we find these firms to be more profitable than levered firms; in fact they are 1.7 times as profitable as NZL and NAZL firms. We therefore find it hard to believe that these firms do not have the ability to acquire any level of debt. If we only look at the last three years in our sample, the profitability of ZL firms is 21.63% while for NZL firms it is 11.40% (unreported).

ZL (AZL) firms also have significantly higher credit ratings compared to leveraged firms. We use Dun & Bradstreet's ratings which are somewhat different than the ratings of for instance Standard & Poor. There are five different ratings: AAA, AA, A, B and C. We have given each rating class a different value, starting with 5 for the highest rating (AAA) and descending until 1 for the lowest rating (C). The significant difference in ratings further strengthens our belief that a ZL (AZL) policy is a conscious decision made by the firms, and not something they have been forced into by either internal or external forces.

Similar to Strebulaev and Yang (2013) we also find that ZL and AZL firms pay significantly more taxes (as a ratio of total assets), 5.62% and 5.27% respectively, than NZL and NAZL firms who correspondingly pay 2.04% and 1.82%. As the levered companies pay less tax our results indicate that there exists ample opportunity for the zero and low levered firms to take advantage of the tax benefits of debt.

One interesting finding is that ZL (AZL) firms have significantly higher cash balances than NZL (NAZL) firms; to be precise their cash balances are on average 2.64 (2.53) times as large. It is therefore possible that these firms actually have enough internal funds to finance all of their investments. If this were the case then the zero-leverage choice could, at least partially, be explained by the pecking order theory. Further, DeAngelo et al.'s (2011) dynamic financing theory states that firms that face high investment shock volatility are expected to maintain higher cash balances and have lower average debt ratios. Unfortunately, we do not have any information on the different firms' investment opportunities or capital expenditure, which could help us back up these claims.

5.3.2 Private consolidated groups

When we take a closer look at private consolidated groups (table 5) we find results which are quite similar to those of private companies. ZL/AZL firms are still smaller (not significantly when looking at absolute size differences between AZL and NAZL), more profitable, have a lower degree of tangibility, have higher cash balances, pay higher dividends, pay their CEO's more, have higher credit ratings and pay more taxes. Most of the t-statistics are lower, although still significant.

Table 5

Descriptive statistics for ZL and AZL firms (Consolidated groups)

The table reports descriptive statistics for ZL and AZL firms and NZL and NAZL firms. NZL firms are firms with an outstanding interest bearing debt above zero and NAZL firms are firms with book leverage above 5%. All variables are defined in Appendix 1 and they show the average value for the different groups in the period 1993 to 2010. The T-statistics show whether there is a significant difference between the groups.

	ZL	AZL	NZL	NAZL	T-stat	T-stat
Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(1) vs. (3)**	**(2) vs. (4)**
Book leverage	0.00	1.02	39.06	42.41	289.12	128.97
Log (Size)	10.51	10.82	11.21	11.21	30.24	22.67
Size abs	150.44	427.04	515.41	497.04	5.50	1.41
Age	18.61	19.99	18.24	17.95	-1.23	-8.43
Profitability	16.18	15.06	11.17	10.93	-9.39	-13.10
Tangibility	15.24	16.23	37.42	39.25	58.17	82.55
Cash	32.93	28.73	12.44	11.36	-69.66	-84.70
Dividend	2.10	1.77	0.63	0.56	-11.41	-12.52
R&D	0.52	0.86	0.53	0.47	0.06	-1.63
CEO comp	0.97	0.78	0.51	0.50	-11.31	-11.03
CEO comp abs	368.75	370.53	305.78	299.61	-4.77	-7.25
Rating	4.02	4.01	3.73	3.70	-12.67	-17.91
Tax	4.53	4.06	1.80	1.63	-36.40	-47.40

The main differences are that R&D is no longer statistically different between ZL (AZL) firms and NZL (NAZL) firms, neither is the difference in age between ZL and NZL.

5.3.3 Public companies

The descriptive statistics for public companies (table 6) show many similarities with tables 4 and 5, but also a number of differences, some of which are quite interesting. Compared to NZL (NAZL) firms ZL (AZL) firms are still smaller, have larger cash balances, lower tangibility, larger CEO compensation ratio, higher credit ratings and pay more taxes. Now both ZL (14.55) and AZL firms (21.87) are significantly younger than NZL (32.91) and NAZL firms (33.86).

Table 6

Descriptive statistics for ZL and AZL firms (Public companies)

The table reports descriptive statistics for ZL and AZL firms and NZL and NAZL firms. NZL firms are firms with an outstanding interest bearing debt above zero and NAZL firms are firms with book leverage above 5%. All variables are defined in Appendix 1 and they show the average value for the different groups in the period 1993 to 2010. The T-statistics show whether there is a significant difference between the groups.

Variable	ZL (1)	AZL (2)	NZL (3)	NAZL (4)	T-stat (1) vs. (3)	T-stat (2) vs. (4)
Book leverage	0.00	1.27	30.12	34.23	60.54	32.27
Log (Size)	12.44	12.91	14.04	14.16	10.70	12.74
Size abs	493.33	3,185.67	9,639.68	10,300.00	2.83	3.34
Age	14.55	21.87	32.91	33.86	6.31	6.20
Profitability	-0.01	2.89	6.39	6.64	2.28	2.48
Tangibility	9.97	10.79	34.66	37.85	10.72	18.78
Cash	37.82	28.67	12.06	10.46	-13.39	-16.49
Dividend	0.16	0.30	0.18	0.15	0.14	-1.24
R&D	22.19	17.33	5.89	4.69	-1.04	-1.70
CEO comp	1.91	0.84	0.34	0.34	-2.29	-2.21
CEO comp abs	1,208.79	1,261.61	1,334.25	1,341.18	0.54	0.57
Rating	4.01	3.98	3.79	3.76	-2.42	-3.21
Tax	2.69	2.08	1.05	0.96	-3.31	-4.07

The differences in dividend are not significant, neither is R&D, for all ZL and AZL firms. Perhaps the most interesting finding for public ZL (AZL) firms is that they are significantly *less* profitable than public NZL (NAZL) firms. Actually the profitability of public ZL firms is insignificantly different from zero. This might indicate that the adoption of a ZL policy may be linked to low profitability for public firms, which would certainly be an interesting topic for further study.

5.3.4 Dividend and interest expense – Private companies

Strebulaev and Yang (2013) point out that a possible explanation of the zero-leverage puzzle is that ZL and AZL firms are mainly high-growth firms and consequently prefer a lower book-leverage. Dang (2012) also argues that a part of the ZL firms might be zero leveraged as a consequence of financial constraints and therefore do not

have the ability to take on debt. In line with their studies we have therefore divided both ZL and NZL firms into dividend paying and non-dividend paying firms and compared the same characteristics, as in the sections above, of these sub-samples. Their intuition for distinguishing between these sub-samples is that high growth firms and constrained firms are more likely to retain all or almost all of their earnings to be able to use them for future investments and to reduce the probability of having to finance their investments externally.

As our findings in section 5.3.1 suggest that ZL firms pay higher dividends, on average, it is not likely that this study will explain the whole zero leverage puzzle. However, Dang (2012) argues that ZL firms may not be homogenous. A comparison between dividend paying and non-dividend paying firms can therefore be important as it is likely that the group of constrained firms consists of firms that are small, young and high-growth firms that are expected to have a more conservative debt policy (i.e. Myers (1977)). On the other hand, the financial choices made by the less constrained groups might be explained by other financial theories, as for instance the dynamic financing theory. The results of the study are presented in Table 7.

Both groups of ZL firms (dividend and non dividend paying) still have the same characteristic differences as in section 5.3.1 when compared with their respective class of leveraged firms. The interesting observation is how ZL firms differ among themselves.

While Strebulaev and Yang (2013) and Dang (2012) find that ZL firms that do not pay dividends have typical characteristics of constrained- and high growth firms, we cannot make this conclusion in our study. They find these firms to be less profitable, smaller and younger than ZL firms who pay dividends. Our findings suggest that they on average are actually larger (68.14 vs. 21.51 m NOK) and have no significant difference in age. Their profitability is significantly lower in our study, although still quite high (15.20% vs. 28.06%).

ZL firms who pay dividends have larger cash balances than ZL firms who do not pay dividend, 38.39% vs. 32.50% respectively, and they pay substantially more taxes (8% vs. 3.27%). This finding is inconsistent with the traditional trade-off theory as the

Table 7

ZL firms with/without Dividend Payments vs. Levered firms with/without dividend payments (Private companies)

The table reports descriptive statistics for dividend paying- and non-dividend paying ZL firms and also dividend paying- and non-dividend paying NZL firms. All variables are defined in Appendix 1 and they show the average value for the different groups in the period 1993 to 2010. The T-statistics show whether there is a significant difference between the groups.

	ZL	ZL	NZL	NZL			
	w Div	w/o Div	w Div	w/o Div	T-stat	T-stat	T-stat
Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(1) vs. (2)**	**(1) vs. (3)**	**(2) vs. (4)**
Book leverage	0.00	0.00	26.87	45.63	-	366.03	519.51
Log (Size)	9.27	9.64	9.67	10.18	47.37	57.10	63.71
Size abs	21.51	68.14	10.01	195.91	9.90	6.52	4.87
Age	14.98	15.18	17.20	14.75	1.58	20.89	-4.09
Profitability	28.06	15.20	20.21	9.77	-58.22	-64.73	-26.57
Tangibility	11.17	12.15	30.44	35.82	7.45	126.83	134.11
Cash	38.39	32.50	17.52	11.67	-32.06	-150.00	-150.00
Dividend	16.53	0.00	8.53	0.00	-	-84.25	-
R&D	0.04	0.35	0.04	0.59	6.91	0.01	2.13
CEO comp	2.36	2.28	1.79	1.46	-3.61	-33.46	-39.88
CEO comp abs	405.63	425.99	350.38	360.85	6.27	-22.25	-3.60
Rating	4.21	4.05	4.15	3.57	-13.94	-6.67	-47.98
Tax	8.00	3.27	4.42	1.16	-93.74	-96.73	-54.73
No. of obs.	32,789	33,207	74,853	204,514			

dividend paying ZL firms choose to pay out funds to their equity holders rather than issue debt and increase their tax benefits.

Consistent with Strebulaev and Yang (2013) we find that dividend-paying ZL firms pay out larger dividends relative to book assets than NZL firms who pay dividends. In fact, they pay out almost twice as much (16.53% vs. 8.53%). Following their study we have therefore chosen to decompose the total payout of these firms. If ZL or AZL firms are in fact high growth firms it would be reasonable to believe that they retain a higher fraction of their earnings so as to be able to finance future investments. Strebulaev and Yang (2013) define total payout as in equation (8).

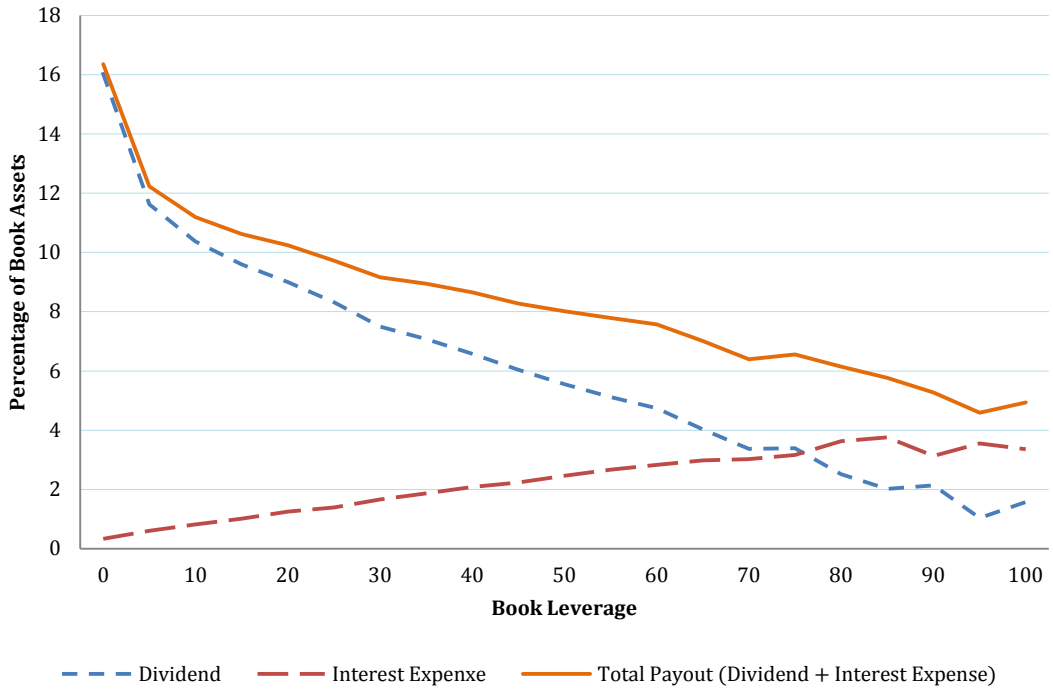

Figure 3: Dividend and interest expense – dividend paying private firms

The figure shows dividend paying private firm's average dividend and interest expense across the leverage spectrum for the period 1993-2010. The total payout is defined as the sum of dividend and interest expense.

$$Total\ payout = \frac{Interest\ Expense + Dividends + Stock\ Repurchase}{Total\ assets} \qquad (8)$$

Unfortunately our dataset does not provide us with a good approximation of stock repurchases. Consequently we leave out stock repurchases in our definition of total payout. Figure 3 shows the result of the decomposition.

We find dividends to be decreasing with leverage and interest expense to be increasing with leverage. This is consistent with Strebulaev and Yang (2013). However, while they find the total payout to be relatively stable across the leverage spectrum, we actually observe the total payout to be decreasing. This means that dividend paying ZL firms, which are almost half of all ZL firms in our sample, have on average a higher total payout than leveraged firms. As mentioned, we have no information on share repurchases in our study, but as Strebulaev and Yang (2013) find share repurchases to be decreasing with leverage it is reasonable to believe that

such an inclusion would make the slope of the total payout even steeper. This is an interesting finding because it indicates that dividend paying ZL and AZL firms do not choose lower debt levels in order to be able to retain a higher fraction of their earnings. In other words, it seems that dynamic financing models cannot explain the zero leverage puzzle for these firms, as they would explain zero leverage as a consequence of a company's wish to retain a higher proportion of its earnings to be able to finance future investments.

5.4 Industry

To get a better understanding of zero-leverage behaviour it might be interesting to take a closer look at differences between the industries the companies operate in. Our dataset provides NACE classifications for all the firm-year observations, which makes it possible for us to do so. In addition to general NACE classifications the data is also sorted into 12 main industries. We have decided to use this main classification in our industry study, which is presented in table 9. For a better understanding of which NACE classifications are included in the 12 different industries, please see Appendix 2.

Table 8 reports the distribution of ZL and AZL firms in addition to the average book leverage (BL) and the average firm size (in mNOK) of each industry. Table 9 shows a considerable variation in the distribution of ZL/AZL firms between the industries, which can indicate that industry specific factors might explain parts of the zero leverage puzzle. The ZL (AZL) distribution ranges from 9.2% (12.9%) in Primary industries to 45.9% (60.4%) in Financial services. IT/Telecom and Culture/Media have the second and third highest distribution of ZL firms. Strebulaev and Yang (2013) point out that reputation, human capital and asset illiquidity considerations might be influential in the explanation of ZL behaviour in these industries.

Given that the average firm size in the financial services sector is as high as 1,224 mNOK, the second largest of the 12 industries, we found it somewhat surprising that this industry had by far the highest proportion of ZL firms, particularly since our previous findings show that ZL firms are significantly smaller than leveraged firms. We therefore examined the different firms within this industry, and found that only a

Table 8

Industry breakdown - Private firms

The table reports the average fraction of ZL and AZL firms in 12 main industries as defined in Appendix 2 in addition to the industry average size and book leverage (BL).

Industry	BL	Size	ZL	AZL	N
Primary industry	0.49	56	9.2	12.9	12,123
Manufacturing	0.32	102	13.5	20.4	54,036
Oil/gas	0.37	3162	17.7	26.4	1,441
Construction/energy	0.21	146	22.6	33.2	35,620
Commerce	0.29	44	20.4	27.3	105,917
Transport/Travel	0.35	102	18.0	24.2	15,785
Shipping	0.53	459	11.1	14.7	8,934
Financial services	0.15	1224	45.9	60.4	882
Services/advisory/real estate	0.40	138	19.2	25.4	78,374
Healthcare	0.34	94	22.9	28.2	7,635
Culture/Media	0.33	59	25.5	33.0	5,138
IT/Telecom	0.21	176	39.0	49.2	7,924
All	**-**	**-**	**19.1**	**26.1**	**333,809**

few, extensively large, firms drove up the average size. In fact, if we leave out the largest firm the average firm size drops to 371 mNOK (unreported). So the high average firm size in the remaining financial firms is mainly due to large outliers.

Even though there is a large variation in ZL/AZL distribution between the different industries the number of firms following this policy is substantial in each industry, proving that zero leverage behaviour cannot be explained by industry alone.

Conducting the same study for public companies and private consolidated groups gives us similar results: For all three sub-categories, Financial services, IT/Telecom and Culture/Media are the three industries with the highest fraction of ZL companies. Primary industry is also the industry with the lowest fraction of ZL and AZL firms. Zero leverage behaviour is also an industry-wide persistent phenomenon as it is present in all industries. The results of the industry-studies for public companies and private consolidated groups are presented in Appendix 3.

5.5 Zero Leverage Event Study – Private companies

From tables 1, 2 and 3 we know that a considerable fraction of Norwegian firms, especially private firms, are zero leveraged. In this section we study what happens in and around the time in which a firm becomes zero leveraged. We will point out any defining changes, and how some important indicator ratios evolve when a firm goes from being NZL to ZL. The subsequent analysis follows Eckbo and Kisser (2013) and conducts an event study for all private firms.

We conduct our analysis by first we identifying all firms which have at least one year in which they are zero leveraged. Then, for each firm, we define the first year in which it becomes zero leveraged, which is our event year zero. Event year (from now: year) -5 is then the state of an average firm 5 years before it became zero leveraged, and subsequently year 5 is the state of the average firm 5 years after it first became zero leveraged. The event period in our figure stretches from year -7 to year 10 with a minimum of observations close to 2,000 in any given year and a maximum close to 23,000 in year 0. This gives us a total of 18 years, and 121,341 firm-year observations.

We include 4 variables in our event study, namely profitability, book leverage, cash and book assets. The first three are defined in Appendix 1. We also thought it would be interesting to include a variable that measures the relative proportion of a firm's total assets in any given year to the firm's total assets in year 0, adjusted for inflation. We have called this variable 'book assets'. In other words: for each firm j we divide inflation-adjusted total assets in year t by inflation-adjusted total assets in year 0, then we summarize and divide by the number of observations in year t. Equation (9) sums up this procedure.

$$Book\ assets_t = \frac{1}{J_t}\sum_{j=1}^{J}\frac{Total\ assets_{j,t}\ CPI_{98}/CPI_{j,t}}{Total\ assets_{j,0}\ CPI_{98}/CPI_{j,0}} \qquad (9)$$

Figure 4 depicts our results, and Appendix 4 provides the results numerically.

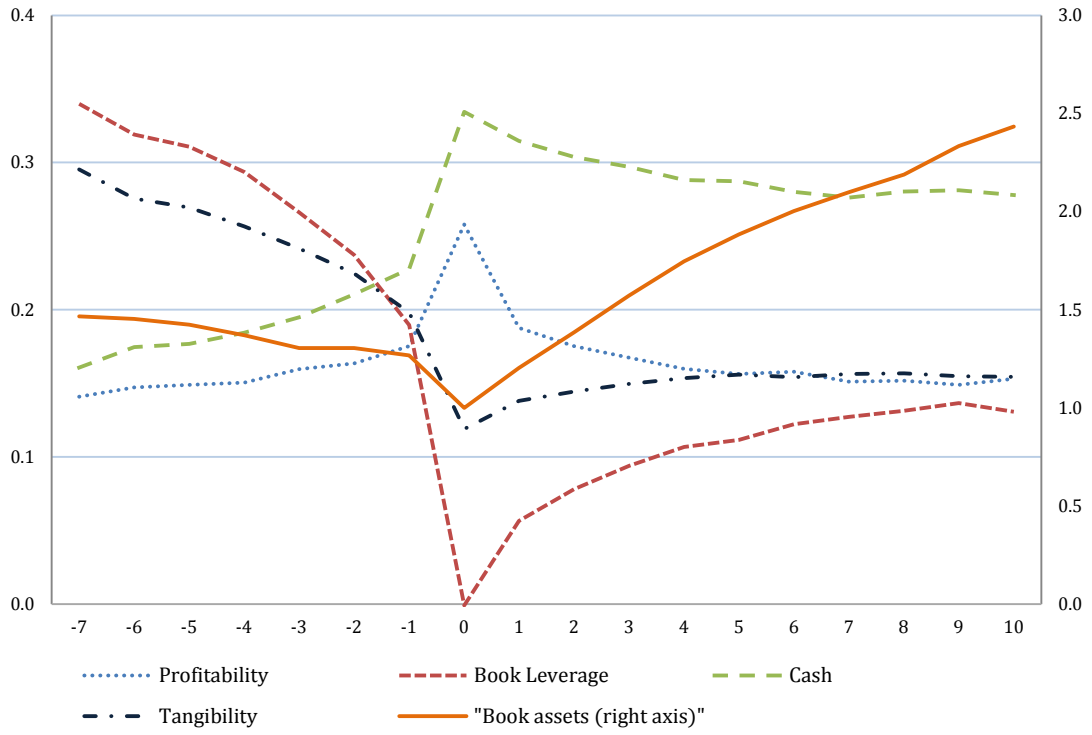

Figure 4: Zero leverage event study

Average ratio evolution around the first year a firm becomes zero leveraged (event year 0), 1993-2010. The x-axis is the event year, the left axis is linked to the first four variables (profitability, book leverage, tangibility and cash) and the right axis is linked to the variable book assets.

If we compare figure 4 to table 4 we see that the average firm in year -7 is quite close to the average NZL firm for our entire sample. Profitability in year -7 is 14.1% compared to 12.6% for the average NZL firm. Book leverage is 40% compared to 40.6%, cash is 16.1% compared to 13.2% and tangibility is 29.52% in year -7 while it is 34.38% for NZL firms. The interesting takeaway here, with regards to these four variables, is that it is next to impossible to identify which firms will become zero leveraged 7 years (or more) ahead of such an event. We also see that the average firm is almost 1.5 times as large in year -7 compared to year 0 with regards to book assets.

Moving closer towards year -1, we see a steady decline in book leverage, book assets and tangibility. This indicates that the average firm in this study disposes of fixed assets to be able to pay down its interest bearing debt. However, it is also possible that the reduction in tangibility and book assets are caused by depreciation and lower asset investments than usual. Either way, it seems as if firms in the years prior to year 0

have a higher focus on reducing their debt levels rather than investing in new, or improving existing, assets.

Both profitability and cash as a ratio of total assets are rising steadily. The reduction in assets then corresponds to an increasing marginal profitability, which may be explained by the fact that when reducing their book assets firms would be expected to sell off their least profitable assets first.

What happens in year 0 is the most interesting part of the study. Book leverage, naturally, drops to zero and book assets is at its lowest point for the whole sample. This is in line with our earlier results, which showed that ZL firms are smaller than NZL firms. Why they choose to hold such large balances of cash is quite interesting. In year 0 the cash to total assets ratio spikes to 33.5%. A possible reason, viewed in the light of the dynamic financing model of DeAngelo et al. (2011), is that they wish to retain a larger degree of financial flexibility for the forthcoming years. However, we already know from the dividend study in section 5.3.4 that this is not the case for the average dividend paying ZL firm.

We also see a large spike in profitability in year 0, from 17.5%, in year -1, to 25.8%. As year 0 is the year in which firms have the lowest level of book assets, these results indicate that they have scaled down their operations to their most profitable segments, which might help explain the reason why ZL firms are more profitable than NZL firms for our entire data sample (see table 5).

Moving forward from year 0 the trend for all five variables has changed. Book leverage, book assets and tangibility start climbing, while profitability and cash start declining. Around year 7 profitability, book leverage, cash and tangibility seem to stabilise in the region of 15%, 13%, 28% and 16% respectively. What is interesting is that book assets continues to climb, while the other variables remain somewhat stable, perhaps indicating some form of post zero leverage-event steady state, although far from certain. Given enough time and a larger data set spanning more years this would definitely be an interesting topic for further study.

Perhaps one of the most interesting results of this event study is that profitability ends up close to, approximately 15%, its pre-event stability of around 14% in year -7, while being at elevated levels in the years between. In year -7 there are of course no ZL firms, while in year 7, 48.53% of the firms have zero leverage (unreported). It would then seem that the profitability effect of zero leverage is a passing phenomenon, which would also be an interesting topic for further study.

5.6 ZL and AZL persistence

When studying zero-leverage behaviour an interesting factor is the duration of the firms' zero-leverage policy. It might be possible that firms stay zero leveraged for only a short period of time due to an imbalance between maturing debt and new debt issuance. If so, the zero leverage puzzle would not be that puzzling (Strebulaev & Yang, 2013). In this section we therefore try to analyse the persistence of zero leverage behaviour.

We analyse ZL persistence by looking at $n = 3{,}335$ private companies and $n = 248$ consolidated groups. For each firm j we start by identifying the first year they adopt a zero-leverage policy ($k = 0$) and study their zero-leverage behaviour for the next seven years. If firm j has continuously followed a ZL policy from year $k = 0$ to k it will be recorded as persistent ($ZLP_{j,k} = 1$) in year k and if not $ZLP_{j,k}$ will be zero. The calculation of the persistence is shown mathematically in equation (10). We have also analysed the AZL persistence. The only difference from the ZL persistence measure is $AZLP_{j,k}$ which equals 1 i f firm j continuously follows an AZL policy (i.e. book leverage < 5 %) from year $k = 0$ to k and zero otherwise. The measure of AZL persistence is shown in equation (11)

$$PerZL_k = \frac{1}{n}\sum_{j=1}^{J} ZLP_{j,k} \tag{10}$$

$$PerAZL_k = \frac{1}{n}\sum_{j=1}^{J} AZLP_{j,k} \tag{11}$$

Table 9

ZL/AZL persistence

The table reports the persistence of ZL and AZL policies. The persistence measure is defined in section 5.6 and shows for each year, k, the fraction of companies that are still ZL firms, and has been since year k = 0.

	Private companies		Private consolidated groups	
k	**$PerZL_k$**	**$PerAZL_k$**	**$PerZL_k$**	**$PerAZL_k$**
0	100.0	100.0	100.0	100.0
1	70.8	72.6	69.0	69.2
2	55.2	58.1	52.4	58.1
3	45.2	48.7	40.3	47.0
4	38.8	41.8	31.5	38.3
5	33.4	36.7	25.0	31.2
6	29.0	31.9	21.4	25.5
7	25.8	28.4	18.5	20.9
Obs. (n)	**3,355**	**4,798**	**248**	**494**

The firms included in this persistence study are selected because only they fulfil our criteria of a recording of a zero-leverage policy and a recording for each of the seven consecutive years in our dataset. Table 9 shows the results of our analysis.

Our results show that approximately 70% and 55% of the private firms in this study continue a ZL policy for at least one and two years respectively, and as much as 25.8% of the firms continuously have zero leverage for at least 7 years after they first become zero levered. These numbers indicate that zero leverage may in fact be a (sufficiently) persistent phenomenon, which leads us to believe that they might not simply be the result of an imbalance between maturing debt and new debt issuance.

Table 9 also reports the persistence of private consolidated groups. We can see that zero-leverage is persistent in this group as well, although the fraction of surviving ZL/AZL firms is declining somewhat faster when compared to private firms. Even so, in year k = 7, the fraction of surviving ZL (18.5%) and AZL (20.9%) firms is still relatively high.

5.7 Logistic Regression Analysis

Table 10 contains the results of our logistic regression analysis. The reported coefficients are the average partial effect of each variable, with standard errors in parentheses. The number of stars reports the level of significance; three being significant at the 1% level, two at 5%, one at 10% and no stars insignificance. The dependent variable is a dummy variable for ZL, which takes the value of 1 if a firm-year observation has zero outstanding debt and 0 otherwise. For each of our three samples we have two subsamples, the first ones including six independent variables: size, profitability, cash, age, tangibility and initial ZL. In the second subsamples we have added three more variables: R&D, CEO compensation and industry fraction of ZL.

Overall the results show that the regressions are statistically significant, with pseudo R-squared ranging from 0.377 to 0.512. The coefficient on firm size is significantly negative in models 1-5, with values ranging from -0.005 to -0.015. In model 6 the size coefficient is insignificantly negative; this may be due to the smaller sample size of this model. These results strongly indicate that a firm is more likely to adopt a ZL policy when it is smaller, which is in line with our descriptive statistics (see table 4 – 6).

Profitability is significantly positive at the 1% level for models 1-3, at the 5% level for model 4, and positive, but not significant, for models 5 and 6. So the more profitable a firm is the more likely it is to be zero leveraged, at least for private companies and private consolidated groups. To explore this relationship further we have also looked at the interaction between profitability and size. For private companies we conducted a fixed effects linear regression with profitability as the dependent variable and log (size) as an independent variable. We conducted the same regression for private consolidated groups, but with random effects instead of fixed[2]. Both regressions revealed a significant negative relationship between size and profitability with coefficients for both sub-samples around -0,01 (unreported). This means that the difference in profitability between ZL and NZL firms for private firms and private consolidated groups might be a consequence of this negative relationship

[2] The choice between fixed and random effects was done by running a Hausman test

Table 10

Logit Regression. Determinants of Zero-leveraged Policy

The table reports the results of logit regressions on the sample over the years 1993-2010. The dependent variable is a dummy variable, which equals 1 if a firm-year observation has an outstanding interest bearing debt of zero. The partial effect of the average and standard errors (in parentheses) are presented. *, ** and *** indicate that the differences are significant at the 10%, 5% and 1% levels, respectively. All the variables are defined in Appendix 1.

	Private companies		**Private groups**		**Public companies**	
Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Log (Size)	-0.009***	-0.005***	-0.008***	-0.010***	-0.011**	-0.015
	(0.001)	(0.001)	(0.001)	(0.004)	(0.005)	(0.013)
Profitability	0.095***	0.105***	0.037***	0.046**	0.004	0.070
	(0.005)	(0.006)	(0.008)	(0.021)	(0.021)	(0.057)
Cash	0.264***	0.312***	0.187***	0.206***	0.212***	0.244***
	(0.004)	(0.005)	(0.009)	(0.022)	(0.026)	(0.060)
Age	0.001***	0.001***	0.001***	0.001***	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Tangibility	-0.207***	-0.245***	-0.131***	-0.199	-0.077	0.098*
	(0.005)	(0.007)	(0.009)	(0.026)	(0.049)	(0.056)
Initial ZL	0.235***	0.231***	0.139***	0.129***	0.109***	0.140***
	(0.001)	(0.002)	(0.003)	(0.008)	(0.013)	(0.020)
R&D		-0.053*		-0.029		-0.321
		(0.029)		(0.055)		(0.388)
Ceo comp abs		0.000		0.000		0.000
		(0.000)		(0.000)		(0.000)
Ind. frac. ZL		0.217***		0.127***		0.273***
		(0.015)		(0.042)		(0.082)
Observations	341,847	215,903	62,979	7,715	2,112	465
Pseudo R-squared	0.416	0.389	0.400	0.377	0.425	0.512

rather than the difference in leverage, since we have found ZL firms to be significantly smaller than NZL firms.

Cash has a statistically significant positive effect on a firm's probability of being zero leveraged, with coefficients ranging from 0.187 to 0.312, all of which are significant

at the 1% level. Regarding age, all the coefficients are marginally positive and statistically significant (except for model 5). Cash is the independent variable with coefficients of the largest magnitude, meaning that the marginal effect of cash is larger than any of the other variables. The larger the cash holdings of a firm the larger the probability of that firm being a ZL firm, which is consistent with our earlier results in tables 4, 5 and 6.

The age coefficients, on the other hand, are of the smallest magnitude, but they are still significant, and positive, for all models except models 5 and 6. The age coefficients in models 1-4 are in line with our earlier results. The older a private firm is the more likely it is to be zero leveraged, although the effect is very small. As we can see from tables 4, 5 and 6, the age gap between ZL and NZL firms is existent, but minor.

Tangibility is significantly negative at the 1% level for models 1-3, significantly positive at the 10% level for model 6, and insignificantly negative for models 4 and 5. The coefficient values for the models range from -0.245 (model 2) to 0.098 (model 6). So a firm with fewer tangible assets is more likely to be a ZL firm, except in model 6.

The coefficients for the variable initial ZL (if a firm is a ZL firm in its first firm-year observation) are all significantly positive, and of a large magnitude, at the 1% level for all six models. A firm which is zero leveraged the first time it is reported in our dataset is then more likely to be zero leveraged in subsequent years, which supports our findings from our persistence study.

As previously mentioned, we added three more variables in models 2, 4 and 6, namely R&D, CEO compensation and industry fraction of ZL. As we can see from table 10 R&D is negative in all models, but insignificant in models 4 and 6, and only significant at the 10% level in model 2. This is consistent with our descriptive study, where we found that ZL firms spend less on R&D than NZL firms.

The coefficients for CEO compensation are not significant for any of the models, and they are also of a very low magnitude.

Lastly, the coefficients of the variable for industry fraction of ZL are significantly positive at the 1% level for all three models, and they are of a large scale. A firm is then more likely to be zero leveraged if the fraction of firms within its NACE-coded industry is high.

All in all comparing the results from our logistic regression with our descriptive study in section 5.3, we find that they support each other nicely, and we can largely draw similar conclusions from both.

6 Concluding remarks

In this thesis we have documented the puzzling fact of Norwegian firms' propensity to have zero outstanding debt. Using publicly available accounting data over the period 1993-2010, collected and provided by SNF (Institute for Research in Economics and Business Administration), we have analysed all Norwegian firms, both public and private.

To our knowledge there are few similar studies regarding Norwegian firms, and little theoretical and empirical research into the fact that firms choose to have zero outstanding debt despite the existence of the tax deductibility of interest payments. We therefore hope that this paper can help shed light on the zero leveraged mystery, and perhaps inspire others to expand and continue our chosen research path.

We begin our analysis by studying both private and public firms. Then we choose to focus primarily on private firms. There are two main reasons behind this choice. First, there are few publicly listed companies in Norway, which makes the sample size small, while on the other hand our sample size of private firms is extensive. Second, zero leverage is a more prevalent phenomenon for private firms, and thus the results from our analysis of this sample are, to us (and hopefully the reader), of greater interest.

We find that 19.1% of all private firms have zero outstanding debt over the whole period, which is twice the rate of public firms, and 29.2% have less than 5% book leverage, thrice the rate of public firms. Compared with leveraged firms, zero leveraged firms are smaller, more profitable, have larger cash balances, pay more dividends, have higher credit ratings, more tangible assets and they pay more taxes.

In the years leading up to the year in which firms become zero leveraged they show increasing profitability and cash holdings, and decreasing total assets and book leverage. The trends are reversed in the years following the zero leverage event-year. Firms are at their most profitable (by a large margin), have largest cash holdings and the smallest amount of total assets in the year they become zero leveraged.

We find that zero leveraged firms can be divided into two main categories, namely dividend payers and non-dividend payers. ZL firms who pay dividends are smaller, more profitable, have larger cash holding and pay more taxes than ZL firms who do not pay dividends. Further, our analysis suggests that zero leverage policy may be persistent, with almost 26% of zero leveraged firms refraining from debt for at least eight consecutive years.

Further studies into the zero leverage mystery would certainly be interesting. Given more time and experience we would have liked to incorporate proxy firms in our analysis as we believe it could help to shed even more light on the extreme corporate financial policy of zero outstanding debt. We would also have liked to have included market values and share repurchases in our study, and if available we believe such data can provide further empirical evidence, and possibly explanations, into the zero leverage mystery. Although a daunting task, we believe cross-national studies examining the zero leverage phenomenon could be very insightful and add to the small, but growing, literature of such an interesting field within corporate finance.

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Appendix 1

Definition of variables

The table describes the definitions of the variables considered in the thesis. The data set is made available by SNF (Institute for Research in Economics and Business Administration) and NHH (Norwegian School of Economics) through Aksel Mjøs and Karoline Øksnes. After our adjustments it c onsists of 345,363 firm-year observations from the period 1993-2010.

Variables	Definition
Book leverage	Interest bearing debt to total assets
CPI	Annual consumer price index from SSB (Statistisk Sentralbyrå (2013))
Log (Size)	Natural logarithm of total assets in 1998 Norwegian Kroner
Size abs	Total assets in 1998 Norwegian Kroner
Age	The difference between the observation year and the firm's registration year
Profitability	Earnings Before Interest and Taxes (EBIT) to total assets
Cash	Cash holdings to total assets
Dividend	Dividends to total assets
R&D	Research and Development to total revenue
CEO comp	CEO compensation to total revenue
CEO comp abs	CEO compensation in 1998 Norwegian Kroner
Rating	D&B's credit rating (C=1, B=2, A=3, AA=4, AAA=5)
Tax	Taxes paid to total assets
Tangibility	Fixed assets (PPE) to total assets
Initial ZL	Dummy variable: 1 if initial interest bearing debt is zero and 0 otherwise
Ind. Frac. ZL	Fraction of ZL firms within the same industry (industry defined in appendix 2)

Appendix 2

Overview of industry classifications

The table gives an overview of the NACE codes included in the 12 main industries we have used in our industry study. Note that we have excluded the following NACE codes in our dataset: 65 Financial intermediation, except insurance and pension funding; 66 Insurance and pension funding, except compulsory social security; 75 Public administration and defence & compulsory social security; 91 A ctivities of business, employers and professional organizations; 95 A ctivities of households as employers of domestic staff. Some observations have no NACE-classification in our data set. These observations have been removed in our industry study.

		NACE codes:	
Industry	**No. of obs.**	**From**	**To**
Primary industry	12,144	-	10,000
Oil/gas	1,588	11,000	12,000
Manufacturing	54,606	10,000	11,000
		12,000	40,000
Construction/Energy	35,691	40,000	50,000
Commerce	106,082	50,000	60,000
Shipping	9,241	60,300	60,400
		61,100	61,200
Transport/Travel	15,818	60,000	60,300
		60,400	61,100
		61,200	64,200
Financial services	899	65,000	70,000
Services/advisory/real estate	78,808	70,000	71,330
		71,340	72,000
		73,000	75,000
		90,000	91,000
Healthcare	7,635	85,000	90,000
Culture/Media	5,158	92,000	95,000
IT/Telecom	8,161	30,020	31,000
		64,200	65,000
		71,330	71,340
		72,000	73,000
Total	**335,831**		

Appendix 3

Industry breakdown - public companies and consolidated groups

The table reports the distribution of ZL and AZL firms in addition to the average book leverage (BL) and the average firm size (in mNOK) of each industry for both Private companies and Private Groups.

	Private companies					Private Groups				
Industry	**BL**	**Size**	**ZL**	**AZL**	**N**	**BL**	**Size**	**ZL**	**AZL**	**N**
Primary industry	0. 49	56	9. 2	12. 9	12,123	0. 45	220	3. 2	6. 0	1,459
Manufacturing	0. 32	102	13. 5	20. 4	54,036	0. 34	392	5. 7	12. 7	8,135
Oil/gas	0. 37	3162	17. 7	26. 4	1,441	0. 32	6487	13. 9	26. 1	230
Construction/energy	0. 21	146	22. 6	33. 2	35,620	0. 28	1406	7. 1	17. 7	3,469
Commerce	0. 29	44	20. 4	27. 3	105,917	0. 33	235	7. 9	15. 9	12,864
Transport/Travel	0. 35	102	18. 0	24. 2	15,785	0. 37	453	8. 4	17. 0	2,376
Shipping	0. 53	459	11. 1	14. 7	8,934	0. 47	1325	5. 0	9. 2	2,251
Financial services	0. 15	1224	45. 9	60. 4	882	0. 19	1221	33. 5	46. 8	248
Services/advisory/real estate	0. 40	138	19. 2	25. 4	78,374	0. 39	337	8. 0	14. 9	24,575
Healthcare	0. 34	94	22. 9	28. 2	7,635	0. 35	266	7. 0	14. 8	670
Culture/Media	0. 33	59	25. 5	33. 0	5,138	0. 37	238	14. 9	20. 5	697
IT/Telecom	0. 21	176	39. 0	49. 2	7,924	0. 19	350	26. 3	42. 3	1,428
All			19. 1	26. 1	333,809			8. 0	15. 5	58,402

Appendix 4

Results from Zero-leverage event study

The table shows the average ratio evolution around the first year a firm becomes zero leveraged (event year 0), 1993-2010. All variables except "Book assets" are described in Appendix 1. "Book assets" are described in section 5.5.

Event year	Book assets	Profitability	Book leverage	Cash	Tangibility	N
-7	1.466	0.141	0.340	0.161	0.295	1,843
-6	1.453	0.147	0.319	0.175	0.275	2,468
-5	1.424	0.149	0.311	0.177	0.269	3,057
-4	1.370	0.151	0.294	0.184	0.256	3,838
-3	1.305	0.160	0.266	0.195	0.242	4,638
-2	1.304	0.164	0.237	0.211	0.225	5,756
-1	1.267	0.175	0.190	0.228	0.198	7,346
0	1.000	0.258	-0.001	0.335	0.119	22,807
1	1.204	0.188	0.057	0.315	0.138	13,828
2	1.384	0.175	0.078	0.304	0.144	11,495
3	1.572	0.168	0.094	0.297	0.150	9,750
4	1.747	0.160	0.107	0.288	0.154	8,152
5	1.884	0.156	0.112	0.287	0.156	6,784
6	2.004	0.158	0.122	0.280	0.154	5,487
7	2.099	0.151	0.127	0.276	0.156	4,578
8	2.189	0.152	0.131	0.280	0.157	3,822
9	2.334	0.149	0.137	0.281	0.155	3,173
10	2.433	0.153	0.131	0.278	0.154	2,519

Appendix 5 – Panel A

Correlation matrix – Private companies

The table reports the correlations between pairs of the variables considered in the thesis. See Appendix 1 for variable definitions. All correlation coefficients are significant at the 1% significance level, except those marked with #

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1)	***Size***	1								
(2)	***Cash***	-0.218	1							
(3)	***Age***	0.175	-0.007	1						
(4)	***Profitability***	-0.116	0.218	-0.034	1					
(5)	***Tangibility***	0.246	-0.348	0.038	-0.051	1				
(6)	***Initial ZL***	-0.155	0.367	-0.027	0.110	-0.270	1			
(7)	***R&D***	0.023	-0.013	-0.012	-0.020	-0.010	-0.004#	1		
(8)	***CEO comp abs***	0.043	0.013	0.014	-0.003#	-0.029	0.008	0.001#	1	
(9)	***Ind. Frac. ZL***	-0.111	0.164	-0.011	0.027	-0.158	0.166	0.014	0.040#	1

Appendix 5 – Panel B

Correlation matrix – Private consolidated groups

The table reports the correlations between pairs of the variables considered in the thesis. See Appendix 1 for variable definitions. All correlation coefficients are significant at the 1% significance level, except those marked with #

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1)	***Size***	1								
(2)	***Cash***	-0.1784	1							
(3)	***Age***	0.1845	-0.0174	1						
(4)	***Profitability***	-0.075	0.122	-0.0131	1					
(5)	***Tangibility***	0.1485	-0.3449	0.0534	0.0001#	1				
(6)	***Initial ZL***	-0.1021	0.2863	-0.025	0.0422	-0.1885	1			
(7)	***R&D***	-0.0127#	-0.0064#	-0.0258	-0.0756	-0.0347	0.0027#	1		
(8)	***CEO comp abs***	0.3269	0.0075#	0.0526	-0.0271	-0.1033	0.0235	0.0052#	1	
(9)	***Ind. Frac. ZL***	-0.0245	0.1276	-0.057	-0.0222	-0.1263	0.1422	0.0568	0.1282	1

Appendix 5 – Panel C

Correlation matrix – Public companies

The table reports the correlations between pairs of the variables considered in the thesis. See Appendix 1 for variable definitions. All correlation coefficients are significant at the 1% significance level, except those marked with #

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1)	***Size***	1								
(2)	***Cash***	-0.3417	1							
(3)	***Age***	0.3472	-0.2138	1						
(4)	***Profitability***	0.2353	-0.0746	0.1096	1					
(5)	***Tangibility***	0.2891	-0.3203	0.1603	0.1497	1				
(6)	***Initial ZL***	-0.2207	0.2797	-0.1652	-0.1129	-0.2289	1			
(7)	***R&D***	-0.0663	0.0527#	-0.0554#	-0.0968	-0.0599#	0.0197#	1		
(8)	***CEO comp abs***	0.3653	-0.0234#	-0.0259#	0.0173#	-0.1178	-0.0093#	-0.0369#	1	
(9)	***Ind. Frac. ZL***	-0.241	0.3117	-0.2414	-0.0693	-0.298	0.2577	-0.0073#	0.1851	1