

Equity Market Environment as a Capital Structure Determinant

Incorporating a systematic risk factor in the trade-off theory

Marcus Fröderberg*

Johan Lundberg**

Abstract: In this thesis, we aim to increase the explanatory power of the trade-off theory by incorporating an element of the market-timing hypothesis. We apply an adjusted version of a generally accepted framework for testing the trade-off theory, with the inclusion of a variable designed to capture the equity market environment. The addition of an equity market variable as a proxy for systematic risk is found to improve the ability to explain the leverage ratios of public Swedish firms. The robustness of the results, however, is not satisfactory, which raises questions about the validity of our findings.

Keywords: Leverage ratios, Trade-off theory, Market-timing hypothesis, Leverage determinants, Capital structure management, Systematic risk

Tutor: Håkan Thorsell

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1. Introduction

Many theories have been proposed as to how firms choose their capital structure. Research of the area picked up speed when Modigliani and Miller, widely regarded as founders of modern capital structure theory, presented their theorems in the 1950's. In the years to come, researchers have sought to identify determinants central to the leverage decision. Subsequent theories include the trade-off theory and the pecking-order theory, each of which takes a different view of the leverage decision. A factor of more recent recognition in broad financial theory is the impact of the prevailing market environment, where the market-timing hypothesis is a prominent addition. All these approaches recognise different elements as the most important when deciphering the enigma that is the capital structure decision.

The basic premise of the trade-off theory is that each firm has a target leverage ratio they strive towards, set by a number of parameters. These parameters are used to calculate the marginal cost of financial distress, which, at the target leverage ratio, is equal to the marginal tax shield benefits of debt. While there is no perfect way of knowing exactly what these parameters are as of today, there is empirical evidence that such a target ratio exists (Graham and Harvey, 2001).

Accepting the existence of said target ratio, we want to expand on existing theory by adding an element of market-timing theory into the trade-off theory. Our ambition is to add some clarification as to which parameters are determinants for the leverage ratio, and we aim to do so by using a combination of the aforementioned theoretical frameworks. We believe that parameters relating to market-timing theory can be an important addition when testing the trade-off theory.

Using generally accepted methods of analysing capital structure through the lens of the trade-off theory, we find that the equity market environment does have an effect on leverage ratio, on a statistically significant level. However, the explanatory power of the market environment parameter is weak. Various additional tests also show that the results might be lacking robustness.

1.1 Background

Historically, researchers have included proxies for earnings volatility to factor in risk when testing the empirical support for the trade-off theory. Such a measure is often calculated by normalising a

size-related accounting item, for instance revenue or total assets for the sample firms. This is intended to work as a proxy for earnings volatility, assuming larger firms' earnings are less volatile, something that in turn affects credit terms and how much debt you are willing to take on. The increased bankruptcy risks associated with taking on additional debt, *ceteris paribus*, represent balancing factors to the interest expense tax shields that leveraged firms benefit from.

While this takes into account the firm-specific, or idiosyncratic, risks associated with debt financing, it fails to acknowledge the systematic risk posed by a general market downturn. With this in mind, we want to examine whether firms factor in the stage of the equity market cycle when selecting their capital structure. This thesis is aimed to incorporate the effect of systematic risk as an addition to the explanatory factors more generally used in previous studies of the capital structure choice. This could potentially help identify the existence of a behavioural pattern in this decision.

This systematic risk factor will work as a complement to the idiosyncratic risk measures often incorporated when testing the trade-off theory. It is not, however, intended to replace the size-based proxy for earnings volatility, as it represents another type of risk.

A systematic risk factor is something that will always be there, no matter what the individual firm does. Having said that, the systematic risk can vary, and one way in which it does is with the stock market. Consecutive time periods of rising equity markets mean that the systematic risk for any given firm is increasing, all other things held equal. Our reason for proposing this is that the longer the market rises, the greater the probability for an imminent market downturn with subsequent loss of income. This is due to the cyclical nature of equity markets, which seems to be following a somewhat consistent pattern over the course of history. Principally, there is nothing any individual firm can do about the stock market; rather, they have to adjust their behaviour according to the present market environment.

Our hypothesis is based on the notion of debt financing as a fixed income instrument to the investor as opposed to the variable returns of holding equity. From the firms perspective then, interest costs, or cost of debt, are to be paid regardless of its profits or losses, as opposed to returns to equity

holders, which are variable and dependent on financial results. It is therefore preferable for firms to be reliant on the cheaper debt financing when business is good, since it, through the tax deductibility of the fixed interest payments, amplifies the return to equity holders. On the flip side, in times with lower income and profit, firms should strive to have as little debt as possible, since its obligatory expenses magnifies the adverse effects of losses. Aware of this, an all-knowing firm would lever up in preparation for good economic times and deleverage in preparation of a market downturn.

Add to this the knowledge that a downturn in equity markets is often followed by an economic slump (Fama and French, 1989), and our hypothesis takes shape. We believe that managers are aware of the changing nature of markets, and the systematic risk it represents. They are proactive about this, and as a market rise continues they adjust their leverage ratio downwards in order to mitigate potential damage from a market slump resulting in reduced profitability. Our general hypothesis is thus that a variable defined to capture the length of an equity bull market will have a negative impact on a firm's leverage ratio, on a statistically significant level. By the same logic, the variable will show that falling equity markets are associated with increasing leverage ratios.

Our statistical hypothesis reads as follows:

H₀: Equity market conditions have no impact on a firm's leverage ratio

H₁: Equity market conditions have an impact on a firm's leverage ratio

1.2 Purpose

With this thesis, we aim to examine whether incorporating a market-timing parameter when testing the trade-off theory adds any explanatory power, and, as such, helps us to better understand why firms have a certain leverage ratio.

1.3 Delimitation

This study is conducted on publicly listed Swedish firms, and any conclusions we might draw are therefore not intended to be directly applicable in an international setting. Furthermore, the sample consists only of firms listed on the Nasdaq OMX small, mid, and large cap stock exchange lists.

The results are thus applicable to Swedish public firms, large enough to be traded on Nasdaq OMX, only.

As a consequence of insufficient data, we were forced to limit our sample one more time. When performing preliminary tests on all firms listed at any given point in our time frame, the results were inconclusive. We therefore limited the sample to firms listed the entire period of time, i.e. from year-end 2000 to 2015. As a result, our conclusions are applicable to Swedish firms that have been listed on Nasdaq OMX for 16 consecutive years.

This thesis does not intend to explain the underlying intentions as to why a firm chooses a certain capital structure, but rather to investigate whether there is a statistical relationship between equity markets and leverage ratios. There might be more than one line of reasoning behind the capital structure choice, and to understand these reasons a qualitative study, built on interviews with key decision makers, would have to be conducted.

1.4 Report outline

The thesis is structured in the following way. First, we present an overview of existing research to get an understanding of the current state of research already made in the field. We then present our set of data, and describe how and why we decided to use that. The statistical method used in our analysis is then described in detail. The results from the regression and robustness tests are subsequently presented and discussed, with focus on the validity and reliability of the results. Finally, we conclude our findings and provide suggestions for further studies.

2. Previous research

2.1 Capital structure theory

In their strive to maximise firm value, business leaders are faced with a vast array of decisions. A lot of attention has been attracted to the capital structure puzzle and its effects on firm value. For over half a century, theorists have tried to dissect the issue of corporate financing in order to explain the nature of firm behaviour in this decision.

Generally quoted as the founding fathers of modern capital structure theory, subsequent Nobel laureates Modigliani and Miller laid out their ideas on capital structure under rigid and, in many instances, unrealistic assumptions back in the 1950s. Nonetheless, their work paved the way for a myriad of ensuing research on the topic. Relaxing parts of the assumptions initially made, Modigliani and Miller's follow-up theorems formed the basis on which the trade-off theory was formulated, one of the important frameworks of present-day financial academia.

Taking off from the field of economics and agency theory, the pecking order theory of corporate financing became the main contrasting attempt to explain why firm finance themselves the way they do. While both theories constitute parts of basic corporate finance courses around the world, the empirical evidence has not been conclusive, whereby alternative ideas have been explored over the past decades (Harris and Raviv, 1991). Many of these new approaches form analyses of the interplay between financial markets and firms' capital structure.

2.1.1 Modigliani and Miller

Modigliani and Miller (1958) argue that a firm's value is independent of financing decisions. Determinants of the firm value are entirely dependent on operational matters and the underlying industry risks. This theorem is based on the assumptions of no taxes, no transaction costs, no bankruptcy costs, perfect symmetric information, identical cost of debt for everyone, and no effect on operations by acquiring debt. With all these assumptions in place, there would be no incremental value of taking on debt, since there are no tax benefits to take advantage of. As such, a firm's value is independent of the debt-to-equity ratio.

Their second theorem tells us in a similar way that capital structure is irrelevant. With additional leverage comes increased financial risk. This higher risk will make equity holders require a higher rate of return on their investments, effectively cancelling the benefits of cheaper debt financing which leads to an unchanged weighted average cost of capital. This is true when all of the above assumptions hold.

Modigliani and Miller (1963) revised their original proposition, relaxing the assumption of no taxes, since they are after all an inevitable fact of life. With this alteration, there are now incentives

for taking on debt, because interest paid on debt is tax deductible and results in a tax shield. This has the implication that both of the original theorems now advocate a financial structure that relies in its entirety on debt.

In reality, the assumptions of the theorems have little empirical support. The existence of agency costs in a way disproves the assumption of perfect symmetric information (Jensen and Meckling 1976), and in a similar way does the signalling cost of dividend policy (Bhattacharya, 1979). Even more important was the research on the link between debt and bankruptcy risk and subsequent costs, the main components of the trade-off theory (Kraus and Litzenberger, 1973).

2.1.2 Trade-Off Theory

Lack of empirical support for Modigliani and Miller's second proposition drew researchers' attention towards the effects of default risk on the capital structure decision. Relaxing assumptions regarding perfect capital markets by allowing for bankruptcy risk and thereby associated costs, Kraus and Litzenberger (1973) suggest a framework pointing to a trade-off between tax shield benefits from debt financing and expected bankruptcy costs. The trade-off theory, as it became known, enables solving mathematically for a firm's value maximising, and thus optimal, capital structure by setting the marginal benefit of debt tax shields equal to the marginal cost of expected financial distress.

In practice, a majority of firms have been found to have an optimal, or "target", debt ratio (Graham and Harvey, 2001), suggesting that the trade-off theory might be the appropriate framework to use when addressing the capital structure decision. Of firms with a target debt ratio, Graham and Harvey conclude that most have "flexible" or "somewhat tight" leverage range, pointing to the changing nature of what is referred to as an optimal level. Hence, the trade-off theory implies that for every given set of circumstances regarding the benefits and costs associated with financial leverage, there is a mathematically optimal debt-to-equity ratio. Graham and Harvey further show that firms with a target leverage ratio "do not rebalance their debt lock-step with changes in equity prices". Graham and Harvey's interpretation is in line with that of Opler and Titman (1998), who found an inconsistency in the target leverage ratio policy in that firms issue equity after stock price increases. Intuitively, one would assume that a rise in equity prices is to be countered with issuance

of debt to maintain the target leverage ratio. Empirical evidence on the other hand, points in the direction that this might not be the case.

This ambiguity raises the question of what factors influence the trade-off. Frank and Goyal (2009) take on the issue with a “clean” approach in the sense that they, unlike preceding researchers, do not attempt to prove an existing theory but rather filter out determinants that are reliably important in the capital structure decision from a list of previously suggested factors. They also acknowledge the importance of the changing corporate financial climate over time, from highly leveraged firms in the 1980s driven by the leveraged buyout boom at the time to the generally less leveraged firms of the 1990s resulting from the emergence of fast-growing IT businesses and the higher concentration of small firms listed on public exchanges. In their paper, they affirm median industry leverage, market-to-assets ratio, asset tangibility, profitability, firm size and expected inflation as the most reliable explanatory factors.

The practical application of the trade-off theory has been questioned (Miller, 1977; Myers, 1984). Miller argues that the model takes disproportionate consideration to the rare, small and uncertain bankruptcy costs in comparison with regular, substantial and quantifiable tax benefits from debt financing. Further, Miller points to the impracticality of the theory by highlighting difficulties in estimating marginal costs of financial distress, e.g. loss of sales, personnel flight and supplier reluctance.

2.1.3 Pecking-Order Theory

Based on the agency theory (Ross, 1973) with information asymmetry between investors and firm managers, Myers and Majluf (1984) suggest that equity issuance signals manager belief that shares are overvalued whereas debt issuance signals the opposite. Hence, investors would be averse to take part in an equity issuance, putting downward pressure on the share price. The resulting rule states that firms prefer to finance investment opportunities with internal resources, debt and equity in falling order.

Fama and French (2002) find support for the pecking-order theory in that more profitable firms, having internal financing available, are less levered. On the other hand, in Frank and Goyal's

(2003) test on a sample of US firms from 1980-1998, none of the predictions suggested by the theory hold true. Further contrasting the pecking-order theory support found by Fama and French, other researchers present evidence that “only when firms are not overvalued do they prefer debt to equity financing” (Dong et al., 2012).

2.1.4 Market-timing hypothesis

Dissatisfied with the lack of conclusiveness in the attempt to identify explanatory determinants in the capital structure decisions, theorists have explored what has become known as the market-timing hypothesis. Factoring in credit and equity market conditions, this part of the corporate finance field proposes that firms attempt to plan their capital market transactions to favourable points in time.

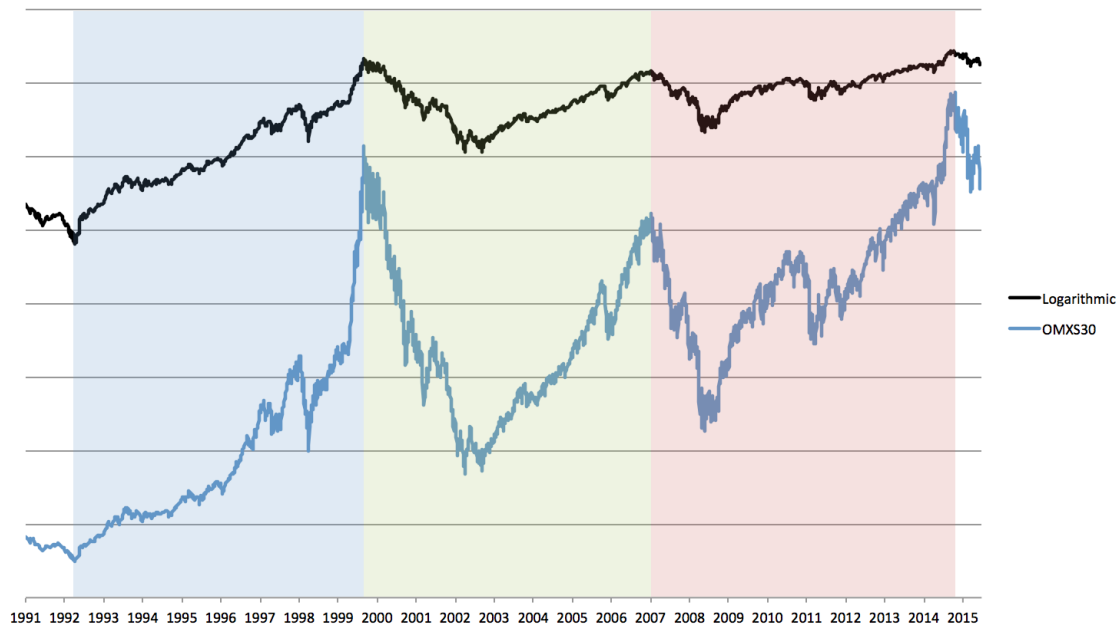
Baker and Wurgler (2002) state that the preference to issue equity when market values are high and make share repurchases at market lows are well-known phenomena and write that as a result of this, “capital structure is the cumulative outcome of [firms’] attempts to time the equity market”.

Graham and Harvey, whose survey-based research show that CFOs to some extent try to time equity markets, support their hypothesis. In the survey, they found that “the amount of debt by which our stock is undervalued or overvalued” was one of the most important factors in deciding on issuance of equity. Similarly, Dong et al. (2012) conclude that issuance and repurchase of equity is connected to over- and undervaluation respectively, but only when firms are not financially constrained. These findings are consistent with our hypothesis that managers believe they are able to time the market, and change the capital structure accordingly.

2.2 Equity market cyclicity

Our research question is based on the notion that the equity market moves in cycles. It seems clear when studying the below chart of the Swedish index OMXS30 that at least the Stockholm equity market has moved in cycles ranging around seven years over the past decades.

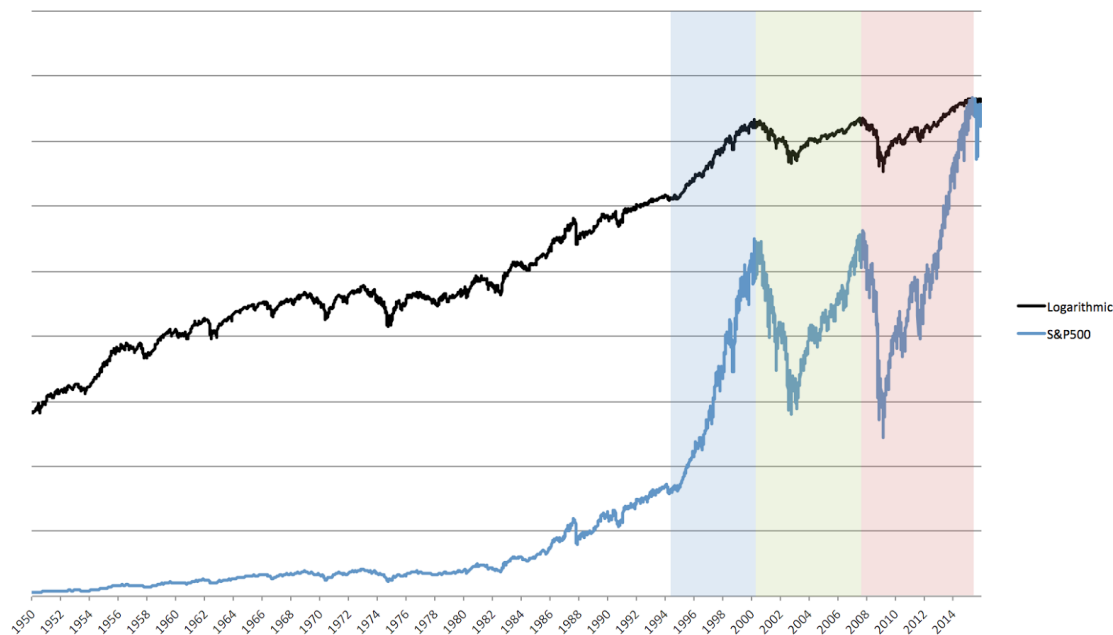
Figure 1A.



Fama and French (1989) conclude that the expected returns on equity as well as debt are related to the general business conditions. They put forward that expected returns are lower in times of strong economic conditions and vice versa. Total financial return of equity, of course, is a function of the price paid for a share and the aggregate return contributed by price changes and dividend payments. The connection between the broader economy and financial returns thereby indicate a correlation between asset valuations and the business environment in general, where valuations increase in good times and thus push total future returns lower (Fama and French, 1989; Chen, 2010).

The cyclical nature of equity markets can be observed over longer periods of time. Below is a presentation of Standard & Poor's (S&P) 500 index levels since 1950, with the last three cycles shaded as in the OMXS30 illustration above. Studying the logarithmic line, it is clear that the index levels from the 50s to the mid-70s follow a pattern of three to five years of increasing valuations before a shorter downturn takes place. Thereafter, the cycles appear to stretch out in length, leading to the seven to eight-year cycles of later decades.

Figure 1B.



2.3 Idiosyncratic and systematic risk

The area of risk is one of the better-explored areas of financial research. One important idea is credited to Harry Markowitz (1952), who argues that the risk of any given investment consists of two parts; the risk associated with the specific asset, and the risk associated with the market as a whole. In the world of finance, where risk is often measured as the volatility of returns, these two types are called idiosyncratic (independent) and systematic (common) risk. Idiosyncratic risk is characterised by it not sharing any correlation across assets whereas the systematic risk is perfectly correlated across assets. Importantly, knowledge of this enables investors to eliminate the idiosyncratic risk by holding a diversified portfolio of assets, thus lowering the total risk (Berk and DeMarzo, 2013).

Applying this thinking to the capital structure decision, firms can divide their risk exposure into separate parts, among them the financial risk, which is directly affected by the leverage ratio, and the market risk, which is an economy-wide phenomenon. The similarity then, is that in the same way that investors can manage their risk-taking through diversification, firms can manage their financial risk by adjusting their leverage ratios. At the same time, investors and firms alike are always exposed to the risk of a market downturn that is intrinsically systematic.

2.4 Our work

While an array of research in the capital structure field has incorporated firms' volatility of earnings as a risk measure, we add to the equation a systematic market risk factor. This component is integral in our exploration of the impact of the equity market cycle on the capital structure decision.

Aiming to assess whether increased understanding of the capital structure puzzle can be reached by expanding the methods traditionally used for testing the trade-off theory with a market-timing component, we lean on previous research in formulating our own tests for the hypothesis as outlined in section 1. Hypothesising that the equity market conditions have an impact on the leverage ratio of Swedish firms through the managements' knowledge of, and willingness to adapt to, cyclical markets, we aim to test our idea through the lens of the trade-off theory. The reason for doing so is that the negative effects of debt financing in terms of bankruptcy risk are larger towards the end of the market cycle since taking on debt prior to a market downturn amplifies the negative effects of souring business conditions through the leverage effect.

3. Method

To assess whether publicly listed Swedish firms factor in the prevailing equity market environment in the financial leverage decisions, we apply a modified version of the statistical model that has served several researchers (Baker and Wurgler, 2002; Fama and French, 2002) in their ambition to identify determinants in the capital structure decision, of which a detailed description follows below. Variants of this model have proven able to provide solid explanatory power for firm leverage ratios on several sets of data, including Swedish samples (Thorsell, 2008).

3.1 Statistical model

Prior to performing the regression exercise, we apply a basic mean comparison test to get a first indication of what results are to be expected. The mean comparison test, or t-test, is carried out in order to illustrate the differences in leverage levels for the sample firms between years. It is important to note that the validity of this test relies on the assumption of a normally distributed random variable, in our case the observed leverage ratios of the sample firms. We therefore also perform a Shapiro-Wilks test for normality on the leverage variable (Newbold et al, 2010; Shapiro and Wilks, 1965).

Our primary statistical model is based on the linear regression framework, and consists of a dependent variable regressed on a number of independent variables. The dependent variable is a measure of a firm's leverage ratio at a given point in time. The regression model is specified as follows:

$$\frac{TD}{IC}_t = \alpha + \beta_1 \frac{MA}{TA}_{t-1} + \beta_2 \frac{PPE}{TA}_{t-1} + \beta_3 ROCE_{t-1} + \beta_4 \log Assets_{t-1} + \beta_5 \text{Systematic risk measure}_{t-1} + \varepsilon_t$$

Where:

TD/IC = Total debt divided by market value of invested capital

MA/TA = Market value of assets divided by total assets

PPE/TA = Property, plant and equipment divided by total assets

ROCE = Return on capital employed

log Assets = the logarithm of total assets

Systematic risk measure = measured in three different ways, elaborated on in section 3.3

The model as such is importantly characterised by the choice of variables, which will be further presented and argued for in section 3.3.

3.2 Sample

Our data was gathered through a sequential process in which we first screened Bloomberg's database for firms that are or have been listed on the Stockholm Stock Exchange. This was done by adding together currently traded firms with those who have been delisted, acquired or liquidated since year 2000, yielding a list of 1043 unique firms. This excludes firms listed on the First North, Aktietorget and Nordic Growth Market exchanges. Then, financial firms such as banks and insurers, as well as real estate companies, were removed from the population since they, due to business and regulatory reasons, have capital structures that are fundamentally different from others (Fama and French, 2002).

A number of accounting and market data items were then collected for each firm from Datastream and Bloomberg. As it turns out, Datastream does not include a backlog of data for formerly listed firms, whereas the Bloomberg data was not satisfactory in terms of completeness. In several instances, the information collected from Bloomberg lacked one or more data items per observation, causing a substantial reduction in the number of complete observations. Since our statistical model is built as a linear regression, we want to minimise the number of missing values since it renders these observations inapplicable in a linear regression (Wooldridge, 2013).

We were thus faced with a trade-off; work with complete data from Datastream for a sample of firms continuously listed over the observation period, or study a complete sample of firms, avoiding any selection bias, and accept the lower quality data. A potential third option would be to merge the two data sets, which would result in complete data for one part of the population and lower quality data for the other.

We chose to accept the selection bias and proceeded with the limited sample of firms continuously listed over the observation period, making use of the advantage of complete data from Datastream. Our main argument for doing so is that this would enable us to draw general conclusions about a limited group of firms rather than limited conclusions about a general set of firms. Also, we suspect that the Bloomberg data is not incomplete in a random manner. Rather, it is plausible that the observations lacking complete data correspond to the very firms that have been delisted for some reason, or simply smaller in size and therefore less monitored. If data items had been incomplete in a random manner, we could have made use of it to draw conclusions about the population (Wooldridge, 2013). Unfortunately, it cannot be confirmed that this is the case. We therefore move on with the dataset collected from Datastream, consisting of 100 firms continuously listen over the research period.

An industry (ICB classification) distribution table of the population is presented below:

Table 1.

Industry classification	No. obs.
Basic Materials	6
Consumer Goods	8
Consumer Services	8
Financials	0
Health Care	12
Industrials	43
Oil & Gas	0
Technology	21
Telecommunications	2
Utilities	0
Total	100

While previous research has pointed to leverage differences across industries and that median industry leverage is a reliably important determinant for capital structures (Frank and Goyal, 2009), these inter-industry differences are not the focus of our work and we do not incorporate this information in our model. Rather, we settle for concluding that our sample firms are concentrated mainly to industrials and technology firms. Interestingly, no oil and gas or utility firms qualified for the sample. As mentioned, financial firms were stripped from the data set. A full list of the sample firms and industry classifications is presented in appendix 1.

As our next step, a series of data items were extracted from Datastream as of December 31st for the years 2000 to 2015. These data were subsequently used to define the variables used in our regression model. See a detailed presentation of the gathered data below.

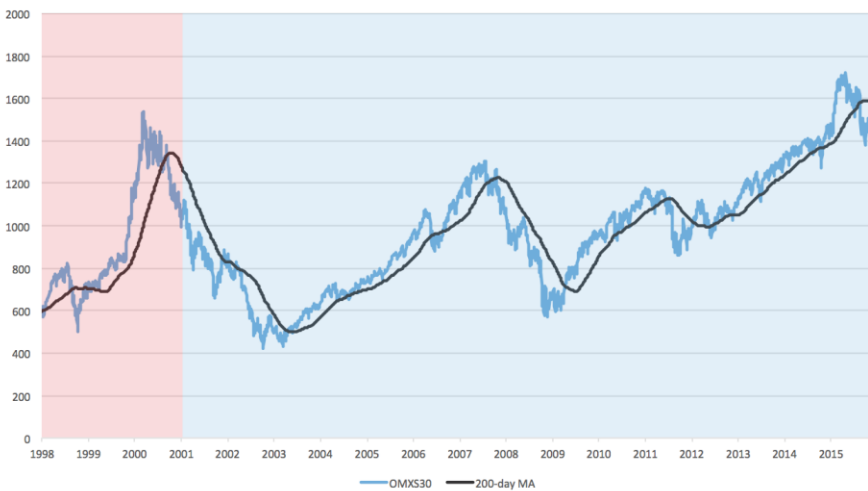
Table 2.

Data item, SEKm	Min	Average	Median	Max	St. dev.	Skewness	Kurtosis	No. obs.
Market capitalization	5	19 394	1 243	850 167	57 210	5.91	49.81	1 600
Shareholders' equity	-2 053	7 381	603	146 525	19 804	4.40	21.68	1 599
Total debt	0	2 426	1 193	367 065	12 082	4.68	55.00	1 599
Net debt	-56 536	2 426	38	131 796	11 858	4.52	42.64	1 594
Total assets	7	18 038	1 193	367 065	47 103	4.29	20.68	1 599
PP&E	0	4 045	179	88 411	12 082	4.68	23.66	1 599
Revenue	0	17 085	1 407	312 515	40 658	3.86	17.67	1 598
EBITDA	-14 849	2 308	145	48 815	6 277	4.13	19.11	1 581
EBIT	-22 630	1 519	92	33 820	4 508	3.84	19.36	1 589

These are the raw data points we use to compute our test variables. One observation to be made is the large difference between average and median values for many of the items. This is to be expected, considering the existence of a small number of behemoths on the OMX large cap with huge balance sheets, compared to the more numerous, comparatively small, firms. This renders our sample positively skewed (Newbold et al, 2010).

Mainly as a result of the availability of the data described above, we study the last two equity market cycles, shaded in blue in figure 2, i.e. from year-end 2000 to year-end 2015. The data is collected from annual reports, yielding 16 observations for each firm.

Figure 2.



3.3 Definition of variables

The choice of independent variables is imperative to our study, and so we screened previous studies for findings on which data items to include in the model. Helpfully, quite a bit of work has been done in the field. One relevant example is Frank and Goyal's article published in 2009, in which they conclude that the factors that are reliably important in the capital structure decision are (i) median industry leverage, (ii) market-to-book assets ratio, (iii) tangibility, (iv) profits, (v) log of assets and (vi) expected inflation. Their findings confirm the viability of the method used before in earlier research (Rajan and Zingales, 1995; Baker and Wurgler, 2002; Fama and French, 2002).

We are using a modified version of the statistical model used in the abovementioned, frequently quoted, papers in order to test our hypothesis. As such, our variables will to a large extent correspond to those used in previous papers, with the important difference of the added time variable we use to gauge the equity market environment.

We further alter the model by Frank and Goyal by not including industry median or expected inflation. In this thesis, we are not interested in investigating inter-industrial differences. The reason for excluding the inflation variable is that we look at a much shorter time period than Frank and Goyal who look at a period of 54 years. During our 16 years, inflation has not fluctuated enough to justify it being included. Thus, we deem the expected inflation and industry median variables to be superfluous.

Leverage measure (dependent variable)

The purpose of our work is to examine the effect of market climate on leverage ratio. It is therefore important to define a suitable variable for leverage. Our dependent leverage ratio variable is defined as the total debt to the market value of invested capital ratio at point t in time. Fama and French (2002) discuss, and test, the implications of using market values as opposed to book values of equity. They arrive at ambiguities in what measure that is most coherent with the independent variables, which are in several cases scaled by the book value of assets, and thus present all findings for both the book and market leverage ratios.

One could reason that there is a circular logic to predicting the market leverage ratio as defined above by using our equity market cycle variables (described in detail below). Intuitively, it seems obvious that the total debt to market value of invested capital ratio would drop as the denominator increases in a bull market, all else equal. The counter-argument is that a majority of firms are known to have a target debt-to-equity ratio (Graham and Harvey, 2001) and as the debt capacity increases with the market capitalisation, firms would issue debt to stay at the target level. Investors also gauge the financial risk of a firm in market value terms, meaning that they would not necessarily be alarmed by a high book leverage ratio, as long as the firm market value is at a level that supports its liabilities. One prime example of this is Swedish Match, a firm that for years has maintained a very low, at times even negative, level of shareholders' equity on the balance sheet,

implying astronomical book leverage ratios, all the while being financially sound from a market perspective.

One more argument for market values is that Frank and Goyal (2009) find that a market-based dependent variable yields more useful results. They write, “[these] factors provide a more powerful account of a market-based definition of leverage than of a book-based definition of leverage”. Since our statistical model to a large extent is based on the work of Frank and Goyal, the natural choice is to go with the recommendations of said authors.

In the context of our study, a market-based debt-to-equity ratio is thus deemed to be the relevant dependent variable. For the sake of robustness, we present findings based on book leverage measures in the results section. To compute the leverage measure we divide total debt by the market value of invested capital, where the latter is defined as the market capitalisation plus total interest-bearing debt. The market capitalisation is defined as share price at year-end multiplied by common shares outstanding. For companies with more than one type of common shares, the market capitalisation represents the total market value of the equity, i.e. the market value of the different series of shares are added together. Total debt represents all interest-bearing and capitalised lease obligations. It is the sum of long and short-term debt.

An alternative, and in the literature more common approach, is to divide total interest-bearing debt by the market value of assets, which is in turn calculated as the total asset base, less the book value of shareholders’ equity, plus the market capitalisation (Baker and Wurgler, 2002; Frank and Goyal, 2009). We prefer the total debt to the market value of invested capital ratio as this normalises firm balance sheets for differences in non-operating liabilities. We argue that this adjustment increases comparability of leverage ratios since there are large inter-industry differences in the level of operating liabilities financing. We do, however, present results with the traditionally used total debt to market value of assets ratio as a robustness test.

Time variable (independent variable)

To capture the effect of prevailing market environment, we chose to create a measure for the length of the market rise or fall. The argument is that, given the assumption of cyclical equity markets,

the longer an upturn goes on, the closer we get to the subsequent downturn. A prolonged and substantial downturn in the stock market most often leads to loss of revenue, which has implications on the volatility of earnings. Volatility of earnings is a common expression for financial risk, which in turn as explained can be divided in idiosyncratic and systematic risk. Thus, our time variable can be considered a proxy for systematic risk and is to be seen as a complement to the risk factors previously used.

The time variable is defined as the number of years passed since the last equity market trough or peak, yielding a higher (lower) value the longer the market rises (falls). This dynamic design enables the variable to function both in bear and bull markets.

As such, we predict the coefficient to be negative, i.e. the longer the market upturn goes on, the lower debt-to-equity ratio or, equivalently, the stronger the firms' balance sheets. By the same logic, in years with a falling market, where the time variable has a negative value, leverage ratio is expected to rise, which again will make the coefficient negative.

Percentage development of stock market (independent variable)

As an alternative gauge of systematic market risk, we use a measure similar to the time variable but rather based on percentage increases and decreases respectively from market index lows and highs respectively.

Price over earnings (independent variable)

As a last proxy, we attempt to capture the systematic market risk by applying the established P/E ratio, usually used to communicate relative valuation of equity instruments or indices. Expensive stocks, in terms of high prices to comparatively low earnings, i.e. a higher P/E ratio, are assumed to indicate a higher market risk.

See the below table for a presentation of the values of the different market environment measures at the different points in time of our observations.

Table 3.

Year ended	Years since extreme	Return since extreme	OMX P/E ratio
2000	-0.82	-30.5%	20.7
2001	-1.82	-42.2%	37.4
2002	0.23	18.3%	116.8
2003	1.23	53.6%	22.9
2004	2.23	80.7%	14.4
2005	3.23	139.6%	13.8
2006	4.22	196.2%	13.9
2007	-0.46	-17.6%	12
2008	0.11	15.7%	10.1
2009	1.11	69.6%	19.6
2010	2.11	108.8%	14.3
2011	3.11	73.9%	13.5
2012	4.11	94.8%	13.8
2013	5.11	140%	17
2014	6.11	168.4%	16
2015	-0.68	-10.6%	17.7

Growth opportunities (independent variable)

We include a market-to-asset ratio, measured as total assets less shareholders' equity plus the market capitalisation divided by total assets, to reflect growth opportunities. Using a proxy for growth opportunities is commonly done when testing the viability of the trade-off theory, the argument being that the inherent value of these growth options make firms risk averse and thus less susceptible to debt financing. While other proxies, such as the P/E ratio, could be used, Adam and Goyal (2008) find that the market-to-asset ratio is the most informative proxy, followed by the market-to-book ratio.

The increased financial risk associated with taking on leverage is unwanted for firms with large growth opportunities, leading us to expect a negative relationship between the market-to-asset ratio and leverage.

Asset tangibility (independent variable)

Asset tangibility is expected to have a positive relationship with leverage since creditors are more likely to offer funding at attractive rates if the investment is deemed secure. One way of providing this security is to put up collateral in terms of tangible assets, which could, in the event of default, be seized by the creditors and sold to recover loss of principal.

Our tangibility proxy is computed as net property, plant and equipment divided by total assets. This is in line with previous research (Frank and Goyal, 2009; Byoun, 2008).

Profitability (independent variable)

Consistent with the agency theory, Baker and Wurgler (2002) propose that profitable firms to a larger degree face the free cash flow problems inherent with the theory. As a firm generates earnings, managers have larger opportunities to pursue wasteful spending, conflicting with the interests of the owners. Debt, it is proposed, mitigates this effect by tying up cash flows to mandatory interest expenses and principal repayments.

On the other hand, advocates of the pecking-order theory might argue that profitability enhances the availability of internal financing which would lessen the need for debt issuance. Previous studies made on American and European firms document a negative relationship between profitability and leverage (Baker and Wurgler, 2002; Fama and French, 2002), a result in line with the pecking-order reasoning. We expect the same outcome in our tests.

Our profitability measure of choice is ROCE, i.e. earnings before financial items divided by capital employed. We see this ratio as superior to for instance ROE, which is, to some extent, a product of the financial leverage. ROCE is as such a “cleaner” measure of profitability that is more comparable across firms with varying capital structures.

Size (independent variable)

Various measures of firm size, often normalised by taking the logarithm of data items such as assets or sales, have been used to proxy for volatility of earnings. This corresponds to the risk part of the trade-off theory equation in which firms are thought to balance benefits and costs of debt financing. We use the logarithm of total assets to factor in the size component in our regression.

Larger firms are deemed less volatile and creditors would thus be more inclined to finance them and offer better credit terms. This logic causes us to expect a positive relationship between firm size and leverage.

Table 5.

Variable	Min	Average	Median	Max	St. dev.	Skewness	Kurtosis	No. obs.
Total debt to market value of invested capital	0.00	0.19	0.13	0.89	0.20	1.16	0.87	1 600
Total debt to market equity	0.00	0.14	0.10	0.89	0.15	1.32	1.83	1 600
Total debt to book value of assets	0.00	0.18	0.15	1.01	0.17	0.74	0.04	1 599
Market value to total assets	0.00	1.77	1.13	27.67	2.09	5.02	38.20	1 598
PP&E to total assets	0.00	0.18	0.12	0.92	0.19	1.56	2.35	1 598
ROCE	-12.85	0.04	0.11	23.31	0.78	11.43	527.20	1 598
Log Assets	8.89	14.38	13.95	19.72	2.21	0.42	-0.60	1 598

Descriptive statistics of the computed dependent and independent variables are presented in table 5 above. Notably, the proxies for growth opportunities and profitability appear to be peculiarly distributed, judging from the skewness and kurtosis figures. We suspect that this might result in a lower explanatory power and/or significance for these variables when running the model.

Summary

Table 6 outlines a summary of our independent variables, what they are proxies for, and their predicted signs.

Table 6.

Variable	Proxy for	Predicted sign
Market environment	Systematic risk	-
Market value to total assets	Growth opportunities	-
PP&E to total assets	Asset tangibility	+
ROCE	Profitability	-
Logarithm of total assets	Size (idiosyncratic risk)	+

Our market environment variables are expected to have a negative coefficient, thus indicating a countercyclical relationship between equity markets and capital structures.

The growth opportunities variable is expected to have a negative sign in line with what has been found in previous studies, showing that firms with more available investments in growth opportunities are risk averse and thus take on less leverage.

The asset tangibility variable is expected to have a positive sign, linking to creditor preference to lend to debtors able to provide tangible assets as collateral. A higher ratio of asset tangibility will thus lead to better credit terms, and consequently to higher propensity to take on debt.

The profitability variable is expected to have a negative coefficient, a result in line with (i) the pecking-order theory in the sense that firms with internal financing available prefer to use that before debt, but contrary to (ii) agency theory and the free cash flow hypothesis in that firms with large cash flows prefer to mitigate wasteful management spending and investment by taking on debt and thereby oblige to future interest payments.

The size variable, as a proxy for earnings volatility, which is in turn a measure for risk, is expected to have a positive coefficient. This implies that large and stable firms are deemed more secure by creditors and thus get the opportunity to borrow cheaper, increasing the benefits of debt financing.

3.4 Method critique

While frequently used in various attempts to understand capital structure dynamics, the applied statistical model has its flaws. Being aware of the shortcomings of applied tools is central when interpreting test results and we have identified a number of potential issues to keep in mind.

Multicollinearity in independent variables

It is plausible that some of the variables used to predict leverage ratios are highly correlated. For instance, correlation is to be expected between firm size measured as total assets and asset tangibility measured as total property, plant and equipment scaled by total assets. The larger firms in our samples mainly consists of industrial manufacturers such as Volvo, Atlas Copco, SKF etc., all of which have large portions of PP&E in their books. The resulting correlation could potentially lead to coefficient estimates highly sensitive to small changes in the underlying data. In the extreme case of two perfectly correlated independent variables, it is impossible to determine which of the two that actually relates to the dependent variable (Newbold et al, 2010).

Table 7.

	Market value of equity to total assets	PP&E to total assets	ROCE	Logarithm of total assets	Years since equity market extreme point
Market value of equity to total assets	-				
PP&E to total assets	-0.117 ***	-			
ROCE	0.053 **	0.046 *	-		
Logarithm of total assets	-0.173 ***	0.276 ***	0.161 ***	-	
Years since equity market extreme point	0.079 ***	-0.034	0.046 *	0.027	-

Presented in Table 7 above are the correlations between the independent variables. As can be seen, there is some degree of correlation between the variables. The strongest correlations, in absolute terms, are between the size proxy and the proxies for growth opportunities, asset tangibility and profitability. This is important to keep in mind when assessing the results of our statistical tests. There are several potential indicators of problems arising from multicollinearity, among them:

- Deviations between calculated coefficient signs and those predicted by theory
- Negligible impact (low absolute coefficient value) of variables expected to have a strong influence on the dependent variable
- Low t statistics for individual parameters in combination with a high F statistic for the model as a whole
- High correlation between independent variables

Potential differences in accounting classifications

Furthermore, one needs to take note of the use of accounting measures as predictors in our model. Several of these are, to some extent, discretionary in nature, which could imply differences in measurement techniques among the sample firms. As such, we must interpret our results under the assumption that all sample firms apply the same methods to arrive at the various accounting items used in our independent and dependent variables. For instance, one factor of particular importance is the classification of financial lease contracts as interest-bearing debt as stipulated in IAS 17 (IFRS, 2012). If the sample firms apply contrasting leasing classifications it would mean that their leverage ratios are not identically defined, which in effect invalidates the application of our model to some extent.

Another example is the capitalisation of research and development expenses. IAS 38 on intangible assets stipulates capitalisation of development expenses “only after technical and commercial feasibility of the asset for sale or use have been established”, the discretionary nature of which could lead to differences in capitalisation practices among the sample firms. Different capitalisation practices would affect the asset base and thereby several of our variables. Similar to the case of leasing classifications, this issue forces us to apply our model under the assumption that all sample firms capitalise R&D expenses according to the same conditions and make similar judgement calls on what is to be viewed as technical and commercial feasibility of assets.

Investor speculation impact on market-based leverage ratios

The market-based manner in which we have chosen to measure leverage is subject to short-term volatility resulting from investor speculation. It would be surprising if the entire sample is free from materially deviating leverage ratios over the 16 year research period in connection with, for instance, takeover rumours or adverse speculation. These variations in the dependent variable would not be captured by our set of independent variables and could thus lessen the predictive power of the model. A way of controlling for the potential impact of this issue is to perform robustness tests in which the dependent variable, the leverage measure, is substituted for an alternatively calculated ratio.

Survivorship bias

Our sample selection suffers from an inherent survivorship bias since the attempts to gather quality data for delisted firms were unsuccessful. This has implications for the possibilities to draw general conclusions from the test results. In essence, the findings we present are only applicable to firms that fit the same criteria as our sample firms, i.e. Swedish firms, excluding financials, which have been listed on Nasdaq OMX for a minimum of 16 years. One needs to be careful in extrapolating any results to firms outside of this delimitation and use our conclusions with this restriction in mind.

3.5 Testing robustness and the assumptions of linear regression

Variable sensitivity

We perform sensitivity analyses of our results by using different leverage measures as the dependent variable, as well as alternative measures for the equity market cycle in the set of independent variables. More on this in chapter 4.

Further, to check the validity of the results from our regression model, we perform three tests of the linear regression assumptions. These tests are designed to address the potential issues of multicollinearity, overall variable sensitivity, heteroscedasticity, and normality of error terms.

Multicollinearity

In addition to the inter-variable correlations presented in section 3.4, we pay attention to the effect on coefficients of substituting variables in the regression model. When performing the sensitivity analysis by switching independent variables, we keep our eyes open for erratic shifts in the coefficient values and/or signs.

Heteroscedasticity

The heteroscedasticity test is carried out by regressing the squared residuals from our main regression model on the original predictors, their squares and cross-products.

The test statistic follows a χ^2 distribution and is calculated by multiplying the resulting R^2 -value from the error term regression by the number of observations. The resulting test statistic, the Lagrange multiplier, follows a χ^2 distribution with a number of degrees of freedom, calculated as:

$$DoF = \frac{P^2 + 3 * P}{2}$$

where P is the number of predictors used in the original regression, five in our case. See appendix 3 for the results (White, 1980).

Normality of error terms

We perform a Shapiro-Wilks test to assess the normality of error terms resulting from the regression. The same test is used to investigate the normality of the sample leverage ratios used in the mean comparison test. See appendix 2 for the results.

4. Results and analysis

4.1 Test results

4.1.1 Test results, mean comparison

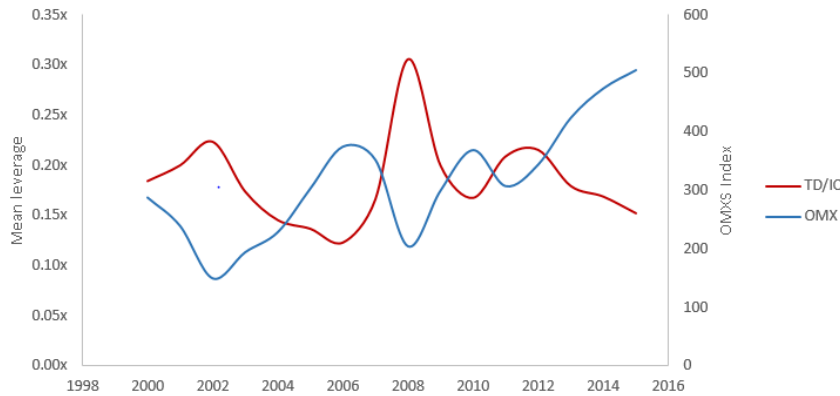
Table 8.

	2001	2002	2003	2004	2005	2006	2007	2008
2002	0.014	-						
2003	-0.014	-0.285	-					
2004	-0.035 *	-0.489 **	-0.020	-				
2005	-0.014	-0.052 ***	-0.023	-0.003	-			
2006	-0.048 ***	-0.063 ***	-0.034 *	-0.014	-0.011	-		
2007	-0.020	-0.035 *	-0.006	0.014	0.017	0.028 *	-	
2008	0.056 **	0.042 *	0.070 ***	0.091 ***	0.093 ***	0.104 ***	0.076 ***	-

	2008	2009	2010	2011	2012	2013	2014	2015
2009	-0.055 **	-						
2010	-0.785 ***	-0.023	-					
2011	-0.051 **	0.000	0.027	-				
2012	-0.043 *	0.012	0.036	0.008	-			
2013	-0.063 ***	-0.001	0.015	-0.012	-0.021	-		
2014	-0.070 ***	-0.015	0.001	-0.019	-0.027	-0.001	-	
2015	-0.092 ***	-0.036 *	-0.013	-0.041 *	-0.049 **	-0.028	-0.022	-

The mean regression results presented in table 8 above show that, on average, the leverage levels for the sample firms fall continuously from 2002 to 2006 before increasing in 2007 and 2008. The pattern is less clear in the second cycle, in which leverage levels appear to fall in 2009 and 2010 and increase in the two subsequent years before falling again in 2013, 2014 and 2015. Mean differences are, not surprisingly, mostly insignificant between two consecutive years and generally more significant for, in terms of time, more distant observations. The countercyclical relationship between the equity market and leverage ratios is illustrated in figure 3 below.

Figure 3.



4.1.2 Test results, regression model

Table 9.

Variable	Proxy for	Coefficient	t	Sig.
Market value to total assets _{t-1}	Growth opportunities	-0.024	-11.504	0.000
PP&E to total assets _{t-1}	Asset tangibility	0.339	14.356	0.000
ROCE _{t-1}	Profitability	-0.003	-0.643	0.520
Logarithm of total assets _{t-1}	Size (idiosyncratic risk)	0.013	6.560	0.000
Years since equity market extreme point _{t-1}	Systematic risk	-0.005	-2.976	0.003
Dependent variable:			Regression adj. R²	
<i>Total debt to market value of invested capital^t</i>			0.257	

To test whether the market environment impacts the capital structure decision we run a regression on the full sample to see if there is any explanatory power at all. We use our time variable as a proxy for systematic market risk. The results, as seen in table 9, are satisfactory in the sense that all coefficients of the five independent variables follow the predicted signs as outlined in section 3.3. We can conclude significance on the 1% level for each variable apart from the profitability measure. The explanatory power, the adjusted R^2 , of the model is in the same order of magnitude as in previous studies made (Welch, 2004; Thorsell, 2008 among others). This speaks in favour of the reliability of the results.

While other factors have stronger impact on the predicted capital structure, our time variable suggest that systematic market risk could be one of the determinants. The negative relationship between the systematic risk variable and capital structure indicate a falling level of leverage over the course of a bull market and a rising level of leverage as markets turn sour. The coefficient of a

negative 0.5% is to be interpreted as a predicted -0.5% (+0.5%) change in leverage levels, measured as total debt to market value of invested capital, for each consecutive year of equity market valuation increases (decreases). When substituting the time variable for alternative measures of systematic market risk, however, results are less conclusive.

Table 10.

Variable	Proxy for	Coefficient	t	Sig.
Market value to total assets _{t-1}	Growth opportunities	-0.025	-11.582	0.000
PP&E to total assets _{t-1}	Asset tangibility	0.343	14.464	0.000
ROCE _{t-1}	Profitability	-0.004	-0.729	0.466
Logarithm of total assets _{t-1}	Size (idiosyncratic risk)	0.013	6.385	0.000
Return since equity market extreme point _{t-1}	Systematic risk	-0.002	-0.830	0.407
Dependent variable:				Regression adj. R²
<i>Total debt to market value of invested capital^t</i>				0.253

Variable	Proxy for	Coefficient	t	Sig.
Market value to total assets _{t-1}	Growth opportunities	-0.025	-11.883	0.000
PP&E to total assets _{t-1}	Asset tangibility	0.345	14.527	0.000
ROCE _{t-1}	Profitability	-0.005	-0.899	0.369
Logarithm of total assets _{t-1}	Size (idiosyncratic risk)	0.013	6.294	0.000
OMX P/E _{t-1}	Systematic risk	0.000	-1.579	0.115
Dependent variable:				Regression adj. R²
<i>Total debt to market value of invested capital^t</i>				0.254

As a robustness test we performed an identical test with other proxies for systematic risk. Neither of them yields any particularly useful outcomes. The percentage return of the equity market variable is not significant on any relevant level, and the coefficient for the P/E-ratio variable is zero and also insignificant. Thus we cannot draw any conclusions with a different version of the systematic risk proxy. We therefore only include the time variable in our analysis henceforth.

To further control for the validity of our study, we did a robustness test by changing the dependent variable, the measure for leverage ratio. Since one of the main decisions we had to make regarding the variables was if market or book value of equity should be used in the leverage measure, we ran an additional regression with book value in the denominator. We applied another commonly used measure, total debt over book value of total assets (TD/TA). The results are presented in table 11.

Table 11.

Variable	Proxy for	Coefficient	t	Sig.
Market value to total assets _{t-1}	Growth opportunities	-0.009	-4.805	0.000
PP&E to total assets _{t-1}	Asset tangibility	0.260	12.514	0.000
ROCE _{t-1}	Profitability	-0.008	-1.594	0.111
Logarithm of total assets _{t-1}	Size (idiosyncratic risk)	0.018	10.242	0.000
Years since equity market extreme point _{t-1}	Systematic risk	-0.001	-0.402	0.688
Dependent variable:				Regression adj. R²
<i>Total debt to book value of assets_t</i>				0.208

The time variable is no longer significant, and the overall explanatory power of the model is weakened. A discussion on why this might be and how it affects our conclusions is presented in section 5. On the other hand, the results from the regression presented in table 9 are confirmed when changing the independent variable to total debt to market value of assets, as presented in table 12 below. This means that our results are robust with regards to non-normalisation of the operating liabilities' impact on capital structures for the sample firms.

Table 12.

Variable	Proxy for	Coefficient	t	Sig.
Market value to total assets _{t-1}	Growth opportunities	-0.016	-10.257	0.000
PP&E to total assets _{t-1}	Asset tangibility	0.29	16.548	0.000
ROCE _{t-1}	Profitability	-0.003	-0.800	0.424
Logarithm of total assets _{t-1}	Size (idiosyncratic risk)	0.009	6.219	0.000
Years since equity market extreme point _{t-1}	Systematic risk	-0.003	-2.170	0.030
Dependent variable:				Regression adj. R²
<i>Total debt to market value of assets_t</i>				0.269

Having had indications of alternating results for firms of different sizes in preliminary studies, we performed a robustness test by checking if there are any size related differences between firms, as measured by market value of equity. We split the sample into three equally sized groups and find that in the third with the largest firms, our time variable is not statistically significant on a relevant level. The results are seen in Table 13.

Table 13.

0-33rd size percentile

Variable	Proxy for	Coefficient	t	Sig.
Market value to total assets _{t-1}	Growth opportunities	-0.018	-4.963	0.000
PP&E to total assets _{t-1}	Asset tangibility	0.323	7.812	0.000
ROCE _{t-1}	Profitability	-0.004	-0.593	0.554
Logarithm of total assets _{t-1}	Size (idiosyncratic risk)	0.074	9.827	0.000
Years since equity market extreme point _{t-1}	Systematic risk	-0.007	-2.279	0.023
Dependent variable:				Regression adj. R²
<i>Total debt to market value of invested capital^t</i>				0.405

34th-67th size percentile

Variable	Proxy for	Coefficient	t	Sig.
Market value to total assets _{t-1}	Growth opportunities	-0.012	-3.627	0.000
PP&E to total assets _{t-1}	Asset tangibility	0.210	5.419	0.000
ROCE _{t-1}	Profitability	-0.010	-1.167	0.244
Logarithm of total assets _{t-1}	Size (idiosyncratic risk)	0.044	8.176	0.000
Years since equity market extreme point _{t-1}	Systematic risk	-0.007	-2.885	0.004
Dependent variable:				Regression adj. R²
<i>Total debt to market value of invested capital^t</i>				0.279

68th-100th size percentile

Variable	Proxy for	Coefficient	t	Sig.
Market value to total assets _{t-1}	Growth opportunities	-0.025	-6.660	0.000
PP&E to total assets _{t-1}	Asset tangibility	0.064	1.741	0.082
ROCE _{t-1}	Profitability	-0.110	-3.195	0.001
Logarithm of total assets _{t-1}	Size (idiosyncratic risk)	0.260	7.777	0.000
Years since equity market extreme point _{t-1}	Systematic risk	-0.003	-1.393	0.164
Dependent variable:				Regression adj. R²
<i>Total debt to market value of invested capital^t</i>				0.324

We would like to elucidate observations to be made in the differences in the explanatory variables between the different size groups. We see that profitability is not a significant explanatory variable for small and medium sized firms, but is significant on all levels for the largest third of firms. A possible explanation for why this could be that larger firms have less volatile earnings and profitability. If profitability is volatile between years, the predictive relationship with leverage ratios might not be strong enough to yield a coefficient beta significantly different from zero.

Table 14.

Variable	Proxy for	Coefficient	Sig.	Own R ²	Cum. R ²
Market value to total assets _{t-1}	Growth opportunities	-0.031	0.000	0.105	0.105
PP&E to total assets _{t-1}	Asset tangibility	0.416	0.000	0.157	0.235
ROCE _{t-1}	Profitability	0.002	0.727	-0.001	0.234
Logarithm of total assets _{t-1}	Size (idiosyncratic risk)	0.025	0.000	0.078	0.253
Years since equity market extreme point _{t-1}	Systematic risk	-0.007	0.000	0.008	0.257

Dependent variable:
Total debt to market value of invested capital^t

As a way of isolating the explanatory power of each individual variable, we then performed an incremental regression, presented in table 14, in which we ran the regression with each individual independent variable separately and then aggregated them one by one. The cumulative R² column is thus to be interpreted as the explanatory power of the growth opportunities variable in itself on the first row, growth opportunities and asset tangibility taken together on row two and so forth. This exercise clearly points to the incremental effect of each independent variable and, not surprisingly, the variables found to be important in previous studies are so for our sample as well. This is particularly the case for the variables growth opportunities, asset tangibility and size, all of which boast an individual adjusted R² in excess of 10%. ROCE is found to not be significant on its own, as well as previously found when included in the regression. Our added proxy for systematic market risk adds additional explanatory power on the margin by 0.4 percentage points, thus increasing the total explanatory power of the model by 1.6%.

4.2 Analysis

The mean comparison results indicate results in line with our hypothesis. A general trend identified for the first cycle appears to show a mean leverage development that is countercyclical to the equity market. While less clear, a similar trend can be distinguished in the second cycle. Here, mean leverage ratios spike in 2008 before gradually falling in 2009 and 2010. Interestingly, the expected pattern is broken in the third and fourth year of the recovery before leverage levels continue to drop in 2012, 2013 and 2015. The deviation from trend might be a result of the infamous “double-dip recession” that hit Europe around this time. Generally, the test points to a statistically significant leverage decrease from the early stages in equity market upturns, i.e. 2001/2002 and 2008/2009, to the later stages of the respective bull markets, i.e. 2006/2007 and 2014/2015 respectively.

The results from the regressions tell us a number of things. First of all, the generally solid explanatory power of the model, as per results for the entire sample, and the fact that the coefficients have signs in line with previous studies made on other data seems to confirm the applicability of the model on our sample over the chosen time period. Somewhat surprisingly, the profitability measure was not significant on any relevant level, contradictory to findings in earlier research, e.g. Frank and Goyal (2009).

A possible explanation for this could be the presence of numerous small and, in terms of profitability, more volatile firms. Smaller, less geographically and operationally diversified firms, could be expected to show less stable earnings. The unweighted manner in which each observation is taken into account in an OLS regression implies that a large enough number of these, supposedly volatile and undiversified, firms could obscure the existence of a statistical pattern in parts of the population.

The results in Table 13, where we split the sample in three size groups, was somewhat surprising as our intuition told us that larger firms ought to have a more predictable behavioural pattern. This idea was based on the notion that larger firms could be assumed to be more sophisticated in their financial decisions. This was not the case, and the reasons for the size-related difference is open for debate.

Our first ambition was to do the test on a large sample, with over 1000 firms. However, when collecting the data we found that it was not of sufficient quality. There were a lot of missing values, which did not seem to appear in a random manner. This led us to look for answers to our research question for a less general population. In this endeavour, we focused our attention to larger, more stable, and supposedly more financially sophisticated firms. Our sample, this time consisting of firms listed on Nasdaq OMX for 16 consecutive years during our time frame, was used to run a corresponding statistical test. The results, as presented in the section 4.1, were somewhat different but, importantly, in line with our predictions.

The inherent selection flaw of our sample disallows us to draw conclusions about Swedish firms in general. What can be done, however, is to draw conclusions about Swedish firms that have been listed for at least 16 consecutive years. The regression made on the delimited sample enables us to make more interesting interpretations. It is important to stress that any conclusion drawn from this is only applicable to companies listed for a long consecutive period, and not any publicly traded company.

The delimited sample can be considered to have a “survivorship bias”, as was pointed out in section 3.4. It might be biased since it could be the case that only companies that handle their capital structure decisions in a certain manner survive long enough to be included in the sample. Applying the results from our limited sample on a general population might therefore lead to wrongful conclusions.

In this light, we find that the variable defined to capture the length of an equity market rise, used by us as a proxy for systematic market risk, has a negative relationship, on a significant level, with the leverage ratio of enduringly listed Swedish firms. On this evidence, our null hypothesis that “equity market conditions have no impact on a firm’s leverage ratio” does not appear to hold true.

Returning to the purpose of this thesis, this result suggests that the incorporation a market-timing hypothesis component, in the shape of systematic risk variable, improves the trade-off theory’s ability to make accurate predictions about a firm’s leverage ratio. We draw this conclusion since our time variable is found to improve the predictive model of capital structure. When including size and our time-variable, both being proxies for risk, in the regression the result is better than when doing it with one of the respective variables only. We interpret this as a result of the two risk proxies capturing two different types of risk. In earlier research studying capital structure, e.g. Frank and Goyal in 2009, they use size as a proxy for earnings volatility. Earnings volatility can be interpreted as the risk associated with the specific firm, also known as the idiosyncratic risk. Our time variable on the other hand is capturing the systematic risk a firm is exposed to.

By adding this time variable we include a proxy for systematic risk, which makes the model paint a more exhaustive picture of the risk factor in capital structure decision-making. Though it should

be noted that when we do the regression with only the time variable, the model is worse than when using only the size variable. It is logical, since we want to capture both the idiosyncratic (size) and systematic (stock market) risk. This means that while the model is better by including our time variable, it should not be considered a replacement for the size variable. The improvement is small in numerical terms, on our sample the systematic time variable increases the predictive power by a mere 1.6%, but it does nonetheless represent a contribution to the overall explanatory power of the model.

5. Discussion

The initial t-test performed to identify patterns in mean leverage ratios over the last two equity market cycles pointed to results in line with our hypothesis. A deleveraging pattern was quite clear over the first cycle but less so over the second cycle, perhaps as a result of the rocky recovery path in the wake of the financial crisis.

Encouraged by the mean comparison results, we moved on to test our hypothesis by running the regression model constructed for the purpose. With regards to the entire sample, we found that a variable designed to capture systematic market risk appear to have a negative relationship, on a significant level, with firm leverage ratios in our sample.

We interpret the result of the regression as evidence in line with the findings of Graham and Harvey (2001) and Opler and Titman (1998), who put forward that firms do not rebalance their debt-to-equity ratios as a consequence of increases in equity valuations. Rather, leverage ratios are allowed to fall over the course of an equity market upturn. While our work does not point to the underlying reasons behind this pattern, it is possible that managers perceive a higher degree of systematic market risk the longer a bull market continues. If so, the optimal leverage ratio for any given firm would decrease accordingly, indicating an improvement of the trade-off theory by an incorporation of a market-timing component. However, there are a number of caveats that should be kept in mind when interpreting our findings.

5.1 Reliability and validity

As mentioned in the method section, the initial mean comparison test is only valid under assumption of a normally distributed variable. When we performed a Shapiro-Wilks test for normality, we found that the leverage variable could not be assumed to be normally distributed, which makes the mean comparison test result less reliable. However, it has been found to be very difficult to prove normality when sample size is large (Shapiro and Wilks, 1965). We believe our sample size can be classified as large, and therefore we consider the outcome of the normality test to be of less importance. The Shapiro-Wilks test is presented in appendix 2.

The statistical model did, in general terms, perform as expected. The predicted signs were confirmed during various sample alterations and the coefficient are estimated at reasonable levels compared to similar studies. This is reassuring in the light of the multicollinearity indications found when we studied the correlations between the independent variables.

On the other hand, our tests for heteroscedasticity led us to reject the null hypothesis of homoscedastic error terms. A summary of the heteroscedasticity test is presented in appendix 3. This indication of heteroscedastic error terms is problematic, since it raises the question of whether a linear regression model is the tool for analysis. Potentially, it could also point to adverse effects on the quality of our results (Newbold et al. 2010).

The result of the Shapiro-Wilks normality test of the residuals (see appendix 2) means that we violate the assumption of normality in the error terms for the regression. As previously stated, since we have such a large sample, it is very hard to prove normality, and as such we should not worry too much about the assumption violation. It should though be kept in mind.

When looking at the sensitivity analysis where we substituted the dependent variable to one with book values in the leverage measure, see table 11, the results can be interpreted as impairing to the robustness of our findings. According to Fama and French (2002), regressing on leverage ratios should provide similar results when using both book and market value measures. We see here that switching to book values has a negative effect on the quality of the results, both on the level of significance on our time variable, as well as the adjusted R^2 of the regression as a whole.

The reason for this discrepancy with the regression with market values is in the worst-case scenario explained by something as straightforward as algebra. With market values in the denominator, intuitively the leverage ratio will decrease with rising equity markets. More worryingly, when substituting the denominator with book value of assets, which do not directly increase with equity markets, the time variable is not significant on any relevant level.

Having this algebra in mind, there is reason to be somewhat worried about our results. Fama and French, together with other researchers, argue that it should not matter which of book or market values that is studied. In contrast to us, they did not use any independent variables designed to increase with a rising equity market whereas we did, and its significance differs a lot when switching between the leverage measures. There is thus a possibility that our findings in this thesis are not valid, and that further investigation is needed for making sure that the causal relationship between market environment and leverage ratio is legitimate.

As seen in table 10, when we perform robustness tests by substituting the time variable for other variables intended to capture the market environment effect, the results are, again, inconclusive. It is possible that we have made some logical errors, but our intention was that both percentage rise of equity market and P/E-ratio variables ought to capture the same phenomenon as the time variable. Intuitively, all three of the variables could be interpreted as a thermometer of the stock market, and consequently systematic risk.

Perhaps it is not necessarily surprising that the cumulative equity market index increase fail to improve the model, given that this is a less stable variable. The quick and irregular fluctuations of the stock market make it impossible for firms to adjust their leverage ratio accordingly, even if they would want to. As such, it becomes more reasonable that the percentage valuation increase of the stock market is not significantly correlated with leverage ratio. This reasoning also applies to P/E, as the two are closely linked to each other.

Even so, this failed robustness test has implications on the quality of our findings. Since the results stemming from the time variable is not replicable when using other variables that are intended to capture the same effect, we cannot exclude the possibility that our results occurred by mere chance.

5.2 Results critique

While our statistical tests designed to test the impact of bull market longevity on leverage ratios among Swedish firms support our hypothesis, it does not rule out other possible explanations for the observed phenomenon. It is possible that the falling leverage ratios over the course of the equity market rises of 2003 to 2007 and 2009 to 2015 are merely parts of a longer trend of deleveraging among Swedish firms. Spikes in debt-to-equity ratios are to be expected in the wake of a market downturn and these could thus be seen as bumps in the road of deleveraging. The negative relationship between our systematic risk variable and firm leverage ratios would then purely be a result of a generally declining use of debt financing and the mechanical downward effect on solidity that results from a temporary adverse market environment.

If a longer trend of deleveraging exists, a possible explanation could be found in the macroeconomic factors, and perhaps specifically the interest rate. Since debt is commonly quoted at book value and equity at market value, the ratio is affected by how the prevailing market values equity. With the development of lowered interest rates over the past decades, the market value of equity could reasonably be expected to rise. All other things held equal, this leads to a lowered leverage ratio, measured in market terms. However, this is not something we aim to explore in this thesis, rather, it is something to keep in mind when interpreting our results.

Another factor that has been found to be of relevance is the expected inflation (Frank and Goyal, 2009). As one would expect, high inflation expectations would be countered by leveraging as the debt costs and repayments become less and less expensive in real terms as inflation picks up. The deflationary pressure combated by central banks in developed markets, including Sweden, since the financial crisis might have had the reverse effect on firm leverage. The fact that this period makes up a large part of our research period suggests that our findings might be a result of deleveraging caused by low inflation expectations.

The fact that the profitability proxy is not significant on any level is a little worrying. In previous research, profitability is often found to have significant explanatory power for predicting capital structure. Since we, to some extent, have tried to emulate said research, we expected our

profitability variable to be significant. This did not turn out to be the case, and a deviation in results like that raises some questions about the quality of our data.

6. Conclusions, contribution and suggestions for further research

To summarize, we have found evidence to reject our null hypothesis that the market environment does not have an effect on capital structure. As equity markets rise, firms seem to lower their leverage ratio. The effect is not very strong, as a year of rising (falling) stock markets predicts a decrease (increase) in leverage ratio of less than one percentage point. This effect also seems to weaken as firms grow larger, since the relationship is not significant for the largest firms.

The results are however inconclusive, as they are not very robust, and there are some inherent flaws in the data sample. We can therefore not with complete certainty put forward that firms adjust their capital structure with respect to the prevailing market environment. Rather, what we can say is that under certain circumstances, including market environment as a factor when analysing capital structures, adds explanatory power and can increase our understanding of the subject.

While the results should not be considered strong enough to act as guidelines to different stakeholders, they might be helpful to keep in mind when further analysing the area of capital structure. Our findings points in the direction that combining the trade-off theory and the market-timing hypothesis might paint a more exhaustive picture and help researchers better understand the true determinants of capital structure. In future research, it would be interesting to further elaborate on this combination of the two theoretical frameworks.

Another suggestion for further research relates to the reasoning behind the capital structure decision in different market environments. It would be interesting to know if there is a component of conscious pro-activeness at the mature stages of a bull market, where managers lower the leverage ratio as a hedge for an imminent loss of revenue. That would have to be done through a qualitative study, including interviews with financial decision makers at firms.

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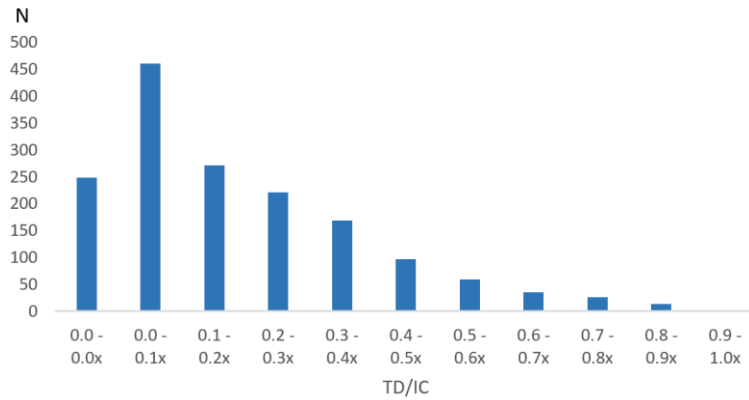
Appendix

Appendix 1 - Sample firms

Firm	Industry	Firm	Industry
SKF	Industrials	KNOW IT	Technology
ACANDO	Technology	LAMMHULTS	Consumer Goods
ACTIVE BIOTECH	Health Care	MALMBERGS ELEKTRISKA	Industrials
ADDNODE GROUP	Technology	MEDA	Health Care
AF	Industrials	MEDIVIR	Health Care
ANOTO GROUP	Technology	MEKONOMEN	Consumer Goods
ARCAM	Industrials	MODERN TIMES GRP MTG	Consumer Services
ASSA ABLOY	Industrials	MSC KONSULT	Technology
ATLAS COPCO	Industrials	MULTIQ INTL	Technology
AXFOOD	Consumer Services	MYCRONIC PUBL	Industrials
AXIS	Technology	NCC	Industrials
B&B TOOLS	Industrials	NET INSIGHT	Technology
BEIJER ALMA	Industrials	NEW WAVE GROUP	Consumer Goods
BEIJER ELECTRONICS	Industrials	NIBE INDUSTRIER	Industrials
BEIJER REF PUBL	Industrials	NOLATO	Industrials
BERGS TIMBER	Basic Materials	NOVOTEK	Technology
BETSSON	Consumer Services	OEM INTERNATIONAL	Industrials
BILIA	Basic Materials	ORTIVUS	Health Care
BIOGAIA	Health Care	PEAB	Industrials
BIOTAGE	Health Care	POOLIA	Industrials
BONG LJUNGAHL	Industrials	PRECISE BIOMETRICS	Industrials
CLAS OHLSON	Consumer Services	PREVAS	Technology
CONCORDIA MARITIME	Industrials	PRICER	Industrials
CONSILIUM	Industrials	PROACT IT GROUP	Technology
CTT SYSTEMS	Industrials	PROFILGRUPPEN	Basic Materials
DORO	Technology	ROTTNEROS	Basic Materials
DUROC	Industrials	SAAB	Industrials
ELANDERS	Industrials	SANDVIK	Industrials
ELECTROLUX	Consumer Goods	SECTRA	Health Care
ELEKTA PUBL	Health Care	SECURITAS	Industrials
ELOS MEDTECH	Health Care	SEMCON	Industrials
ENEA	Technology	SINTERCAST	Industrials
ENIRO	Consumer Services	SKANSKA	Industrials
ERICSSON	Technology	SKISTAR	Consumer Services
FAGERHULT	Industrials	SOFTRONIC	Technology
FEELGOOD SVENSKA	Health Care	SSAB	Basic Materials
FINGERPRINT CARDS	Industrials	STOCKWIK FORVALT	Technology
GETINGE	Health Care	SWECO	Industrials
GUNNEBO	Industrials	SVEDBERGS I DALSTORP	Industrials
HALDEX	Consumer Goods	SWEDISH MATCH	Consumer Goods
HENNES & MAURITZ	Consumer Services	SVENSKA CELLULOSA	Industrials
HEXAGON	Technology	TELE2	Telecommunications
HIQ INTERNATIONAL	Technology	TELIASONERA	Telecommunications
HOLMEN	Basic Materials	TRELLEBORG	Industrials
I.A.R. SYSTEMS	Technology	VBG GROUP PUBL	Consumer Goods
IMAGE SYSTEMS	Industrials	VENUE RETAIL GROUP	Consumer Services
IND & FIN SYSTEMS	Technology	VIKING SUPPLY	Industrials
INTELLECTA	Industrials	VITEC SOFTWARE GRP	Technology
KABE HUSVAGNAR	Consumer Goods	VOLVO	Industrials
KARO PHARMA	Health Care	XANO INDUSTRI	Industrials

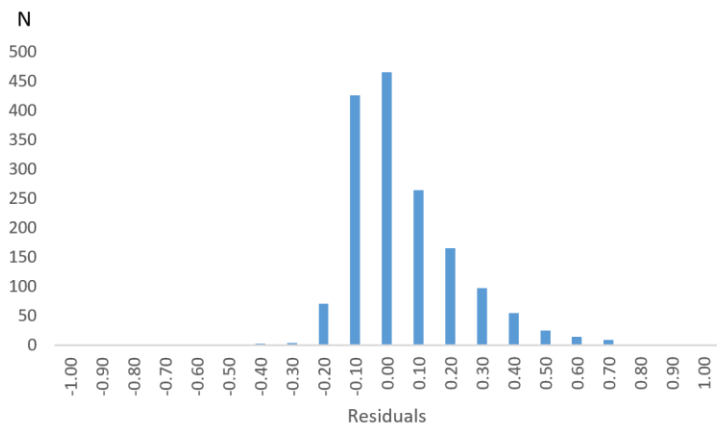
Appendix 2 - Shapiro-Wilks test for normality

Normality test for leverage ratio (TD/IC)



Dependent variable	Statistic	DoF	Sig.	Normality?
TD/IC	0.865	1593	0.000	No

Normality test for regression residuals



Dependent variable	Statistic	DoF	Sig.	Normality?
Residuals*	0.918	1593	0.000	No

* Original regression run with TD/IC as dependent variable

Appendix 3 - tests for heteroscedasticity

Dependent variable	Adj. R ²	N	F	Sig.	DoF	Chi ²	Critical Chi ²	Heteroscedastic?
Squared residuals**	0.098	1592	9.686	0.000	20	156.016	37.566*	Yes

* Based on 20 DoF and 1% significance level

** Original regression run with TD/IC as dependent variable

