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CEO wealth and company risk

An empirical investigation of relationships between CEO wealth and leverage ratios.

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ABSTRACT:

Capital structure theorists have argued for different determinants of leverage ratios throughout the age of modern corporate finance literature, with thorough empirical evidence of key determinants having surfaced in recent years. In this paper I add risk aversion into the equation, and find a significant relationship between CEO risk aversion proxied by non-firm wealth and leverage ratios. I also find significant relationships between percentage of wealth at stake in the company the CEO manages and leverage ratios, although this latter finding should be treated with caution due to the contingency of causality.

PREFACE

I would like to express my sincere gratitude towards my supervisor, Prof. Carsten Bienz at The Norwegian School of Economics, who did not only bring this topic to my attention but also has provided great insights and guidance in the process of writing this thesis. I would also like to thank Thomas Hasner at Fondsfinans and Mats Weltz at Arctic Securities for providing me with invaluable help in data gathering.

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INTRODUCTION:

A recent paper published by Bo Becker (Becker, 2006) suggests that CEOs with higher non-firm performance dependent wealth receive stronger incentives. Becker's findings show that Swedish CEOs with higher external wealth independent of the firm receive stronger incentives, both in the form of total wealth dependent on company performance, as well as their absolute ownership share in the company itself.

Becker's study has been replicated by a master's thesis at the Norwegian School of Economics (Wezeman, 2010), using Norwegian companies and CEOs. Wezeman's findings are similar to Becker's, although the significance on wealth explaining incentives received is somewhat weaker in the latter paper.

An interesting element from before mentioned papers is the use of non-firm wealth as a proxy for total risk aversion on behalf of the agent. If risk total risk aversion may be proxied by personal wealth, then personal wealth may explain certain behavior and actions performed by the CEO. Following this assumption, a wealthier CEO may be willing to take on more risk and one should expect a less risk-averse behavior.

During the recent financial crisis several highly levered firms went into distress, with their leverage ratios being a catalyzing effect of their fundamental issues. Following these events, a discussion about high leverage and senior managements' opportunities to discretionary adapt a capital structure suitable to their personal ambitions have emerged. This discussion may be enchanted to a broader perspective, and to the much debated question on whether management have the right incentives to implement optimal capital structures for their companies.

With the previous questions in mind, this study aims to take the research of Becker further, and investigate whether CEO risk aversion trough non-firm wealth may influence the riskiness of their respective firms. Regressions are run to examine to which extent the leverage ratio of Norwegian listed companies may be explained by CEO wealth outside of the firm and percentage of wealth dependent of company performance.

Hypothesis: Magnitude of CEO external wealth and percentage of total wealth dependent on company performance affects leverage ratios.

THEORETICAL BACKGROUND:

Capital Structure.

"There is no universal theory of the debt-equity choice, and no reason to expect one. There are several useful conditional theories, however. … Each factor could be dominant for some firms or in some circumstances, yet unimportant elsewhere." – Myers (2003, p. 217)

There exists extensive literature on how firms choose and optimally should choose their capital structure. The static *Tradeoff Theory*, originally proposed by Kraus & Litzenberger (1973), suggests that a company chooses its debt with consideration to both; (I) marginal benefit of debt, mainly tax shields and management discipline, and (II) marginal costs - bankruptcy and other non-bankruptcy costs such as staff resigning, tougher terms from suppliers etc. The tradeoff theory thus predicts that companies choose their capital structure based on rational profit and value maximizing.

A supporting empirical paper for this theory is George & Hwang (2010), who finds that companies with high leverage suffers higher distress costs, and suggests that firms manage their capital structures to avoid financial distress costs.

There have surfaced a number of more dynamic models bearing the label *Tradeoff Theory*, notably by Stulz (1990) who explains though his model that adding constraints on managerial discretionary investments reduces the costs of over- and underinvestment. Morellec (2004) incorporates agency costs into the equation, and show that shareholder-management conflicts may explain why debt levels are empirically suboptimal.

The static version of the textbook tradeoff theory has been criticized, most notably by Myers (1984) who rather proposes a "pecking order" theory, where a firm has no well-defined target ratio of debt versus equity. Myers proposes an internal hierarchy of financing, where internal financing is preferred over debt issuance, which again is preferred over equity financing. The rationale behind the theory is an information asymmetry problem, with managers being better informed than the market; First of all, management prefers internal financing as no flotation costs arise, and no proprietary information that could lead to loss of competitive advantage has to be disclosed to the market. When internal financing is depleted, debt issuance is secondly preferred. Issuance of debt signals that management has a strong conviction that the company will be able to service its debt in the future, and is generally positively received by the

market. In case of a share issue, the market will interpret the offering as a signal of management taking advantage of a current overvaluation and will thus lead to a drop in share price. Share issues are therefore the last resort of financing according to this theory, and will only be used when other sources are depleted.

The pecking order theory does not predict an optimal capital structure, but it suggests an explanation for why companies have their observed leverage ratios;

Myers & Majluf (1984) also suggests that managers will act foremost in the interest of current shareholders, and may forego positive-NPV projects in order not to benefit new shareholders at the expense of existing shareholders through share issuances. Hawawini & Viallet (2010) further brings management incentives into the pecking order theory, by suggesting that managers may choose debt over equity, simply to retain control.

In a more recent years the *market timing* theory, described as early as 1984 by (Myers, 1984), has gained renewed support. The theory states that companies will time their issues of equity to periods after a rise in equity prices rather than after a fall, as the gain from raising equity is higher when prices are relatively high. Further on, a company who does not need additional capital may issue equity just to take advantage of a high valuation, or may defer issuances if market conditions are unfavorable. This view directly contradicts both the tradeoff theory and pecking order theory; If firm value rises, the ratio of debt to equity will fall and according to the tradeoff theory firms should then issue debt to rebalance, not additional equity. As for the pecking order theory, (Myers, 1984) states that the information asymmetry between managers and investors does not increase with higher share prices, and that "there is no way firms can systematically take advantage of purchasers in a rational expectations equilibrium".

While each theory[1] has been supported by at least some empirical evidence[2], a recent study by Frank & Goyal (2009) examines all publicly traded American firms from 1950 – 2003 in order to determine which main factors explain the ratio of leverage to market value of assets. With over 200 000 company-years in their sample, they have identified six "core factors" of leverage which are statistically significant (27% of variation explained) across several treatments of their data.

Their significant factors; *Industry Median leverage, Tangibility, Profits, Firm Size, Market-to-book assets ratio* and *Expected Inflation* does not combined support either before

[1] For a summarized rewiew of capital structure literature, see (Frank & Goyal, 2008)
[2] see (Harris & Raviv, 1991) & (Titman & Wessels, 1988)

mentioned theories. However, five of the factors – the profit factor being excluded – are consistent with static tradeoff theory. Their theoretical significance and impact on leverage will further be discussed in the Variables section of this paper.

Managerial Ownership

CEO and executive management ownership is traditionally perceived as an effective agent to align management interests with shareholders, as well as it mitigates risks of shirking and managerial opportunism at shareholders' expense. There is however a risk-shifting problem with this form of compensation, as a CEO with interests perfectly aligned with shareholders may choose a capital structure unfavorable to other stakeholders.

Equity ownership

Jensen & Mecking (1976) argues in their classical agency-theory paper that CEO ownership reduces risk aversive behavior and motivates managers to increase firm risk. Equity ownership by management[3] is also stated to be an effective agent in reducing agency costs and should enhance firm performance. Stein (1988) further argues that managerial ownership aligns long-term interests, by discouraging pursuit of short term profits and reduces the likelihood of takeovers.

Several studies have further explored the subject and examined the effect of management shareholdings on company value and profitability, their combined results are however inconclusive. McConnell & Servaes (1990) show that the percentage of shares owned by corporate insiders has a positive linear relationship with the quotient Tobins' q, a ratio of market and replacement value of assets [4]. Their study argues that the quotient slope will rise until insider shareholdings reach between 40-50%, which supports the before mentioned theories of shareholder alignment. In their paper it is further argued that managerial efforts increase with ownership in general, which is consistent with standard agency theory.

Other studies of management shareholdings and Tobin's q have yielded various results, notably Morck, Shleifer & Vishny (1988) who only finds a positive relation between q and board member shareholdings in the intervals of 0-5% and over 25%, while the

[3] *A potential weakness in their model - which for the record is pointed out in their paper - is the assumption of the manager having all wealth invested in the company. Although this fact reduces the absolute strength of the before mentioned argument, its general validity is still present.*

[4] $q = \frac{Market\ Value\ of\ Equity + Market\ Value\ of\ Debt}{Replacement\ Value\ of\ Assets}$

relationship is negative in the 5%-25% ownership interval. Holderness, Kroszner & Sheehan (1999) also present similar figures in their sample of firms both in 1935 and 1995.

Cho (1998) concludes that ownership structure has a significant relation with corporate value, but at the same time that ownership structure is a function of corporate value and may therefore not be treated exogenously. He further states that previous studies may be prone to error due to assumptions of exogeneity. Zhou (2001) also argues that the relation may be sensitive to modeling techniques, and that "fixed effects estimators may not detect an effect of ownership on performance even if one exists".

More recently Yermack (1996) and Cornett, Marcus & Tehranian (2008) does not find any evidence of a linear relation between insider shareholding and company performance.

Debt implications

Aligning CEO incentives with shareholder interests may according to agency theory induce management to take on more risk[5], and thus increase the leverage ratio of the company. Even though shareholders benefit from this shift in financing, bondholders may experience reduced wealth as a consequence of increased risk trough default. Other studies, notably Shleifer & Vishny (1997) and Barclay & Holderness (1989), point to management entrenchment and other non-value increasing behavior as a consequence of ownership, which may increase probability of default and thus hurt both share- and bondholders.

The before mentioned arguments on incentive compensation by Stein (1988), Morck, Shleifer & Vishny (1988) and others are on the other hand valid from a bondholder perspective as well. As managers are incentivized to improve company performance, probability of default decreases and bondholder wealth should thus increase. If covenants are in place to mitigate managerial opportunism, they should benefit bondholders as well.

CEO Wealth, Equity Incentives & risk aversion

CEO influence over total changes in company value will always be limited by outside factors, and thus equity ownership exposes management to risks beyond their control. In a paper on Swedish executives, Becker (2006) states that agency-theory therefore

[5] Jensen & Meckling (1976), Demsetz & Lehn (1985), Agrawal & Mandelker (1987)

predicts the inherent risk of equity and option compensation to reduce optimal incentives.

Becker's paper on executive wealth and compensation examines incentives received by Swedish CEOs in order to determine whether CEOs with higher wealth receive stronger incentives in the form of pay, percentage ownership of firm (Value sensitivity) and money-at-stake (Return sensitivity). This follows a theoretical assumption that higher wealth results in lower total risk aversion, and that wealthier CEOs require a smaller risk premium on their incentive compensation.

By using taxable wealth data obtained from the Swedish tax authorities on CEOs of Stockholm listed companies between 1993 and 1999, he determines that CEO wealth is significant in explaining both percentage share of firm and money at stake. Wealth is however insignificant in explaining pay levels, and Becker concludes that his findings does not support the use of wealth as a proxy for neither CEO skill nor power.

Becker's study has been replicated in a Norwegian master's thesis at NHH (Wezeman, 2010), who employ mainly the same techniques on 425 CEO observations of Oslo-listed companies. Wezeman also finds a positive relationship between CEO wealth and incentive strength, and thus strengthens the universal application of Becker's study. It should be noted that the evidence found in Wezeman's thesis is somewhat weaker, as a significant relationship is only observed when explaining percentage ownership (value sensitivity), and not CEO value at risk. This is contrary to Becker's paper, where the relationship is positive regardless of measuring value or return sensitivities.

VARIABLES:

This section will first discuss different methods of measuring risk trough leverage ratio, and will further cover the theoretical background of the included variables and control variables used in this paper.

Risk and leverage

Adding leverage to an asset will increase owner risk according to standard textbook finance literature[6]. This is due to the multiplication of losses that the residual claimant will bear in the event of a reduction in asset value, as the face value of the obligation to the external financing claimant remains fixed until an eventual bankruptcy. The multiplication thus entails that adding leverage to a company causes higher volatility in both earnings and share prices, the latter being thoroughly explained by Christie (1982).

Leverage ratios

When writing a paper examining leverage ratios, one should pay attention to the different views on how to measure such and their corresponding argumentation for relevance. There are proponents of using both market and book values when calculating this ratio, and arguments from both camps should be reviewed.

As for book leverage, Myers (1977) argues that for the sense of practicality, target debt ratios should be set in terms of book leverage. As market fluctuations constantly change the market capitalization of a firm, book leverage makes for a more reliable measure when developing financing policies. He further states that book values refer to assets in place, while market values additionally incorporate the option value of future investments. Book values referring to assets in place are thus a better support for debt, which is supported by the fact that firms tend to match the maturities of assets and debt.

In a survey of 392 CFOs, Graham & Harvey (2001) finds evidence that most firms do not balance their debt according to changes in equity prices, and that few firms lets market equity movements affect debt policy. This fact may be due to the transaction costs of rebalancing, which they find moderate evidence of firms considering in their debt issuance decisions. Fisher, Heinkel & Zechner (1989) supports this notion, and theorizes that firms only rebalance when certain limits are reached.

[6] I.e. Bodie, Kane & Marcus (2010)

I another paper, Welch (2004) partially agrees with the before mentioned theories regarding rebalancing. His findings are that only 40% of changes in debt equity ratios are explained by stock market returns. He is however a proponent for employing market leverage in the ratio calculations as he states that book leverage is just a plug number used to balance assets and financing in the balance sheet, and that it in fact can be negative. Barclay, Morellec & Smith (2006) also makes a similar argument through their paper on debt capacity. They state that while book values are representations of past events, market values are forward looking and anticipate future earnings.

For Norwegian companies, book values of assets was generally restricted to depreciated historical cost as NGAAP (Norwegian Generally Accepted Accounting Principles) was the accounting standard used by Norwegian companies until IFRS reporting was made mandatory in 2005. As the book values of equity for the firms in the sample was calculated on the basis of NGAAP until 2005, the book liability ratio is believed to be more a function of accounting than other factors, and the emphasis of this thesis is thus put on market leverage.

Control variables

Market to book

According to both tradeoff theory, pecking order theory and market timing theory, the market to book ratio should be an important factor in explaining leverage ratios as it is a commonly used proxy for investment opportunities. The theories do albeit give very different reasons for its significance, as well as whether the correlation should be positive or negative.

According to tradeoff theory, distress costs play an important role in determining the optimal leverage ratio for a given firm. As the market-to-book ratio is a proxy for future growth opportunities and growth entails higher costs of financial distress, the relation should therefore be negative.

Similarly may firms with a high market-to-book ratio have less debt if one assumes the company utilizes market timing to take advantage of a high valuation.

The pecking order theory does on the contrary predict that firms with higher market-to-book ratios should have more debt. Following the assumption that debt is used after internal financing sources are depleted, firms with higher investments – and thus higher PVGO though the market-to-book ratio – will eventually have higher debt ratios than firms with less investment activity.

There are also differing opinions on how the measure of market-to-book ratio should be calculated. Both Graham & Rogers (2002) and Lewellen, Loderer & Martin (1987) use the market-to-book equity ratio, where market capitalization is divided by the book value of common stock. Adam & Goyal (2008) however make a strong argument for the use of the market-to-book asset ratio, with their findings of a larger explanatory power using the quotient more closely related to Tobin's q.

Size

As company size is important in determining default risk, larger firms should have higher debt ratios. Larger firms are generally older than smaller ones, and thus enjoy higher trust and better terms when seeking external financing[7] which should entail a higher debt ratio. On the flip side, older companies may have retained earnings for a longer time, and should thus have less debt according to pecking order theory.

Profits

[7] Frank & Goyal, (2009)

There are several studies on the subject of profitability and leverage, each with different assumptions and results. Intuitively, a profitable firm should benefit more from the tax shields that debt financing entail, and should thus have a larger share of debt than less profitable firms. Also, as expected bankruptcy costs are smaller for profitable firms, tradeoff theory therefore suggests that profitable firms should have higher debt.

Jensen (1986) argues that firms with free cash flows may face agency problems, as managers may discretionary dispose said cash into new investments and to build empires without being monitored by the market in general. The disciplining effect of debt may thus entail that profitable firms take on more debt as an agent to mitigate principal-agent conflicts.

Other empirical studies, i.e. Kayhan & Titman (2007) argue that as firms accumulate profits and retain earnings, the ratio of debt to equity will fall. This argument is also consistent with pecking order theory, where internal financing when available is preferred over debt issuance. Kayhan & Titman does however also find that even though profitability affects leverage negatively, companies will over longer time spans adjust their capital structure to target ratios as explained by tradeoff theory.

Risk

As volatility in cash flows enhances the costs of financial distress, companies expecting such volatility should choose a less levered capital structure (George & Hwang 2010). Frank & Goyal (2009) also point to the reduced probability of fully utilizing the benefits of tax shields for such firms, but also argue that volatile firms may take on more debt than the tradeoff theory suggests due to adverse selection and frequent requirements for additional financing. Volatility may also play a significant factor in determining the actual ability of said firms to acquire external financing, at least to an acceptable cost.

Industry

It is an indisputable fact that leverage ratios vary across different industries. Nature of assets, volatility, competition, macroeconomic conditions, technological advances, taxes and numerous other factors may have specific implications for a certain industry, and thus for optimal and/or consequential leverage ratios. This is consistent with all previously mentioned leverage theories; if one assumes the tradeoff theory to be correct, marginal benefits and costs of debt will vary across industries. Pecking order theorists will also have to acknowledge the different relative magnitudes of cash flows available for internal financing, the possibility to raise debt due to i.e. nature of assets

and finally the market's willingness to invest in a certain sector. The before mentioned arguments will also contribute to explain differences in leverage trough a market timing perspective under the assumption of correlation within industries.

Several earlier papers have pointed out that firms use industry median leverage as their target debt ratio, and that industry median leverage is significant in explaining the ratio in larger datasets. In papers examining target debt ratios, Hovakimian, Opler & Titman (2001) and Flannery & Rangan (2006) both point to median industry leverage as target leverages, and find consistency between the industry leverages and leverage for the companies in their regressions. In the comprehensive study by Frank & Goyal (2009), industry median leverage is also highly significant in explaining capital structure, and is considers as one of their "core factors" of leverage.

Another justification for industry leverage as a control variable is the likelihood that the variable will capture other industry specific omitted variables. In the case of this paper, available consistent data on the nature of assets for each company is limited. As the nature of firm assets may be an important factor in explaining leverage from all theories[8], there is a potential loss of explanatory power from the regression performed below. Industry median leverage thus becomes even more important, as it at least partially will take into account the different assets held by a company in an industry (even if it will be with wider strokes than preferential.)

[8] Frank & Goyal (2009)

DATA AND METHODOLOGY:

Norwegian tax figures

This thesis attempts to use non-firm dependent wealth as a proxy for risk aversion using wealth figures from the Norwegian tax authorities. There are however drawbacks of using the reported figures as they are prone to several sources of error for the purpose of this thesis. Also, the findings of this paper may not be replicated directly outside of Scandinavian countries due to several aspects which will be discussed in the following.

The Norwegian tax authorities automatically collect information from the central securities depository (VPS), banks, employers, insurance companies, pension providers and other public and non-public institutions each year in order to determine the income and wealth of each Norwegian taxpayer. The taxpayer is in the following year presented with a pre filled tax form and may submit documented corrections before tax is calculated. The tax authority's opportunity to gather information on holdings of assets in other countries is however limited, and the system to some extent relies on the taxpayers to report such holdings to the authorities under a regime of sanctions if they are found to be underreporting their real assets and their value. The limitations of the authorities' reach outside of Norway may lead to tax evasion trough holdings in offshore accounts, and final wealth figures may be underreported. As Norway currently taxes wealth with 1.1% percent per year over a minimum threshold of 750 000 kroner (2012), there are substantial incentives for persons with large fortunes to relocate assets to other countries where reporting is less stringent.

When calculating wealth, the Norwegian tax code allows for deductions of mortgages and other liabilities the taxpayer has acquired. This means that the taxable wealth figures only are net of any obligations on the taxpayers' behalf. As homeownership in Norway is very common (73% of households in 2009 according to Statistics Norway) and mortgages are favorable due to deductibility of principal and interest payments in calculations of capital tax and income tax respectively, the net wealth figures are understated to a large extent. This can be observed in the sample used in this thesis, where 158 of 663 CEO-years have zero taxable wealth.

Another fact contributing to lower wealth figures is the assessment values put on different asset classes by the tax authorities. Real estate that serves as the taxpayer's primary residence is for instance on average valued at 25% of market value, while the figure for secondary homes is 40%. There is also a cap on the assessment values, and

primary and secondary residences may not have taxable values over 30 and 60%. Year 2009 estimates by Statistics Norway show that while 65% of the gross wealth of Norwegian households is invested in own dwellings , the tax-assessed values of said dwellings is only 19 % of gross household wealth (Epland & Kirkeberg, 2012). Holdings of other assets like exchange listed securities are valued at closing price per 31.dec, but for unlisted companies the taxable value equals the book value of the companies.

Even though the figures for wealth may be grossly understated, they are (without the possibility of tax evasion) equally calculated for each individual. If one assumes that every CEO is optimizing his/her behavior according to the tax code, then taxable wealth should serve as a good proxy for wealth and thus total risk aversion.

The replication of the results of this paper outside of Scandinavia may be difficult due to several reasons:

First of all, the desire for transparency by the current government in Norway has led to tax figures being made publicly available. Any Norwegian may request tax data on another person from the last tax year through a web search engine provided by the tax authorities. Also, the authorities provide tax data for several years back for research purposes (as for this thesis) without any need for consent from the taxpayers being researched. The figures publicly available are however limited to taxable wealth, taxable income and taxes paid, which makes estimations of true values for wealth figures difficult.

Secondly, the wage structure of the Norwegian (and Scandinavian) societies entails a large degree of income equality across professions and job hierarchies. Average salaries are high compared to other western countries, while executive compensation is relatively lower than in other western countries.

Data

Sample

The data in this sample consists of companies listed on the Oslo stock exchange in the period from 1998 to 2011. As more detailed data is available for companies in recent years, this might lead to a bias toward younger companies in the sample. To adjust for this fact, a requirement for inclusion in the sample is that the company was listed in 2008, which eliminates companies introduced to the exchange in 2009 and after. The sample consists of 75 of the largest 100 companies listed on the Oslo stock exchange in 2008 measured by market capitalization of both A and B stock. Data on the companies are from the year 1998 to 2011, or from the year the company was first listed. Two large Norwegian companies, DNB and Storebrand, were omitted from the sample due to their regulated nature and different accounting practices which makes calculations and estimations of important variables difficult (Banking and Insurance).

The sample consists of a total of 663 CEO-year observations, with 146 different individuals. A few CEOs have held 2 positions during different points in time, and 1 CEO have held the executive position in 2 companies at once. The average age is 50.16 years and average tenure for each CEO is 6.81 years. The average time each company has been listed on the Oslo stock exchange is 11.09 years.

Collection

The data in the sample is gathered from several public and non-public sources. To ensure consistency in the sample, each type of data used has been acquired from a single source when possible.

Initial data on CEO age, tenure, shareholdings and options are gathered from annual reports and in a few instances from correspondence with companies' respective investor relations departments. Age and person were again confirmed by both public databases such as proff.no, and by correspondence with the tax authorities in order to confirm that data for the right person was requested.

Data on wealth was obtained from the tax authorities in Norway (Skatteetaten). As there are strict control routines on what data is distributed, the tax authorities will only submit data if there is an absolute match between the person requested and the person on file. If any persons have the same name and the same birth year, manual searches must be performed to confirm identities. As information for this thesis was requested during the busy spring season, the sample was reduced by 8 data-points due to persons

having equal names and due to the demise of 2 individuals for which tax data is no longer available.

Accounting data was gathered using a Bloomberg terminal (codes supplied in the following variables section), and supplemented by the accounting database Amadeus at the Norwegian School of Economics, the accounting database from FactSet, and annual reports.

Expected inflation figures were gathered from the yearly statistical publication "Economic Outlook" (Økonomisk Utsyn in Norwegian), published by Statistics Norway. GNP deflator estimates were obtained from the website of the World Bank, and was later confirmed by correspondence with Statistics Norway.

Description of variables

Variable definitions

TDM (Total debt to market)

This Leverage ratio was calculated by dividing total liabilities (Bloomberg BS_TOT_LIAB2) by market capitalization. Market capitalization was calculated by multiplying shares outstanding (Bloomberg BS_SH_OUT) with closing share price as of 31. Dec (Bloomberg PX_LAST)

WIND_TDM (Winsorized Total debt to market)

TDM Winsorized at the 0.5 percentile in both ends.

TDM_FULL (Interest bearing debt to market)

Another leverage ratio, consisting of Long-term interest bearing debt (Bloomberg BS_LT_BORROW) + current portion of long term debt (BS_ST_BORROW) divided by the market value of assets. Market value of assets was calculated as Market capitalization + Long-term interest bearing debt (Bloomberg BS_LT_BORROW) + current portion of long term debt (BS_ST_BORROW) – Deferred taxes and investment tax credit (From FactSet)

TDB (Total liabilities to Book)

Leverage ratio of total liabilities (Bloomberg BS_TOT_LIAB2) divided by the book value of shareholder equity (Bloomberg TOTAL_EQUITY)

WIND_TDB (Winsorized Total liabilities to Book)

TDB Winsorized at the 0.5 percentile in both ends.

Ln Non-Firm wealth (Real)

Ln Non-Firm Wealth was calculated by taking the natural logarithm of taxable wealth minus value at risk. Value at risk was calculated by multiplying the number of shares held by the CEO at year-end by closing price per 31. Dec (Bloomberg PX_LAST) added with the number of options held by the CEO multiplied with 0,6 and again with closing price per 31 Dec. (Bloomberg PX_LAST). The resulting figures were inflated/deflated to 2005 figures by using a Norway-specific GNP deflator obtained from the World Bank.

Percentage of taxable wealth at stake (Wealth at stake)

Percentage wealth at stake was calculated by dividing the CEO value at risk with taxable wealth. If the CEO value at risk was higher than the taxable wealth, the value was set to 100%. Value at risk was calculated by multiplying the number of shares held by the CEO at year-end by closing price per 31. Dec (Bloomberg PX_LAST) added with the number of options held by the CEO multiplied with 0,6 and again with closing price per 31 Dec. (Bloomberg PX_LAST).

Percent ownership

Percent ownership was calculated by dividing value at risk with market capitalization. Value at risk was calculated by multiplying the number of shares held by the CEO at year-end by closing price per 31. Dec (Bloomberg PX_LAST) added with the number of options held by the CEO multiplied with 0,6 and again with closing price per 31 Dec. (Bloomberg PX_LAST). Market capitalization was calculated by multiplying shares outstanding (Bloomberg BS_SH_OUT) with closing share price as of 31. Dec (Bloomberg PX_LAST)

Stock volatility

Volatility figures in the regression are 360 days Bloomberg calculations (Bloomberg VOLATILITY_360D)

Median industry leverage

Industry median leverage is calculated as the median leverage ratio (Calculated like TDM) of clusters based on 2-digit GICS-Codes[9] for all firms listed on Oslo Exchange in the sample period. *4 or 6 digit specification would be preferred to capture more detailed industry specifics, but due to the limited number of listed companies on Oslo Exchange (I.e. 2 airlines, 2 telecom providers) the broader definition was used.*

Profitability

Profitability is calculated as EBITDA (Bloomberg EBITDA) over total assets (Bloomberg BS_TOT_ASSET)

WIND_Profitability

Profitability winsorized at the 05% level in both ends,

[9] GICS codes are the standard industry classification used by the Oslo Exchange, by nature similar to SIC codes.

Log of assets

Log of assets is the natural logarithm of total assets (Bloomberg BS_TOT_ASSET) deflated/inflated to 2005 figures by using a Norway-specific GNP deflator obtained from the World Bank.

Tangibility

Tangibility of assets is calculated as net property, plant and equipment (FactSet Net PPE) over assets (Bloomberg BS_TOT_ASSET).

Market-to-book

As market value of debt is difficult to obtain for such a large sample, a proxy was made to capture most of the PVGO in this figure. The market-to-book asset ratio was calculated by dividing market capitalization by assets (Bloomberg BS_TOT_ASSET). Market capitalization was calculated by multiplying shares outstanding (Bloomberg BS_SH_OUT) with closing share price as of 31. Dec (Bloomberg PX_LAST).

WIND_Market-to-book

Market-to-book winsorized at the 0,5% level in both ends.

Expected inflation

The figures for expected inflation are acquired from Statistics Norway (SSB) and are SSB beginning of year estimates of KPI-JAE, which is a consumer price index adjusted for taxes and energy commodities. The rationale behind using this figure is that the Norwegian Central bank uses this adjusted measure when setting their key policy rate and it is the measure generally used when estimating inflation in mainland Norway.

NIBOR

NIBOR is the 12 month Norwegian Interbank Offer Rate in December of the current accounting year, obtained from the Central Bank of Norway

Term Spread

Term spread is the spread between 10 year government bonds and 12 month certificates in December of the current accounting year. Data on bonds and certificates[10] obtained from the Central Bank of Norway.

[10] The rates of some certificates are synthetic, and are calculations made by the Central Bank of Norway due to lack of offering.

Descriptive statistics

The following table (Table 1) presents descriptive statistics of the sample used in the regression.

In Panel A, sample statistics per observation year not used in the regression may be observed. The mean CEO age is 50 years and average tenure is 6.81 years. Mean wealth per year is 41.40, while the median value is 3.93 million NOK. The companies have been listed an average of 11.9 years per observation year, and the average market capitalization is 15.6 million NOK.

Panel B presents summary statistics of all variables used in the regressions. Due to missing data in the sources used, TDM_FULL, percentage ownership, volatility and tangibility have slightly less observations than the total sample of 663 observation years. The leverage ratios TDM and TDB have either a very high maximum or minimum observation, which may be caused by unusual events and/or circumstances (Maximum TDM is 56.86 while minimum TDB is -22.63). The irregularity of these observations is confirmed by observing the maximum and minimum values of the winsorised ratios, WIND_TDM and WIND_TDB, where the maximum TDM is 26.67 and the minimum TDB is 0.09. In the explanatory variables, percentage ownership ranges from 0 to 70.77 with a median observation of 22%, while the median CEO's wealth at stake is 100%.

The figures for profitability and market-to-book also show very high maximum and/or minimum values, which irregularity may be confirmed by observing the less extreme values found in the winsorized (0,5%) ratios.

Panel C and D presents taxable wealth and non-firm wealth respectively for the CEOs in the sample for each year. Both mean and median value of taxable wealth has doubled during the 14 sample years, while mean and median non-firm wealth has increased 3 to 4 times the 1998 figures. The distribution of wealth among CEOs is very skewed in all observation years, as may be observed when comparing the mean and median values where the latter is between 4 and 10 times higher. Non-firm wealth has a median value of zero in 12 of the 14 years, while the lowest observed median value of taxable wealth is 1.39 MNOK in all sample years. This observation may to some extent be attributed to the different tax assessment values of equity and real estate, but may also indicate strong CEO incentives throughout the sample.

Panel E presents a pairwise correlation matrix between the independent variables used in the regressions. From observing the table it can be concluded that all explanatory variables (Wealth at stake, percent ownership and non-firm wealth) are highly correlated, which implicates that separate regressions should be performed for each explanatory variable. Term spread, NIBOR and expected inflation are as anticipated also highly correlated (significant at the 0.1% level). As these variables are largely founded on the same macroeconomic forecasts, only one should be necessary to control for macroeconomic outlook (the "results" section includes this consideration which involves weighting of explanatory power of the regression and significance).

Panel F presents pairwise correlations between leverage ratios and the independent variables. Both wealth at stake and non-firm wealth show significant correlations with the leverage ratios, ownership percentage is however uncorrelated. TDM, TDM_FULL and WIND_TDM have significant correlations with all key variables from Frank & Goyal (2009), with the exception of expected inflation. As this proxy for expected yield curve also is considered in the NIBOR and Term Spread variables, expected inflation is thus dropped from subsequent regressions. The correlations between book leverage, TDB and WIND_TDB, and independent variables are of less significance than the market based leverage ratios, which supports the findings of Frank & Goyal (2009) and the notion of book equity to be a plug number. There is no notable difference in correlations regarding winsorization of Market-to-book and profitability.

Table 1

Sample overview

Summary statistics for the sample of 75 companies listed on Oslo Stock exchange for the period of 1998-2011. Observation years where data is missing are omitted. Panel A present pooled statistics on the companies and their CEOs. CEO age is the age of the CEO in the observation year. Tenure is the number of years the CEO has held the position, where 1 is the first year. CEO wealth is taxable wealth obtained from the Norwegian tax authorities. Time listed on Oslo Exchange is the number of years the company has been listed in the observation year. Market Cap is the market capitalization of the company, calculated by multiplying closing price per 31. Dec with shares outstanding per 31. Dec. Volatility is return volatility. Panel B Presents summary statistics of variables used in tests. Leverage ratio is book value of liabilities divided by market capitalization. Wealth at stake is the percentage (in decimal numbers) of CEO wealth tied to company performance. % Ownership is the percentage the CEO holds of the equity. Ln non-firm wealth is the natural logarithm of CEO wealth, wealth at stake subtracted. Ln market Cap is the natural logarithm of the market capitalization (Size). Profitability is EBITDA over book value of assets. Ln Assets is the natural logarithm of book assets, deflated/inflated to 2005 figures. Market-to-book is market capitalization over book value of assets. Expected inflation is the year-start expected KPI-JAE as estimated by Statistics Norway. Median leverage is the median industry leverage ratio, calculated as total liabilities divided by market capitalization, Clustered by 2-digit GICS-Codes for all firms listed on Oslo Exchange in the sample period. NIBOR is the Norwegian Inter Bank Offer Rate as of 31. Dec current year. Term Spread is the spread in interest rates between 10-year bonds and 12 month certificates from the Norwegian Central Bank. The prefixes WIND_ refer to a 0.5% winsorization in both ends. Panel C presents taxable wealth as presented by the Norwegian tax authorities. Panel D presents Non-firm wealth which is total wealth minus the value of CEO share- and option holdings in the employing firm. Panel E presents variable correlations between independent variables in the pooled sample. Panel F presents variable correlations between leverage ratios and independent variables. *,** and *** denotes significance at the 5%, 1% and 0,1% level

Panel A: Summary statistics of sample (Pooled)

	Mean	Median
CEO Age	50.16	50.00
Tenure	6.81	5.00
CEO Wealth (MNOK)	41.40	3.93
Time listed on Oslo Exchange	11.90	9.00
Market Cap (MNOK)	15,599.99	3,208.93

Panel B: Summary statistics of variables

	Observations	Mean	Std. D.	Min	25th	Median	75th	Max
TDM	663	1.75	3.82	0.01	0.45	0.88	1.73	56.86
WIND_TDM	663	1.68	3.12	0.02	0.45	0.88	1.73	27.67
TDM_FULL	608	0.36	0.25	0.00	0.17	0.33	0.54	1.14
TDB	663	1.79	2.02	-22.03	0.97	1.50	2.21	19.20
WIND_TDB	663	1.80	1.46	0.09	0.97	1.50	2.21	11.45
Wealth at stake	663	0.73	0.39	0	0.41	1	1	1
% Ownership	641	4.66	12.13	0	0.03	0.22	1.27	70.77
Ln non-firm wealth	663	5.56	7.52	0	0	0	14.49	20.64
Volatility	643	48.24	23.91	0.49	31.99	41.4	58.17	214.13
Profitability	663	0.10	0.13	-1.25	0.06	0.1	0.15	0.56
WIND_Profitability	663	0.11	0.11	-0.36	0.06	0.10	0.15	0.46
LN Assets	663	8.54	1.59	4.34	7.54	8.55	9.46	13.28
Tangibility	589	0.39	0.31	0.00	0.12	0.30	0.65	3.01
Market-to-book	663	1.08	1.4	0.02	0.38	0.67	1.15	13.57
WIND_Market-to-book	663	1.07	1.34	0.03	0.38	0.67	1.15	9.42
Median leverage	663	1.06	0.45	0.09	0.91	1.10	1.10	2.11
Expected Inflation	663	1.93	0.65	0.3	1.5	2.2	2.3	2.7
NIBOR	663	4.60	1.71	2.21	3.06	4.01	6.33	7.19
Term Spread	663	0.65	1.00	-0.64	-0,24	0.83	1.33	2.42

Panel C: Taxable Wealth

(100.000 NOK)	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25th percentile	0.00	2.80	0.05	0.00	0.00	0.00	0.19	13.25	8.68	22.91	4.12	0.00	2.83	0.00
Median	30.14	15.55	16.25	16.45	13.99	17.35	36.91	57.76	73.13	96.71	41.28	75.17	50.30	62.39
Mean	263.56	385.13	482.06	240.95	148.78	161.14	254.01	216.38	438.10	757.60	369.42	718.61	423.22	574.09
75th percentile	473.12	501.52	134.84	90.34	59.27	37.26	130.42	209.31	222.71	379.79	208.45	292.32	182.17	269.80
Max	1254.52	2607.36	8421.11	2882.15	1353.42	1725.95	2777.05	3041.63	4042.23	16727.98	4305.84	9659.33	4114.63	6108.60
Observations	25	30	34	37	41	38	44	51	61	67	69	46	61	60

Panel D: Non-Firm Wealth

(100.000 NOK)	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25th percentile	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Median	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,87	0,00	0,00	0,03
Mean	79,60	16,19	20,18	29,47	34,80	28,27	43,70	41,35	77,55	220,64	163,60	77,93	108,13	307,65
75th percentile	23,21	2,08	0,00	0,00	10,73	0,00	0,45	32,09	9,68	59,01	95,96	15,95	40,17	80,95
Max	788,00	394,74	620,68	969,86	664,14	956,56	973,19	402,36	2340,10	9229,13	3021,72	1080,48	2107,16	4576,63
Observations	25	30	34	37	41	38	44	51	61	67	69	46	61	60

Panel E: Pairwise correlations between independent variables

	Wealth at stake	Ownership	Ln Non-firm	Volatility	Profitability	W_Profitab.	Ln Assets	Mk-T-B	W_Mk-T-B	Exp. Inflation	Median Lev.	NIBOR	Term Spread	Tangibility
Wealth at stake	1.000													
Ownership	0.186 (0.000)***	1.000												
Ln Non-firm	-0.739 (0.000)***	-0.178 (0.000)***	1.000											
Volatility	-0.052 (0.191)	0.001 (0.983)	-0.021 (0.594)	1.000										
Profitability	-0.077 (0.047)*	-0.069 (0.080)	0.029 (0.451)	-0.183 (0.000)***	1.000									
W_Profitab.	-0.075 (0.053)	-0.074 (0.062)	0.019 (0.633)	-0.195 (0.000)***	0.941 (0.000)***	1.000								
Ln Assets	-0.016 (0.677)	-0.122 (0.002)**	0.132 (0.001)**	-0.218 (0.000)***	0.287 (0.000)***	0.288 (0.000)***	1.000							
Mk-T-B	0.119 (0.002)**	-0.097 (0.014)*	-0.171 (0.000)***	-0.006 (0.876)	0.018 (0.647)	0.021 (0.595)	-0.420 (0.000)***	1.000						
W_Mk-T-B	0.116 (0.003)**	-0.097 (0.014)*	-0.171 (0.000)***	-0.011 (0.779)	0.019 (0.633)	0.016 (0.684)	-0.428 (0.000)***	0.979 (0.000)***	1.000					
Exp. Infl.	-0.061 (0.119)	0.022 (0.582)	0.034 (0.378)	-0.156 (0.000)***	-0.014 (0.728)	-0.005 (0.900)	-0.046 (0.234)	0.040 (0.298)	0.049 (0.212)	1.000				
Median Lev.	-0.193 (0.000)***	-0.047 (0.239)	0.192 (0.000)***	-0.167 (0.000)***	0.159 (0.000)***	0.149 (0.000)***	0.255 (0.000)***	-0.340 (0.000)***	-0.346 (0.000)***	0.010 (0.789)	1.000			
NIBOR	-0.050 (0.194)	0.055 (0.165)	0.004 (0.919)	0.146 (0.000)***	-0.058 (0.136)	-0.042 (0.280)	-0.027 (0.493)	-0.097 (0.013)*	-0.107 (0.006)**	0.556 (0.000)***	0.010 (0.800)	1.000		
Term Spread	0.074 (0.057)	-0.042 (0.287)	-0.050 (0.201)	-0.081 (0.041)*	0.046 (0.240)	0.024 (0.534)	0.007 (0.853)	0.082 (0.034)*	0.089 (0.022)*	-0.644 (0.000)***	-0.011 (0.779)	-0.946 (0.000)***	1.000	
Tangibility	-0.258 (0.000)***	-0.020 (0.636)	0.145 (0.000)***	-0.097 (0.020)*	0.158 (0.000)***	0.145 (0.000)***	0.276 (0.000)***	-0.248 (0.000)***	-0.254 (0.000)***	-0.054 (0.187)	0.225 (0.000)***	-0.011 (0.781)	0.037 (0.365)	1.000

Panel F: Pairwise correlations between leverage ratios and independent variables

	TDM	TDM_FULL	TDB	WIND_TDM	WIND_TDB
Wealth at stake	-0.134	-0.191	-0.081	-0.133	-0.126
	(0.001)**	(0.000)***	(0.037)*	(0.001)**	(0.001)**
Ownership %	0.035	0.080	-0.019	0.044	-0.031
	(0.371)	(0.052)	(0.633)	(0.267)	(0.427)
Ln Non-firm wealth	0.121	0.172	0.101	0.119	0.121
	(0.002)**	(0.000)***	(0.010)	(0.002)**	(0.002)**
Volatility	0.343	0.164	0.028	0.347	0.171
	(0.000)***	(0.000)***	(0.475)	(0.000)***	(0.000)***
Profitability	-0.130	-0.169	0.013	-0.135	0.002
	(0.001)**	(0.000)***	(0.735)	(0.000)***	(0.958)
W_Profitability	-0.149	-0.176	0.006	-0.150	-0.010
	(0.000)***	(0.000)***	(0.885)	(0.000)***	(0.795)
Ln Assets	0.092	0.229	0.046	0.111	0.073
	(0.018)*	(0.000)***	(0.241)	(0.004)**	(0.060)
Mk-T-B	-0.243	-0.604	-0.182	-0.279	-0.256
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
W_Mk-T-B	-0.249	-0.586	-0.186	-0.292	-0.263
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Exp. Infl.	0.008	-0.059	0.044	0.010	0.050
	(0.831)	(0.146)	(0.258)	(0.798)	(0.195)
Median Lev.	0.083	0.187	0.161	0.107	0.222
	(0.033)*	(0.000)***	(0.000)***	(0.006)**	(0.000)***
NIBOR	0.172	0.126	0.048	0.187	0.060
	(0.000)***	(0.002)**	(0.219)	(0.000)***	(0.124)
Term Spread	-0.154	-0.113	-0.053	-0.173	-0.056
	(0.000)***	(0.005)**	(0.176)	(0.000)***	(0.153)
Tangibility	0.099	0.511	0.110	0.132	0.158
	(0.016)*	(0.000)***	(0.008)**	(0.001)**	(0.000)****

Methodology

Dimension specific effects

The dataset contains observations on specific firms and CEOs over several years, and thus caution must be exercised when considering the appropriate statistical methodology; The leverage ratio of a firm is likely highly correlated over time, the same is likely for CEO wealth, both invested in own firm and total figures. Macroeconomic factors and the two turbulent periods of financial turmoil during the sample years also suggest that there will be time-specific effects that may influence the sample. The presence of dependence in the residuals is thus possible on both a firm and time basis, which must be considered when selecting the appropriate model.

If the residuals are not dependent and identically distributed, ordinary least squares regressions (OLS) and White standard errors will be biased. In order to capture and control for such correlation, several methods have been and are currently used; If only cross-sectional time correlation is present, a Fama-MacBeth approach may be used to correct the standard errors. This method does however yield downwards biased standard errors if a firm effect is present, as presented in a paper by Petersen (2009). Clustering by one dimension (i.e. firms) in the regression is another approach widely used, as the White standard errors will be corrected for correlation (also known as Rogers standard errors). To capture any other effect with this method, dummies for the other parameter may be used to control for correlation within this dimension, and standard errors should thus be unbiased if the sample is great enough.

In the presence of both time- and firm effects, Petersen (2009) also proposes a methodology of two-dimensional clustering, where standard errors will be unbiased in both dimensions. Petersen also argues that this approach will produce correctly sized confidence intervals, regardless of whether the firm effects are fixed or temporary. As the methodology suggested by Petersen does capture the potential dependence in residuals on both a time and firm basis, it is thus suitable for the purposes of this paper if such effects are present. Said methodology has also been utilized in papers facing similar issues as this paper, notably Frank & Goyal (2009) and Jain et al. (2013).

Model Selection

When considering which model to utilize, standard errors were observed for the different methodologies mentioned above on the 663 observation dataset. First, an OLS regression with White standard errors was performed. A subsequent regression with clustering in the time dimension yielded considerably larger standard errors which strongly indicate a time effect. When also clustering by firm, the standard errors were even greater, which led to the conclusion that both a time and firm effect is present in the sample. The two dimensional clustering approach suggested by Petersen (2009) is thus utilized for the subsequent statistical analyses.

In order to determine which variable should be used to proxy for inflation/yield curve, regressions with all leverage ratios and explanatory variables was run, with either NIBOR or Term spread as the interest/yield component. Analysis of the AIC and BIC values showed a slightly better model using Term Spread, which thus became the control variable used in the regressions presented in the following.

RESULTS:

Regressions were run separately on all leverage ratios, with either Non-firm wealth (Table 2) or wealth at stake (Table 3) as the explanatory variable. For the winsorized leverage ratios, WIND_TDM and WIND_TDB, winsorized control variables were used for market-to-book and profitability.

Non-firm wealth

On the liabilities/market value of equity ratio (TDM), non-firm wealth shows a highly significant positive correlation (significant at the 0,2%-level). The coefficient of the log transformed variable is however small (0.052), and implies that a 1 percent increase in non-firm wealth would increase leverage ratio by 0,052% all other variables kept equal. A 50% increase in non-firm wealth would however involve a 2.6% increase in the leverage ratio, which is an interesting finding as this assumption is feasible.

In order to examine whether the findings in the regressions on liabilities/market value of equity are abnormal due to extreme observations, a regression was also performed on the winsorized (at the 0,5% level) leverage ratio, WIND_TDM. The still positive coefficient in this regression is slightly smaller (0.038) but still shows a highly significant correlation (1%).

On the leverage ratio considering only interest bearing debt (TDM_FULL), non-firm wealth shows a positive significant correlation, although the significance is lower (only significant at the 10%-level) and the coefficient smaller (0.002) than in the TDM regressions. As a 100% increase in non-firm wealth would only increase the leverage ratio by 0.2%, the effect of non-firm wealth on this leverage ratio could be described as marginal, although significant.

The regression on liabilities over book leverage (TDB) only show significant correlations with the market-to-book ratio and industry median leverage, which is consistent with previous statements. This effect should not be caused by extreme observations, as the regression on the winsorized book leverage ratio (WIND_TDB) yields similar results, with no significant correlation with non-firm wealth.

Table 2

Regressions of leverage ratios on non-firm wealth

The results of the regressions of leverage ratios on non-firm wealth are shown in the table below. The dependent variables are TDM, TDM_FULL, TDB, WIND_TDM and WIND_TDB. TDM is total liabilities divided by market capitalization. TDM_FULL is Long-term interest bearing debt plus current portion of long term debt divided by market capitalization plus Long-term interest bearing debt plus current portion of long term debt minus Deferred taxes and investment tax credit. TDB is total liabilities divided by the book value of shareholder equity. WIND_TDM is TDM Winsorized at the 0,5 percentile in both ends. WIND_TDB is TDB Winsorized at the 0,5 percentile in both ends. Ln Non-Firm wealth is the natural logarithm of taxable wealth minus value at risk in own company. Value at risk was calculated by multiplying the number of shares held by the CEO at year-end by closing price per 31. Dec added with the number of options held by the CEO multiplied with 0,6 and again with closing price per 31 Dec. The resulting figures were inflated/deflated to 2005 figures by using a Norway-specific GNP deflator obtained from the World Bank. Profitability is EBITDA divided by total assets. Volatility is 360 days stock volatility. Ln Assets is is the natural logarithm of book assets, deflated/inflated to 2005 figures. Market-to-book is market capitalization over book value of assets. Median leverage is the median industry leverage ratio, calculated as total liabilities divided by market capitalization, Clustered by 2-digit GICS-Codes for all firms listed on Oslo Exchange in the sample period. Term spread is spread between 10 year government bonds and 12 month certificates in December of the current accounting year. Tangibility is net property, plant and equipment divided by assets. Standard errors are adjusted by clustering for industry and year, and are reported in parenthesis. *, ** and *** denotes significance at the 10%, 5% and 1% level respectively. ^denotes winsorized data is used in WIND_TDM and WIND_TDB regressions.

Variable	TDM	TDM_FULL	TDB	WIND_TDM	WIND_TDB
Ln Non-Firm wealth	0.052***	0.002*	0.016	0.038**	0.011
	(0.016)	(0.001)	(0.012)	(0.015)	(0.010)
Profitability^	-3.283**	-0.397***	0.091	-3.480***	-0.120
	(1.342)	(0.131)	(0.700)	(1.081)	(0.685)
Volatility	0.049***	0.001***	-0.000	0.037***	0.010**
	(0.016)	(0.001)	(0.013)	(0.011)	(0.004)
Ln Assets	0.245*	0.008	-0.062	0.199*	-0.015
	(0.132)	(0.010)	(0.068)	(0.102)	(0.053)
Market-to-book^	-0.297**	-0.106***	-0.175**	-0.327***	-0.169**
	(0.133)	(0.021)	(0.076)	(0.117)	(0.070)
Median leverage	0.508*	0.046	0.454*	0.484*	0.552***
	(0.302)	(0.034)	(0.245)	(0.269)	(0.207)
Term-Spread	-0.438**	0.351***	0.398	0.736***	0.415
	(0.181)	(0.042)	(0.461)	(0.273)	(0.398)
Tangibility	0.694**	-0.029***	-0.073	-0.410***	-0.034
	(0.297)	(0.004)	(0.080)	(0.144)	(0.075)
Number of observations	573	532	573	573	573
R2	0.192	0.557	0.047	0.232	0.121

Wealth at stake

In the regression on liabilities over market value of equity (TDM), wealth at stake shows a negative (-0.011) and highly significant coefficient (at the 1% level). As the coefficient is a decimal portion of wealth invested, the interpretation should be treated carefully; A one percent increase of the total share invested (i.e. from 10 to 10.1%), and not a one percentage point increase (i.e. from 22 to 23%), would entail a 0.011 percent drop in the leverage ratio. This finding is consistent with the risk aversion assumption that a higher percentage of total wealth invested will increase CEO risk aversion on the firms' behalf, although the effect is very small. If one considers a CEO with 50 percent of wealth dependent on firm performance, an increase to 60% would only entail a 0.22 percent drop in the leverage ratio.

The control regression performed on the winsorized ratio (WIND_TDM) show a slightly smaller although still significant coefficient (-0.009), which may imply a marginalized effect of wealth at stake when correcting for extreme outliers caused by rare events. An explanation of the reduced coefficient and significance between the raw and winsorized ratio could be that as a company enters severe financial distress, the market value of equity is diminished and thus also the CEO percentage of wealth invested in own company, all while the capital structure of the firm shifts towards external financing only. This feasible causality has not been examined in this paper, and a time-series analysis revealing the existence of such causality should be incorporated in future research on whether CEO percentage wealth at stake affects leverage ratio.

For the leverage ratio TDM_FULL, the wealth at stake coefficient is very small (-0.0004) and insignificant (P>|t| 0.127), though it should be noted that the sign is still negative. No clear conclusions should be drawn from this limited sample, but the lack of significance in this ratio compared to the high significance in the TDM ratio is interesting, and could be researched further. It should be noted that the number of observations is smaller for this ratio, and as the distribution only spans from 0 to 1.14 (in contrast to the TDM ratio where the maximal observed value is 56.86 and 26.67 for the winsorized ratio) the above mentioned causality theory could be the reason.

As for book leverage, the wealth at stake coefficient shows no significant correlation with either the raw- nor winsorized ratio. Only market-to-book and median leverage

controls shows a significant relationship with the TDB ratio, which could testify to the argument of book leverage being a product of past events.

Other findings

The performed regressions also partially support the findings of Frank & Goyal (2009) in regard to capital structure determinants. In the regressions of non-firm wealth on market leverage, all control variables show a significant coefficient, with the exception of assets and median leverage on the TDM_FULL ratio. The latter may be due to the calculation of median leverage, as this variable was calculated on the basis of the raw TDM which distribution is greatly larger than for the TDM_FULL ratio.

In the regressions of wealth at stake, the significance of industry leverage and tangibility has diminished. As the correlations table show significant relationships between the three variables, the previous causality explanation of the wealth at stake figure could be applied although no conclusions should be based on this limited sample.

Consistent with the findings of Frank & Goyal (2009), the TDM_FULL ratio is largely explained trough the included control variables. The R2 of both regressions on this leverage ratio is over 50%, which is a strong signal considering the limited sample size in this paper.

Table 3

Regressions of leverage ratios on wealth at stake

The results of the regressions of leverage ratios on wealth at stake are shown in the table below. The dependent variables are TDM, TDM_FULL, TDB, WIND_TDM and WIND_TDB. TDM is total liabilities divided by market capitalization. TDM_FULL is Long-term interest bearing debt plus current portion of long term debt divided by market capitalization plus Long-term interest bearing debt plus current portion of long term debt minus Deferred taxes and investment tax credit. TDB is total liabilities divided by the book value of shareholder equity. WIND_TDM is TDM Winsorized at the 0.5 percentile in both ends. WIND_TDB is TDB Winsorized at the 0.5 percentile in both ends. Wealth at stake is the percentage (in decimal numbers) of CEO wealth tied to company performance.. Profitability is EBITDA divided by total assets. Volatility is 360 days stock volatility. Ln Assets is the natural logarithm of book assets, deflated/inflated to 2005 figures. Market-to-book is market capitalization over book value of assets. Median leverage is the median industry leverage ratio, calculated as total liabilities divided by market capitalization, Clustered by 2-digit GICS-Codes for all firms listed on Oslo Exchange in the sample period. Term spread is spread between 10 year government bonds and 12 month certificates in December of the current accounting year. Tangibility is net property, plant and equipment divided by assets. Standard errors are adjusted by clustering for industry and year, and are reported in parenthesis. *, ** and *** denotes significance at the 10%, 5% and 1% level respectively. ^denotes winsorized data is used in WIND_TDM and WIND_TDB regressions.

Variable	TDM	TDM_FULL	TDB	WIND_TDM	WIND_TDB
Wealth at stake	-0.011***	-0.000	-0.001	-0.009**	-0.002
	(0.004)	(0.000)	(0.004)	(0.004)	(0.002)
Profitability^	-3.607**	-0.412***	0.046	-3.802***	-0.186
	(1.466)	(0.131)	(0.699)	(1.214)	(0.705)
Volatility	0.047***	0.001**	-0.000	0.036***	0.010**
	(0.016)	(0.001)	(0.012)	(0.011)	(0.004)
Ln Assets	0.288**	0.010	-0.053	0.233**	-0.007
	(0.141)	(0.011)	(0.068)	(0.108)	(0.053)
Market-to-book^	-0.299**	-0.107***	-0.179**	-0.328***	-0.171**
	(0.137)	(0.021)	(0.074)	(0.120)	(0.070)
Median leverage	0.455	0.044	0.466*	0.437*	0.551***
	(0.279)	(0.034)	(0.242)	(0.256)	(0.205)
Term-Spread	-0.433**	0.342***	0.391	0.561**	0.390
	(0.178)	(0.042)	(0.436)	(0.273)	(0.383)
Tangibility	0.478	-0.029***	-0.077	-0.406***	-0.035
	(0.308)	(0.005)	(0.080)	(0.141)	(0.074)
Observations	573	532	573	573	573
R-squared	0.194	0.557	0.045	0.235	0.119

SUMMARY AND CONCLUSIONS:

After reviewing capital structure literature, literature reviewing capital structure literature and empirical papers, no single theory is able to point out an absolute truth regarding capital structure decisions and how firms choose their levels of debt. There are however a few determinants that over a large sample explain some of the observed variance, but the decisions still seems to be made arbitrarily by shareholders, the board of directors and ultimately with the CEO.

In a sample of 75 Norwegian companies listed on the Oslo stock exchange between 1998 and 2011 i examine whether CEO risk aversion, measured by wealth independent of company performance and percentage wealth at stake, explains some of the observed variation in leverage ratios.

Several regressions are run, where standard errors in both time and on a firm basis are corrected for trough two dimensional clustering. Control variables included in the regressions are the key variables defined by Frank & Goyal (2009) in their empirical study on leverage ratios.

Consistent with the hypothesis of this paper, the non-firm wealth of the CEO shows significance in explaining market leverage ratios; CEOs with higher non-firm wealth run companies with higher leverage ratios. The coefficients are however small, and the implications of further confirmation of the findings of this thesis is unclear.

I also find a relationship between CEO percentage wealth at stake in the company and one of the leverage ratios calculated, but due to the chance of causality these results should be verified with more analysis.

Suggestions for further research

The findings of this preliminary paper in the field of CEO risk aversion versus company risk could encourage other researchers to look more closely into this particular problem. As the availability of wealth data is limited to Scandinavia, a next step could be to pool data on companies in both countries to generate a larger sample and verify whether the findings of this paper show consistency on a larger scale.

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APPENDICES:

Appendix 1 - List of firms in sample clustered by 2-digit GICS.

GICS Prefix	Companies in cluster
07	Yara International
13	Statoil, Aker Solutions, Fred Olsen Energy, Petroleum Geo-Services, Subsea 7, Aker, Bonheur, DNO International, Farstad Shipping, Sevan Marine, Songa Offshore, Solstad Offshore, BW Offshore Limited, Det Norske Oljeselskap, DOF, Siem Offshore, Norwegian Energy Corporation, Rem Offshore, Norse Energy Corp., Deep Sea Supply, GC Rieber Shipping, I.M. Skaugen, AGR Group, Eidsevik Offshore
15	Veidekke, Ekornes, AF Gruppen, Infratek, BWG Homes
20	Orkla, Marine Harvest, Austevoll Seafood, Lerøy Seafood Group, SalMar, Cermaq, Rieber & Søn, Grieg Seafood,
26	Norske Skogindustrier
27	Schibsted
28	Pronova Biopharma, Algeta, Photocure
33	Norsk Hydro, Scana Industrier
35	Prosafe, Odim, Hexagon Composites
36	Renewable Energy Corporation (REC), Tandberg, Eltek, Q-Free, Nordic Semiconductor
37	Kongsberg Gruppen, Kongsberg Automotive
38	Axis-Shield
44	Wilh. Wilhelmsen, Odfjell, Star Reefers
45	Norwegian Air Shuttle
48	Telenor
49	Hafslund, Arendals Fossekompani
61	AktivKapital
62	ABG Sundal Collier
65	Olav Thon Eiendomsselskap, Norwegian Property
73	Tomra Systems, Atea, Opera Software, EDB Business Partner, StepStone

Appendix 2 – Raw stata output

```
//NON-Firm Wealth:

//TDM adding nonfirm wealth


Linear regression with 2D clustered SEs                Number of obs =     573
                                                       F(  8,   564) =    5.97
                                                       Prob > F      =  0.0000
Number of clusters (companyid) =    65                 R-squared     =  0.1922
Number of clusters (year) =      14                    Root MSE      =  3.3229
------------------------------------------------------------------------------
         TDM |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
nonfirm_real |   .0521951   .0163093     3.20   0.001     .0201608    .0842294
profitabil~y |  -3.282721   1.341862    -2.45   0.015    -5.918379   -.6470636
stockvolat~y |   .0486343    .015898     3.06   0.002     .0174078    .0798608
lnrealassets |   .2448023   .1320122     1.85   0.064    -.0144933    .5040979
markettobook |  -.2969101   .1332565    -2.23   0.026    -.5586498   -.0351704
   industlev |   .5081081   .3024587     1.68   0.094    -.0859749    1.102191
  termspread |  -.4375691   .1810553    -2.42   0.016    -.7931941   -.0819441
 tangibility |   .6942826   .2974154     2.33   0.020     .1101054     1.27846
       _cons |  -2.992491     1.8274    -1.64   0.102    -6.581832     .596849
------------------------------------------------------------------------------

     SE clustered by companyid and year


 //TDM_FULL nonfirm wealth

Linear regression with 2D clustered SEs                Number of obs =     532
                                                       F(  8,   523) =   82.32
                                                       Prob > F      =  0.0000
Number of clusters (companyid) =    63                 R-squared     =  0.5568
Number of clusters (year) =      14                    Root MSE      =  0.1667
------------------------------------------------------------------------------
    tdm_full |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
nonfirm_real |   .0019564   .0011438     1.71   0.088    -.0002907    .0042035
profitabil~y |  -.3966836   .1309575    -3.03   0.003    -.6539508   -.1394163
stockvolat~y |   .0013913   .0005254     2.65   0.008     .0003592    .0024234
lnrealassets |   .0084253   .0104052     0.81   0.418    -.0120159    .0288665
markettobook |  -.1064511   .0210246    -5.06   0.000    -.1477542   -.0651481
   industlev |   .0462309   .0338017     1.37   0.172    -.0201728    .1126346
 tangibility |   .3507541   .0415131     8.45   0.000     .2692011     .432307
  termspread |  -.0289898   .0044928    -6.45   0.000     -.037816   -.0201636
       _cons |    .173202   .1251695     1.38   0.167    -.0726947    .4190987
------------------------------------------------------------------------------

     SE clustered by companyid and year

 //TDB nonfirm wealth

Linear regression with 2D clustered SEs                Number of obs =     573
                                                       F(  8,   564) =   10.03
                                                       Prob > F      =  0.0000
Number of clusters (companyid) =    65                 R-squared     =  0.0473
Number of clusters (year) =      14                    Root MSE      =  2.0446
------------------------------------------------------------------------------
         tdb |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
nonfirm_real |   .0163859   .0116695     1.40   0.161    -.0065351    .0393068
profitabil~y |   .0907096   .7004094     0.13   0.897     -1.28502    1.466439
stockvolat~y |  -.0001441   .0128998    -0.01   0.991    -.0254817    .0251935
lnrealassets |  -.0624025   .0681144    -0.92   0.360    -.1961913    .0713863
markettobook |  -.1747684   .0756093    -2.31   0.021    -.3232786   -.0262582
   industlev |   .4538001   .2449845     1.85   0.064    -.0273932    .9349934
 tangibility |   .3979027    .460735     0.86   0.388    -.5070634    1.302869
  termspread |  -.0732182   .0800206    -0.91   0.361    -.2303929    .0839566
       _cons |    1.81532   1.102307     1.65   0.100    -.3498089    3.980448
------------------------------------------------------------------------------

     SE clustered by companyid and year
```

```
//WIND TDM

Linear regression with 2D clustered SEs                Number of obs =     573
                                                       F(  8,   564) =    8.29
                                                       Prob > F      =  0.0000
Number of clusters (companyid) =    65                 R-squared     =  0.2322
Number of clusters (year) =      14                    Root MSE      =  2.5329
------------------------------------------------------------------------------
    wind_tdm |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
nonfirm_real |   .0381655   .0147996     2.58   0.010     .0090964    .0672345
wind_profi~y |   -3.47987    1.08091    -3.22   0.001    -5.602971    -1.35677
stockvolat~y |   .0373777    .010952     3.41   0.001     .0158661    .0588893
lnrealassets |   .1992277   .1015321     1.96   0.050    -.0001994    .3986548
wind_marke~k |  -.3268017   .1174592    -2.78   0.006    -.5575125   -.0960908
   industlev |   .4835623   .2689024     1.80   0.073    -.0446102    1.011735
 tangibility |   .7360439   .2731405     2.69   0.007     .1995472    1.272541
  termspread |  -.4102359   .1436995    -2.85   0.004    -.6924875   -.1279844
       _cons |  -1.998771   1.327851    -1.51   0.133    -4.606909    .6093656
------------------------------------------------------------------------------

     SE clustered by companyid and year

//WIND TDB

Linear regression with 2D clustered SEs                Number of obs =     573
                                                       F(  8,   564) =   13.02
                                                       Prob > F      =  0.0000
Number of clusters (companyid) =    65                 R-squared     =  0.1208
Number of clusters (year) =      14                    Root MSE      =  1.3716
------------------------------------------------------------------------------
    wind_tdb |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
nonfirm_real |   .0111303   .0095572     1.16   0.245    -.0076417    .0299023
wind_profi~y |  -.1202156   .6853793    -0.18   0.861    -1.466423    1.225992
stockvolat~y |   .0101756   .0044302     2.30   0.022     .0014739    .0188774
lnrealassets |  -.0146447   .0529807    -0.28   0.782    -.1187082    .0894189
wind_marke~k |  -.1692366   .0698081    -2.42   0.016    -.3063522   -.0321211
   industlev |   .5519235   .2066191     2.67   0.008     .1460867    .9577604
 tangibility |   .4150276     .39775     1.04   0.297    -.3662246     1.19628
  termspread |  -.0340469   .0754247    -0.45   0.652    -.1821946    .1141007
       _cons |   .8284137   .6781976     1.22   0.222    -.5036877    2.160515
------------------------------------------------------------------------------

     SE clustered by companyid and year


//Wealth at stake

//TDM

Linear regression with 2D clustered SEs                Number of obs =     573
                                                       F(  8,   564) =    6.28
                                                       Prob > F      =  0.0000
Number of clusters (companyid) =    65                 R-squared     =  0.1943
Number of clusters (year) =      14                    Root MSE      =  3.3187
------------------------------------------------------------------------------
         TDM |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
wealthatst~e |  -.0112856   .0038377    -2.94   0.003    -.0188236   -.0037476
profitabil~y |  -3.607082   1.465869    -2.46   0.014    -6.486311    -.727852
stockvolat~y |   .0472169    .015585     3.03   0.003     .0166052    .0778285
lnrealassets |   .2883616   .1412197     2.04   0.042     .0109809    .5657423
markettobook |  -.2988977   .1365423    -2.19   0.029    -.5670913   -.0307041
   industlev |   .4553909   .2790501     1.63   0.103    -.0927134    1.003495
  termspread |   -.432931   .1783913    -2.43   0.016    -.7833234   -.0825386
 tangibility |   .4775857   .3081683     1.55   0.122    -.1277119    1.082883
       _cons |  -2.011171   1.699925    -1.18   0.237    -5.350129    1.327786
------------------------------------------------------------------------------

     SE clustered by companyid and year
```

//TDM_FULL

```
Linear regression with 2D clustered SEs                Number of obs =     532
                                                       F(  8,   523) =   80.10
                                                       Prob > F      =  0.0000
Number of clusters (companyid) =    63                 R-squared     =  0.5572
Number of clusters (year) =      14                    Root MSE      =  0.1667
------------------------------------------------------------------------------
    tdm_full |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
wealthatst~e |  -.0004146    .000271    -1.53   0.127     -.000947    .0001179
profitabil~y |  -.4119086   .1312998    -3.14   0.002    -.6698485   -.1539687
stockvolat~y |   .0013316   .0005216     2.55   0.011     .0003069    .0023562
lnrealassets |    .010015   .0107461     0.93   0.352    -.0110958    .0311258
markettobook |  -.1067687     .02149    -4.97   0.000     -.148986   -.0645514
   industlev |   .0440184   .0338687     1.30   0.194     -.022517    .1105537
 tangibility |   .3419548    .042028     8.14   0.000     .2593904    .4245192
  termspread |  -.0289351   .0047617    -6.08   0.000    -.0382895   -.0195807
       _cons |   .2113612   .1308424     1.62   0.107      -.04568    .4684025
------------------------------------------------------------------------------

     SE clustered by companyid and year
```

//TDB

```
Linear regression with 2D clustered SEs                Number of obs =     573
                                                       F(  8,   564) =    9.07
                                                       Prob > F      =  0.0000
Number of clusters (companyid) =    65                 R-squared     =  0.0447
Number of clusters (year) =      14                    Root MSE      =  2.0475
------------------------------------------------------------------------------
         tdb |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
wealthatst~e |  -.0014801   .0041031    -0.36   0.718    -.0095392    .0065791
profitabil~y |    .045567   .6987104     0.07   0.948    -1.326825    1.417959
stockvolat~y |  -.0002264   .0124199    -0.02   0.985    -.0246213    .0241684
lnrealassets |  -.0533616   .0677091    -0.79   0.431    -.1863543    .0796312
markettobook |   -.179437   .0744496    -2.41   0.016    -.3256694   -.0332047
   industlev |   .4659318   .2423823     1.92   0.055    -.0101505     .942014
 tangibility |   .3911774   .4361408     0.90   0.370    -.4654811    1.247836
  termspread |  -.0771074   .0796991    -0.97   0.334    -.2336507    .0794359
       _cons |    1.94478   1.057649     1.84   0.066    -.1326317    4.022193
------------------------------------------------------------------------------

     SE clustered by companyid and year
```

//WIND TDM

```
Linear regression with 2D clustered SEs                Number of obs =     573
                                                       F(  8,   564) =    8.85
                                                       Prob > F      =  0.0000
Number of clusters (companyid) =    65                 R-squared     =  0.2354
Number of clusters (year) =      14                    Root MSE      =  2.5274
------------------------------------------------------------------------------
    wind_tdm |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
wealthatst~e |  -.0087851   .0039292    -2.24   0.026    -.0165026   -.0010675
wind_profi~y |  -3.802037    1.21366    -3.13   0.002    -6.185883   -1.418191
stockvolat~y |   .0361949    .010815     3.35   0.001     .0149524    .0574374
lnrealassets |    .232929   .1081714     2.15   0.032     .0204611     .445397
wind_marke~k |  -.3277407    .120015    -2.73   0.007    -.5634716   -.0920098
   industlev |   .4370232   .2561237     1.71   0.089    -.0660495     .940096
 tangibility |   .5609112   .2731936     2.05   0.041     .0243101    1.097512
  termspread |  -.4061088   .1412524    -2.88   0.004    -.6835537   -.1286638
       _cons |  -1.228357   1.283855    -0.96   0.339    -3.750078    1.293364
------------------------------------------------------------------------------

     SE clustered by companyid and year
```

```
//WIND TDB


Linear regression with 2D clustered SEs                Number of obs =     573
                                                       F(  8,   564) =   12.18
                                                       Prob > F      =  0.0000
Number of clusters (companyid) =    65                 R-squared     =  0.1194
Number of clusters (year) =      14                    Root MSE      =  1.3726
------------------------------------------------------------------------------
    wind_tdb |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
wealthatst~e |   -.001677   .0023215    -0.72   0.470    -.0062367    .0028828
wind_profi~y |  -.1857493   .7046155    -0.26   0.792     -1.56974    1.198242
stockvolat~y |   .0099898   .0042342     2.36   0.019      .001673    .0183066
lnrealassets |  -.0067983   .0530038    -0.13   0.898    -.1109073    .0973106
wind_marke~k |  -.1711827   .0695283    -2.46   0.014    -.3077487   -.0346167
   industlev |   .5508241   .2050088     2.69   0.007     .1481502     .953498
 tangibility |   .3903963   .3828965     1.02   0.308    -.3616809    1.142473
  termspread |  -.0350663   .0737759    -0.48   0.635    -.1799754    .1098427
       _cons |    .975402    .697456     1.40   0.163    -.3945264     2.34533
------------------------------------------------------------------------------

     SE clustered by companyid and year
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