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THE IMPACT OF THE FINANCIAL CRISIS ON CORPORATE CAPITAL STRUCTURE DYNAMICS IN THE NORDIC COUNTRIES†

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Abstract

The concept of corporate capital structure is dynamic in nature as the changing economic and business situations influence on it. Financial crisis of 2007-2008, among other things, have led companies to bring important changes in their capital structure. In turn, capital structure has also influenced corporate risks and the weighted average cost of capital of the firms. However, this topic is under-researched in general and in the context of Nordic countries, in particular. This paper examines the determinants that have affected firm-level corporate capital structure across Nordic countries during the financial crisis sub-period (2007-10). In addition, we also study and compare the same phenomenon during the pre (2003-06) and post financial crisis (2011-17) sub-periods. The principal finding of the study underlines that during the pre-financial crisis period, firms producing high accounting- and market returns borrow less, thus rendering their capital structure more towards equity capital as more debt increases fixed cash outflows in the form of debt servicing. However, during and post financial crisis sub-periods firms giving better performance, with reference to the same benchmarks, borrow more. Several factors can be attributed this finding such as high risk premium to the equity investments due to adverse equity investment climate, falling interest rates during the financial crisis and increasing non-performing assets accumulated with banks. The current paper contributes to the body of knowledge, both academic and practitioners, in several ways. First, the study identifies the key determinants affecting capital structure in the pre, during and post financial crisis sub-periods and thus portraying a comprehensive and in-depth picture. Second, the study explores how the capital structure affects the risk and weighted average cost of capital (WACC).

Keywords: Financial Crisis, Capital Structure, Leverage, Risk, Return

JEL Classifications: G32, G34, M41

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1. Introduction

This paper examines how the corporate capital structure has been affected in the Nordic countries by several business and economic factors in the pre-financial crisis (before 2003-06), during the financial crisis (2007-10), the post-financial crisis (2011-17) sub-periods as well as the full period (2003-17). A variety of business and economic determinants including the corporate performance (both, accounting and market), cost of capital and risk (and its decomposition), and taxation have been identified as the explanatory variables. The paper further explores the effects of the capital structure on the other business and economic factors too. The financial crisis started in 2007 has an enormous impact on the global economy, and the Nordic countries have not been an exception to it (Foster and Magdoff, 2008). Many scholars believe that economic crisis is over now and the global economy is showing perceptible signs of recovery, nonetheless, the effects of the crisis on both the global economy in general and corporate sector in particular are still quite evident.

'Like financing, like investing', since the capital structure of firm underlines its financing, which in turn affects operations and investing of the firm, therefore, determining the capital structure is one of the most strategic decisions of a firm (Donaldson, 1978). The total capital requirements underpin financing of assets necessary to run a firm. Capital structure of the firm generally consists of debt and equity and it is an important determinant of its solvency (Berk and DeMarzo, 2017). The financial crisis ignited in 2007-08 has witnessed a series of corporate bankruptcies largely owing to the sub-optimal investing by firms fueled by their sub-optimal capital structure (Akbar et al., 2013; Demirguc-Kunt et al., 2015). Therefore, exploring the impacts of financial crisis on corporate capital structure is an important area of research. It is also important to explore whether the firm-level capital structure has experienced any changes during the financial crisis and post crisis periods when compared with the pre-financial crisis period. It is also utmost important to identify determinants that could have affected firm-level capital structure during crisis and post crisis periods in comparison to the same in the pre-crisis period. The current study further contends that in order to attain in-depth understanding of dynamics of capital structure, it is also important to explore the effects of various determinants on the firm-level systematic risk, unsystematic risks and weighted average cost of capital (WACC) during the pre-crisis, crisis, and post-crisis periods, amongst other factors (Campbell and Viceira, 2005). The empirical analysis is conducted for the full period too.

The current paper contributes to the extant literature, both academic and practitioners, in several ways. First, this is one of the fewest studies exploring the dynamics of corporate capital structure and several business and economic determinants in settings of the Nordic countries in the pre, during and post financial crisis sub-periods and thus providing a clearer, comparable and comprehensive picture of the abovementioned dynamics. Second, the study explores how the capital structure affects the risk and weighted average cost of capital (WACC).

The current study attempts to study and analyze the following research objectives. First, it aims to identify key determinants underlying the financial crisis that have affected the firm-level capital structure during the financial crisis, post-crisis and pre-crisis sub-periods as well as full analysis period. Second, it explores the effects of corporate capital structure on business and economic factors such as systematic risk, unsystematic risk and WACC during the same sub-periods and period. Both research objectives are placed in relation to each other as the current study explores *the dynamics* of capital structure and other business and economic determinants, therefore, capital structure is analyzed both as the explained and explanatory variable.

In order to answer the aforementioned questions, the financial data of 30 non-financial publicly traded companies listed on the Nasdaq OMX Nordic Stock Exchange (OMXN40) in Denmark, Finland, Norway and Sweden, have been analyzed. Similarly, historical accounting and market data have been taken from annual reports of sample companies and respective central banks. The effects of the crisis were investigated by dividing the data period into three distinct time intervals called the pre-crisis (2003-2006), during-crisis (2007-2010) and the post-crisis (2011-2017) sub-periods in order to have a comparison. Similarly, the data of full period have been studied too.

A major finding of the current paper is that during the pre-financial crisis period accounting, and market returns have been found to be negatively associated with the firm capital structure,

measured as the leverage ratio (debt (D) to equity (E) ratio). The above finding underlines that firm giving better performance relies on the equity capital, because the firm may invite equity holders' wrath and increased financial distress costs if it finances its investing and operations through increased borrowings. Similarly, during and after the financial crisis sub-periods, a better firm-performance, both accounting and market, is accompanied by a higher leverage ratio (positive association), because during the financial crisis period the investors may attach high risk premium to the equity investments as the share prices drop substantially and the equity investment climate is extremely uncertain. Similarly, due to falling interest rates during the financial crisis, high performing firms find it cheaper to borrow, and bank prefers to diminish their already piled-up non-performing assets by providing debt to such *highflyer* firms on favorable terms. The current paper is divided into five sections including introduction, literature review and hypotheses development, empirical methodology, findings and discussion and then conclusions at the end.

2. Review of Literature and Hypotheses Development

Determination of an optimal capital structure signifies a high impact on a firm's growth and even existence. In order to finance its activities, a firm can use both its own capital and borrowed capital. Those firms, who have access to inexpensive capital and that too in sufficient amount have more opportunities to grow and gain larger market share. However, gaining cheaper finance on favorable terms is not the only strategic decision that firms makes in this context, firms also must ensure that they determine and sustain the optimum capital structure (Berk and DeMarzo, 2017).

This optimal capital of a firm helps to ensure its financial stability, meeting the liquidity and solvency requirements and generating higher return on invested capital (Graham and Leary, 2011). The determining of an optimal capital structure of a firm must meet the requirements imposed by both the macro-economic situation and the firm's management by taking into account its characteristics and other institutional settings (for example, its market value, profitability, risk, industry/sector background), and regulatory requirements at a given time, *ceteris-paribus* (Salim and Yadav, 2012). The requirements related to the macro-economic situation, for example, are the uncertainties related to external business/economic factors due to the influence of globalization and the availability of the range of possible options for investing available resources. The requirements of the firm's management underline effective functioning, leadership, monitoring, control and decision making in a competitive environment in order to determine the optimal capital structure under dynamic conditions. The right composition of capital structure provides superior conditions for achieving maximum return on capital at the given level of financial risk. The firm can maximize its profitability by optimizing its capital structure. It is significant to keep in mind that the maximization of the return on capital must remain within the acceptable level of financial risks. The specific level of risks that a firm faces is determined by the risk-taking attitude of its owners or managers, among others (Kang et al., 2018). In order to obtain ex-ante rate of return on capital employed, it is an important to recognize business and financial risks emanating from investing and operations in order to form an effective risk management policy of the firm aiming to minimize firm risks (Kang et al., 2018).

An important aspect of the capital structure dynamics is the financial control that the founder members/controlling family owners (both known as promoters) intend to exercise over the firm. For example, Hundal (2016, 2017) and Sarkar and Sarkar (2009) find that in India, where promoters significantly control the firm, changes in the capital structure can be made in order to further strengthen promoters' control over a firm (and also other firms in the same corporate group). Therefore, decision related capital structure changes have important corporate governance traces (see Aguilera and Crespi-Cladera, 2016; Basu and Sen, 2015; Chakrabarti *et al*.; 2008; Sarkar and Sarkar, 2000).

The optimum capital structure allows the firm to acquire financial flexibility as it allows the firm to generate the necessary amount of additional capital in a timely manner with an unexpected appearance of some attractive investment opportunities in the wake of new growth prospects. A firm can obtain the virtue of financial flexibility by optimizing various gearing ratios, effective

management of financial risks, and effective communication with investors and creditors (Hamberg, 2001).

The firm-level capital structure depends on several factors such as the firm size, profitability, risk, cost of capital, taxation, growth prospects, tangibility, and financial distress costs, among others (Harris and Raviv, 1991). The following discussion highlight some key determinants of the capital structure.

2.1. Firm Size

Firm-size has an important association with the capital structure. Rajan and Zingales (1995) highlight that the large size firms have lower probability of default (financial distress costs). Therefore, large firms are likely to borrow more. Huang and Song (2002) and Friend and Lang (1988) empirically support the above argument that there is a positive association between the firm-size and leverage. Not only the firm-size matters, but even the size of banks that these firms are affiliated to also matters. Sheard (1989) and Hoshi et al. (1990) find that Japanese firms having clientele relationship with large banks have lower financial distress costs, because such banks are more resourceful to save their client firms from any potential distress.

However, Rajan and Zingales (1995) put forward an alternative argument by contending that informational asymmetries between insiders of a firm and the capital markets are lower for large firms. Therefore, a theoretical argument is formed that large firms rely on issuing equities, as they are more informationally sensitive in comparison to debt. The above argument is empirically supported by Kim and Sorensen (1986), Titman and Wessels (1988) and De Jong and Verwijmeren (2010).

2.2. Profitability of Firms

There is no clear consensus among researchers with respect to the association between the profitability and leverage of firms. According to the trade-off theory, firms that earn more profit are more likely to have a higher portion of debt in their capital structure as firms can avail more interest tax shield by exposing less profit before corporate tax after paying more interest to the debtholders (Kraus and Litzenberger, 1973). Furthermore, the agency theory perspective underlines corporate governance issues. According to the agency theory more profitable firms borrow more in order to discipline the managers, for example by exerting pressure on them to do cash payout to investors instead of undertaking inefficient projects and thus inflicting managerial entrenchment risks on firms (Jensen and Meckling, 1976).

In contrast to the above theories the pecking-order theory highlight that successful firms prefer equity to debt in order to avoid any unwanted pressure on their cash flows (Myers and Majluf, 1984). Several empirical studies, such as Rajan and Zingales (1995), Huang and Song (2002), Booth et al. (2001), Friend and Lang (1988), Titman and Wessels (1988), and Kester (1986) demonstrate a negative relationship between leverage and profitability.

2.3. Tangibility of Assets

The tangibility of the firm assets implies the proportion of tangible (fixed/physical/visible) assets in its total block of assets. The tangibility of a firm's assets affects decisions regarding its capital structure significantly. In theory, higher proportion of tangible assets the firm possesses, higher will be its value and lower the risk of it going bankrupt, therefore, the firm is able to receive debt on more favorable terms (Booth et al., 2001). Friend and Lang (1988), Rajan and Zingales (1995) and Titman and Wessels (1988) also observe a positive association between tangibility and leverage. Thus, issuing debt secured by the property with known values avoids these costs. The tangible assets are more likely to be accepted as collateral by the lenders since such assets carries lower risk of losing the value.

However, there is also a negative reason why the shareholders of highly leveraged firms have an incentive to invest sub-optimally in order to expropriate wealth from the firm's debt holders, and thus inflict agency cost on the firm (Jensen and Meckling, 1976; Myers, 1984). This

behavior reflects the managerial opportunism, short-termism and entrenchment phenomena. Several empirical studies support the abovementioned agency costs assertion (Huang and Song, 2006; Jong *et al.* 2008; Serrasqueiro and Rogao, 2009).

On the other hand, it may also be argued that there is a negative association between the tangible assets of a firm and its leverage, because more debt imposes more pressure on corporate managers to produce higher cash flows in order to repay the interest and part of the debt. In case the firm produces less than required level of cash flows, in order to make debt servicing, it can expose itself to the possible bankruptcy. Therefore, debt can be used as a corporate governance mechanism in order to minimize managerial opportunism, enhance efficacy of the monitoring and control mechanisms of the firm. Several empirical studies back-up the above argument (Booth et al., 2001; Bauer, 2004; Mazur, 2007; Karadeniz et al., 2009).

2.4. Growth Opportunities

Future growth opportunities of a firm plays an important role in the overall planning, including the capital structure. Researchers hold different opinions regarding the growth opportunities available to the firm and its leverage. According to the agency theory, there exists a negative relationship between the growth opportunities available to a firm and its level of leverage. This is so because the shareholders invest in such firms in order to earn substantial capital gains instead of dividends due to higher expected market value of their equity, and therefore, the growth-oriented firms are less dependent on debt (Jensen and Meckling, 1976; Frank and Goyal, 2005). Another aspect of the agency theory is that managers behave rationally when trying to expand their own earning at the expense of the shareholders, and debt financing controls this managerial opportunism/discretion. Nonetheless, more debt leads to increased debt-servicing and this leads to fewer investment opportunities and resources available to a firm. Therefore, firms with more growth opportunities are often *debt averse*.

On the contrary, according to the pecking order theory, there exists a positive association between the growth opportunities and leverage. The core argument of pecking order theory as opposed to the agency theory is that managers display rational behavior, which is not necessarily opportunistic. Therefore, debt exerts no special disciplinary pressure on managers (Myers and Majluf, 1984).

According to the trade-off theory, growth firms invest heavily in the R&D projects, which are less tangible and thus render growth firms not good borrowers. This is so because firm cannot use unrealized growth opportunities as collaterals when seeking debt from financial institutions. Therefore, the trade-off theory underpins a negative relationship between growth opportunities and leverage and many empirical studies confirm this relationship (Deesomsak *et al.* 2004; Zou and Xiao, 2006; Eriotis *et al*. 2007).

2.5. Corporate Tax and Debt Tax Shield

According to the trade-off theory, a firm paying higher taxes possesses a higher leverage ratio, because of the tax shield advantage that is available only to debt and not to equity (Kraus and Litzenberger, 1973). Even Modigliani and Miller (1963) also advocate the tax advantage of the borrowing costs in their modified theory of capital structure. The reason for the positive association between the corporate tax and leverage is that since the interest expenses are tax deductible before calculating earnings before tax, therefore, in a way the government is subsidizing firms that issue debt securities for financing their operations and projects. Hypothetically, if A firm has no debt then it will pay no interest expenses and therefore its earnings before tax will be higher than another comparable firm B, who has borrowings and thus pay interest expenses, *ceteris-paribus*, resultantly, firm A will end up paying more corporate tax than firm B. Therefore, a firm can capitalize on its debt tax shield by adding value to it through its liability side of the balance sheet. A rational firm attempts to maximize its debt tax shield when planning its capital structure.

However, for example, Fama and French (2002) argue that debt has no net tax benefits. The tax shields benefit that are potentially available to a firm by the virtue of debt finance are

either low or disappear altogether, when a firm is reporting an income that is consistently low or negative. Consequently, the burden of interest payments can be felt by the firm. Similarly, the potential costs of financial distress can overweigh the benefits of debt tax shield. Financial distress costs underline the likelihood of bankruptcy of the firm arising due to high share of debt in its total capital. Nonetheless, the trade-off between the debt tax shield and financial distress costs is addressed by the non-debt tax shields hypothesis given by DeAngelo and Masulis (1980). According to the non-debt tax shields hypothesis depreciation and provisions provide the benefit of tax deductibility to firms. Therefore, non-debt tax shields can substitute debt tax shields, without any financial distress costs. Hence, one may argue that potential non-debt tax shields provide motivation to firm managers to borrow less.

Therefore, a negative relationship between the non-debt tax shields and leverage exists. Bradley et al. (1984) provide empirical evidence to the positive association between leverage and the relative amount of non-debt tax shields. Titman and Wessels (1988) finds no support for this phenomenon, whereas, Deesomsak *et al.* (2004) finds a significant negative relationship between leverage and non-debt tax shields.

2.6. Earnings Volatility

The earning volatility of a firm implies the financial distress risk that it is exposed to. The underlying assumption is that as the earning volatility of a firm increases, the firm employs less proportion of debt in its capital structure (Kim and Sorensen, 1986). The higher volatility of earnings implies the higher probability of a firm finding itself in a financial crunch and thus unable to meet its financial liabilities as they become due. Therefore, a firm experiencing higher earnings volatility may also experience contraction in its debt capacity. Studies of Booth *et al.* (2001), Fama and French (2002) and Jong et al. (2008) show a negative relationship between leverage and earnings volatility.

There are several theoretical explanations that can explain the association between the financial crises and their impact on the capital structure of firms (for example, Demirguc-Kunt et al., 2015). One of the most important arguments related to the theoretical roots highlighting the relationship between the financial crises and their impact on the capital structure dwells in the agency theory (Jensen and Meckling, 1976). Majority of theoretical explanations pertaining to the above-mentioned phenomenon underline their effects through the solvency, liquidity, operations, investing and other strategic decisions of firms. The financial crisis are characterized by the uncertainty and risks, which results in increasing risk premiums and falling expected returns and resultantly lenders and borrowers do not want lock-in capital in long-term investments. Dick et al. (2013) find that due to enhanced default probabilities, the long-term debt loses its relevance in comparison to the short-term debt, for example, financial intermediaries may be more demanding with respect to higher proportion of lending margins, selection and value of collaterals and increase in risk premium (also see, for example, Demirguc-Kunt *et al.* 2015; Diamond, 2004). However, the increased reliance on short-term debt during the financial crisis, due to the lack of commitment of both borrowers and lenders with respect to the long-term borrowing, can increase the cost of debt because of the increased demand for the short-term debt, rolling over cost of debt and transaction costs (Brunnermeier and Oehmke, 2012). On the other hand, Diamond and He (2014) have found that during the financial crisis period the borrowers prefer to increase the repayment period by preferring long-term debt due to the enhanced rolling over-costs pertaining to short-term debt. Nevertheless, the capital structure, even during the financial crisis, is not merely a matter of *firm's choice* as it also depends on the dynamics of financial systems and the institutional settings (for example, investors rights) in which firms operate (Demirguc-Kunt *et al.* 2015).

Based on the review of diverse literature the following hypotheses have been formed:

H_1: The firm-performance affects capital structure of firms;
H_{1a}: The market performance affects capital structure of firms
H_{1b}: The accounting performance affects capital structure of firms

H_2: Risk exposure affects capital structure of firms;
H_{2a}: Systematic risk affects capital structure of firms
H_{2b}: Unsystematic risk affects capital structure of firms

H_3: Cost of capital affects capital structure of firms;
H_{3a}: Cost of equity affects capital structure of firms
H_{3b}: Cost of debt affects capital structure of firms
H_{3c}: Weighted average cost of capital affects capital structure of firms

H_4: The firm-performance affects systematic risk of firms;
H_{4a}: The market performance affects systematic risk of firms
H_{4b}: The accounting performance affects systematic risk of firms

H_5: Capital structure affects systematic risk of firms;

H_6: Cost of capital affects systematic risk of firms;
H_{6a}: Cost of equity affects systematic risk of firms
H_{6b}: Cost of debt affects systematic risk of firms
H_{6c}: Weighted average cost of capital affects systematic risk of firms

H_7: The firm-performance affects unsystematic risk of firms;
H_{7a}: The market performance affects unsystematic risk of firms
H_{7b}: The accounting performance affects unsystematic risk of firms

H_8: Capital structure affects unsystematic of firms;

H_9: Cost of capital affects unsystematic risk of firms;
H_{9a}: Cost of equity affects unsystematic risk of firms
H_{9b}: Cost of debt affects unsystematic risk of firms
H_{9c}: Weighted average cost of capital affects unsystematic risk of firms

H_{10}: The firm-performance affects weighted average cost of capital of firms;
H_{10a}: The market performance affects weighted average cost of capital of firms
H_{10b}: The accounting performance affects weighted average cost of capital of firms

H_{11}: Capital structure affects weighted average cost of capital of firms;

H_{12}: Risk exposure affects weighted average cost of capital of firms;
H_{12a}: Systematic risk affects weighted average cost of capital of firms
H_{12b}: Unsystematic risk affects weighted average cost of capital of firms

3. Data and Methodology

In order to test the hypotheses, 30 non-financial publicly traded companies listed on the Nasdaq OMX Nordic Stock Exchange (OMXN40 Index) in Denmark, Finland, Norway and Sweden, have been analyzed. The market data have been obtained from the Nasdaq OMX Nordic Stock Exchange and respective central banks. Similarly, the historic accounting data have been taken from firms' financial statements and other reports available in the annual reports. The effects of the crisis were investigated by dividing the data period into three distinct time intervals called the pre-crisis (2003-2006=117 firm-years), in-crisis (2007-2010=120 firm-years) and the post-crisis (2011-2017=210 firm-years) sub-periods in order to have a comparison. In the pre-crisis sub-period data of three firm-years were lost due to unavailability of stock market data. Similarly, the data of full period (2003-2017=447 firm-years) have been studied too. Several variables include capital structure, systematic risk, unsystematic risk, WACC, tangibility, profitability, growth, and

effective corporate tax. The multivariate analysis of the data was performed with the help of SPSS statistical software.

The following table 1 highlights the description of key variables used in the analysis. The column 1, column 2 and column 3 as given in table 1 show the abbreviations used for each variable, full name and measurement (data sources) of each variable used in the data analysis, respectively.

Table 1. Description of key variables

Variable's name	Variable	Measurement and Operationalization, Data Source
D/E	Debt-to-equity ratio	Total debt/total equity Source: Annual Report
Sys-Risk	Systematic risk	β_i*σ_m (Beta coefficient signifying firm-level systematic risk multiplied by standard deviation of market return) Source: Nasdaq
Unsys-Risk	Unsystematic risk	Firm-level total risk (measured by standard deviation of firm stock return) minus systematic risk Source: Nasdaq
WACC	Weighted average cost of capital	$WACC = \frac{E}{E+D}R_e + \frac{D}{E+D}R_d(1-t)$ E=Equity, D=Debt, R_e=Cost of Equity, R_d=Cost of Debt, t=Effective Tax Rate (ETR) Source: Nasdaq, Annual Report
Firm-Ret	Firm's Return	Firm's return is a standardized value and it reflects change in its stock price over a time-period. Annualized value of the average of daily stock price is taken Source: Nasdaq
ROE	Return on equity	Net operating profit/total equity Source: Annual report
$\mathbf{R_e}$	Expected cost of equity	Expected cost of equity determined by the Capital Asset Pricing Model (CAPM) as follows: $R_e = R_f + \beta_i(R_m - R_f)$ $\beta_i, R_m \text{ and } R_f \text{ highlighting beta coefficinet, market return and risk free rate of return}$ Source: Nasdaq and Bank of Finland
$\mathbf{R_d}$	Cost of debt	Financial costs/total debt Source: Annual report
ETR	Effective corporate tax rate	Total corporate tax paid/profit before taxes Source: Annual report
LnTA	Total assets	Natural logarithm of total assets signifying firm size Source: Annual report
RD/Revenue	R&D Expenditure/Total Revenue	A higher ratio highlights growth prospects of firms Source: Annual report
Tangible-Assets-Ratio	Tangible Assets to Total Assets	Financial institutions are more likely to accept tangible assets as collaterals a firm applies for loan. A higher tangible assets ratio implies that a firm may have more leverage ratio i.e. higher D/A ratio.

In this paper the multivariate ordinary least square (OLS) regression technique has been applied to test the causality relationship among variables by building the following regression models:

$$\left(\frac{D}{E}\right)_{it} = \alpha_{it} + \beta_1(\text{Firm} - \text{Ret})_{it} + \beta_2 (ROE)_{it} + \beta_3(Re)_{it} + \beta_4(Rd)_{it} + \beta_5(\text{Sys} - \text{Risk})_{it} + \beta_6(Unsys - Risk)_{it} + \beta_7(ETR)_{it} + \beta_8(LnTA)_{it} + \beta_9(WACC)_{it} + \beta_{10}\left(\frac{RD}{Revenue}\right)_{it} + \beta_{11}(Tangible - Assets - Ratio)_{it} + u_{it} \quad (1)$$

$$(\text{Sys} - \text{Risk})_{it} = \alpha_{it} + \beta_1\left(\frac{D}{E}\right)_{it} + \beta_2(Firm - Ret)_{it} + \beta_3 (ROE)_{it} + \beta_4(Re)_{it} + \beta_5(Rd)_{it} + \beta_6(Unsys - Risk)_{it} + \beta_7(ETR)_{it} + \beta_8(LnTA)_{it} + \beta_9(WACC)_{it} + \beta_{10}\left(\frac{RD}{Revenue}\right)_{it} + \beta_{11}(Tangible - Assets - Ratio)_{it} + u_{it} \quad (2)$$

$$(Unsys - Risk)_{it} = \alpha_{it} + \beta_1\left(\frac{D}{E}\right)_{it} + \beta_2(Firm - Ret)_{it} + \beta_3 (ROE)_{it} + \beta_4(Re)_{it} + \beta_5(Rd)_{it} + \beta_6(\text{Sys} - \text{Risk})_{it} + \beta_7(ETR)_{it} + \beta_8(LnTA)_{it} + \beta_9(WACC)_{it} + \beta_{10}\left(\frac{RD}{Revenue}\right)_{it} + \beta_{11}(Tangible - Assets - Ratio)_{it} + u_{it} \quad (3)$$

$$(WACC)_{it} = \alpha_{it} + \beta_1\left(\frac{D}{E}\right)_{it} + \beta_2(Firm - Ret)_{it} + \beta_3 (ROE)_{it} + \beta_4(Re)_{it} + \beta_5(Rd)_{it} + \beta_6(\text{Sys} - \text{Risk})_{it} + \beta_7(Unsys - Risk)_{it} + \beta_8(ETR)_{it} + \beta_9(LnTA)_{it} + \beta_{10}\left(\frac{RD}{Revenue}\right)_{it} + \beta_{11}(Tangible - Assets - Ratio)_{it} + u_{it} \quad (4)$$

In the above given four models α, β and u are the usual intercept term, slope coefficients and error term, respectively, for the 'i'th firm belonging to the 't'th period.

4. Findings and Discussion

4.1. Descriptive Statistics

Table 2 highlights descriptive statistics including mean, standard deviation, maximum, minimum and range values of the data for the full period. The findings show that the highest and the lowest stock market returns have been 5.3% and -1.1%, respectively; similarly, the accounting returns, measured as ROE, has been 6.1% and -7.1% the highest and the lowest, respectively.

Table 2. Descriptive statistics

Variables	*N*	*Range*	*Min*	*Max*	*Mean*	*Standard Deviation*
LnTA	447	6.986	6.351	13.337	9.2015	1.719
Firm-Ret	447	0.064	-0.011	0.053	0.011	0.001
Unsys-Risk	447	0.041	0.000	0.041	0.017	0.006
Sys-Risk	447	0.116	-0.013	0.103	0.002	0.003
R_e	447	0.112	0.000	0.112	0.026	0.021
R_d	447	0.045	-0.014	0.031	0,011	0.208
ETR	447	0.332	-0.061	0.271	0.159	1.144
ROE	447	0.132	-0.071	0.061	0.028	0.113
Tangible-Assets-Ratio	447	0.600	0.291	0.891	0.624	0.126
D/E	447	0.520	0.211	0.731	0.398	0.345
WACC	447	0.085	-0.007	0.078	0.039	0.234
RD/Revenue	447	0.267	0.000	0.267	0.111	0.199

Note: LnTA: Log of total assets: Firm-Ret: Firm level average annual stock return, D/E: Debt-to-equity ratio, Sys-Risk: Systematic risk, Unsys-Risk: Unsystematic risk, WACC: Weighted average cost of capital, ROE: Return on equity, Re: Cost of equity, Rd: Cost of debt, ETR: Effective corporate tax rate, RD/Revenue: Research and Development Expenditure to Total Revenue, Tangible-Assets-Ratio: Tangibles assets-to-total assets.

Similarly, the leverage ratio, measured as D/E ratio, has been 0.731 and 0.211 the highest and lowest, respectively. Another interesting observation is that highest level of tangible assets to the total assets has been 89.1%, whereas the lowest level of the same has been 29.1%.

4.2. Analysis of Capital Structure

Table 3 depicts the results of the OLS regression analysis with Debt-to-equity ratio as the dependent variable. Results are analyzed separately for pre-, during-, and post crisis periods. The results hold that significant determinants of the firm capital structure include; firm stock return, return on equity, expected cost of equity, systematic risk and total firm size for all the sub-periods and full period. One prominent observation of the study is the association between firm return and the firm leverage ratio. Both accounting (ROE) and stock returns (Firm-Ret) are have found to be significantly negatively associated with the firm leverage (D/E) in the pre-financial crisis period. However, when analyzing during- and post crisis time periods, as well as the full study period, firm return variables turn out to be positive and significant indicators of firm leverage.

Table 3. OLS model for capital structure: D/E regression estimates

Dependent variables	**D/E** 2003-2006 (pre-crisis)	**D/E** 2007-2010 (during-crisis)	**D/E** 2011-2017 (post-crisis)	**D/E** 2003-2017 (full period)
Constant	-2.819	-4.119	-3.002	-3.128
	(-8.111)	(-10.393)	(-15.111)	(-27.322)
Firm-Ret	-4.049***	2.412***	2.121***	2.102***
	(-25.711)	(11.121)	(6.656)	(5.976)
ROE	-2.233*	6.872***	1.226**	1.229**
	(-1.289)	(15.298)	(1.745)	(1.712)
R_e	0.681***	3.877***	4.693***	3.204***
	(6.853)	(16.172)	(16.111)	(12.389)
R_d	-1.189*	0.319**	-0.002	-0.013*
	(-1.312)	(1.771)	(-0.933)	(-1.433)
Sys-Risk	-0.827***	0.132*	0.139*	0.138**
	(-13.029)	(1.389)	(1.437)	(1.932)
Unsys-Risk	0.001*	0.011*	0.007	0.003
	(1.299)	(1.297)	(0.656)	(0.423)
ETR	-0.030	-0.009	0.023*	0.025*
	(-0.948)	(-0.248)	(-1.303)	(-1.327)
LnTA	5.453***	9.221***	11.157***	9.111***
	(16.503)	(21.500)	(26.574)	(19.441)
WACC	-0.072	0.081*	0.097**	0.067*
	(-0.403)	(1.461)	(1.772)	(1.611)
RD/Revenue	-6.003***	0.007	-0.011*	-0.011*
	(-28.211)	(0.623)	(-1.327)	(-1.497)
Tangible-Assets-Ratio	-0.147	0.089*	0.101**	0.128**
	(-0.765)	(1.523)	(1.882)	(1.977)
N	117	120	210	447
R Square	0.435	0.444	0.497	0.499
Durbin-Watson test statistic	2.109	2.144	2.117	2.117

Note: OLS estimates are shown in above table (t-statistics appear in parentheses). *** Significant at 1%. ** Significant at 5%. * Significant at 10%.

Before the financial crisis sub-period, a firm with a better performing stock return do not prefer to mobilize more debt capital to finance its operations. Instead, a firm giving good performance prefer to rely more on the equity capital, as it may invite increased financial distress cost if it borrows more. Furthermore, the accounting based return on equity (ROE) measure

shows a similar pattern. The inverse relationship between cost of debt and leverage ratio is also proved in the empirical finding that as the cost of debt rises (falls) the leverage ratio falls (rises).

Before the crisis period, good performance leads to a lower debt capitalization, whilst the situation turns around during and after the crisis. During the financial crisis period, investors may attach high-risk premium to the equity investments as the share prices drop substantially, and the equity investment climate is extremely adverse. Thus, even the high performing firms may find it difficult to mobilize equity investors during times of crisis. On the other hand, due to falling interest rates during the financial crisis, high performing firms may find it cheaper to borrow. Similarly, during the crisis period, the financial institutions disseminate less credit because, first, the demand for new investments is low, and second, stricter debt covenants imposed by financial institutions exclude many firms from receiving debt; consequently, financial institutions find themselves amidst piling non-performing assets. In such situation, financial institutions find high performing firms as the suitable candidates, who can receive debt on favorable terms.

The cost of equity emerges a positive and significant determinant of leverage in all the investigated time periods. This finding seem to follow the Market-timing theory of capital structure (Rajan and Servaes, 1995; Myers, 1984). Managers have an incentive to time the market and exploit temporary fluctuations in the cost of equity capital relative to other forms of capital available. During times when cost of equity is high, more debt capital are utilized.

Systematic risk, as measured by the firm-level beta multiplied by standard deviation of the market return, is found to be negatively associated with firm leverage, especially during the time period before the financial crisis as the firms facing high market risk prefer lower level of debt lest the market risk should increase any further. Firms having higher market risk can invite adverse market reaction if its borrowings increase. However, during and after financial crisis periods this relationship turns out to be positive. A possible reason for such pattern is that during the financial crisis period, which is characterized by numerous uncertainties in the equity market, a high-risk firm prefers to borrow, first to avoid any wrath of uncertainties prevailing in the equity market and second, to avail benefits of falling interest rates (Lambrinoudakis, 2016).

Interestingly, the relationship between the firm size, as measured by the natural logarithm of total assets, and leverage has been found to be positive in all time periods. This result is consistent with the Trade-off and Pecking order theories of capital structure as well as previous findings in the literature (Chen et al., 1999). Larger companies may have lower probability of bankruptcy due to diversification benefits, which enables them to take more debt. They may also have lower costs in acquiring debt financing (Titman and Wessels, 1988).

The variable on growth prospects of the firm, as measured by R&D expenditure to total revenue ratio (RD/Revenue), shows a significant negative relationship with leverage before and after the financial crisis periods. A possible reason of this finding is that innovation undertaken by firms are usually reckoned as high-risk projects and financial institutions are averse of funding such projects.

4.3. Analysis of Systematic and Unsystematic Risk

Since the current paper explores dynamics of capital structure, therefore, it not only studies the changes in the capital structure explored by other determinants but also how the capital structure itself explores changes in the other key variables including systematic, and unsystematic risk and WACC. Table 4 highlights the determinants that affect systematic risks of the sample firms. The results indicate that leverage (D/E), firm market return (Firm-Ret) and expected return on equity (R_e) have a significant positive relationship with systematic risk in all periods. Higher leverage of firms increases systematic risks that they are exposed to. The finding is in accordance with the established theoretical argument that increased leverage can increase financial distress costs of firms, which reflect in higher systematic risks. Thus, investors see the trade-off between risk and return through the lenses of capital structure (see e.g. Schlueter and Sievers, 2014). Similarly, higher return is also accompanies by higher market risks, which is conformity with the popular theoretical underpinnings. The similar arguments can be given in the context of expected return on equity with respect to systematics risk. On the other accounting performance, measured by ROE, is also positively associated with the market risks faced by firms, except for the pre-crisis

period. Furthermore, firm size is negatively associated with the systematic risk implying that large sized firms are less exposed to the risk emanating from the market. Investors may perceive when a firm expands its size, it becomes more resourceful and as a result the market risk that it faces decline. Another interesting finding is that RD/Revenue variable, signifying growth orientation of firms, has been observed to be significantly positive except for during-crisis period. During the pre-, post- and full periods, firms spending a larger proportion of their revenue on R&D experience more market risk, nonetheless, the same relationship disappears during crisis-period. A possible reason is that firms might have reduced their R&D expenditure during crisis period to such an extent that any marginal increments incurred subsequently in the R&D spending have no impact on the systematic risks, which already may be very high during the financial crisis. Similarly, firms having higher proportion of tangible assets have lower systematic risk.

Table 4. OLS model for systematic risk: regression estimates for market risk

Dependent variables	**Sys-Risk** 2003-2006 (pre-crisis)	**Sys-Risk** 2007-2010 (during-crisis)	**Sys-Risk** 2011-2017 (post-crisis)	**Sys-Risk** 2003-2017 (full period)
Constant	1.821	1.201	1.119	1.111
	(5.201)	(3.355)	(2.481)	(2.135)
D/E	2.008**	4.676***	2.329***	2.309***
	(1.691)	(21.286)	(16.327)	(13.227)
Firm-Ret	3.398***	1.256***	0.995**	0.917**
	(17.676)	(4.921)	(1.967)	(1.823)
ROE	0.001	0.157***	0.098*	0.089*
	(0.228)	(4.656)	(1.333)	(1.329)
R_e	2.212**	0.029***	0.003*	0.013**
	(1.686)	(8.671)	(1.333)	(1.864)
R_d	0.001*	0.331**	-0.021	-0.018
	(1.287)	(1.971)	(-1.167)	(-1.111)
Unsys-Risk	0.017*	0.017*	0.009	0.011
	(1.423)	(1.389)	(0.789)	(1.101)
ETR	0.024	0.014	0.035*	0.038*
	(0.277)	(0.377)	(1.436)	(1.445)
LnTA	-1.691**	-1.799**	-0.923*	-0.812*
	(1.698)	(-1.877)	(-1.442)	(-1.389)
WACC	0.017	0.004	0.004	0.018*
	(0.112)	(0.101)	(0.101)	(1.534)
RD/Revenue	0.019*	-0.006	0.031*	0.056**
	(1.301)	(-0.753)	(1.367)	(1.732)
Tangible-Assets-Ratio	-0.019	-0.011*	-0.011*	-0.027*
	(-0.290)	(-1.337)	(-1.302)	(-1.567)
N	117	120	210	447
R Square	0.273	0.345	0.303	0.489
Durbin-Watson test statistic	1.991	1.898	1.997	2.002

Note: OLS estimates are shown in above table (t-statistics appear in parentheses). ∗∗∗ Significant at 1%. ∗∗ Significant at 5%. ∗ Significant at 10%.

Table 5 highlights the determinants that affect unsystematic risks of the sample firms in the pre-, during-, and after financial crisis sub-periods as well as full data period. The leverage ratio, in accordance to theoretical arguments, is positively associated with the unsystematic risk except for the pre-crisis sub-period. The market performance of the firm is also positively associated with the unsystematic risks during and the post-crisis periods. On the other hand, accounting performance affects unsystematic risk positively only during the crisis period. Interestingly, higher the firm size, higher have been the unsystematic risk. The possible reason

of the above finding is that larger firms have more complex organizational structure, which may increase the specific risk they are exposed to.

Furthermore, expected return on equity (R_e) is positively associated with the unsystematic risk in the pre-and during crisis periods, whereas, the same is negatively associated for the full period. Tangible assets ratio affects unsystematic risk negatively but only during the crisis period.

Table 5. OLS model for unsystematic risk: regression estimates

Dependent variables	Unsys-Risk 2003-2006 (pre-crisis)	Unsys-Risk 2007-2010 (during-crisis)	Unsys-Risk 2011-2017 (post-crisis)	Unsys-Risk 2003-2017 (full period)
Constant	-0.709	0.645	-0.117	-0.321
	(-1.646)	(1.425)	(-0.445)	(-0.765)
D/E	-0.001	0.017***	0.023*	0.021*
	(-0.179)	(9.772)	(1.449)	(1.359)
Firm-Ret	-0.001	0.006*	0.006*	0.001
	(-0.298)	(1.332)	(1.479)	(0.991)
ROE	0.003	0.011*	-0.001	-0.001*
	(0.551)	(1.469)	(-0.352)	(-1.323)
Re	2.209**	1.355***	-0.006	-0.009*
	(1.681)	(8.112)	(-1.001)	(-1.328)
Rd	0.423	0.327***	0.008	0.006
	(0.622)	(8.107)	(0.370)	(0.229)
Sys-Risk	0.001	-0.102*	0.097*	0.012
	(0.229)	(-1.324)	(1.312)	(1.181)
ETR	-0.019	-0.011	-0.016	-0.019
	(-0.197)	(-0.297)	(-0.459)	(-1.221)
LnTA	0.003*	0.007**	0.007**	0.012**
	(1.301)	(1.791)	(1.787)	(1.899)
WACC	0.012	0.013*	-0.005	-0.011
	(0.221)	(1.505)	(-1.001)	(-1.125)
RD/Revenue	0.009	0.011	0.012	0.011
	(0.109)	(0.323)	(0.376)	(0.333)
Tangible-Assets-Ratio	-0.015	-0.063*	-0.019	-0.021
	(-0.297)	(-1.471)	(-0.921)	(-0.945)
N	117	120	210	447
R Square	0.323	0.445	0.478	0.567
Durbin-Watson test statistic	1.991	2.089	2.091	2.111

Note: OLS estimates are shown in above table (t-statistics appear in parentheses). ∗∗∗ Significant at 1%. ∗∗ Significant at 5%. ∗ Significant at 10%.

4.4. Analysis of WACC

Table 6 highlights the determinants that affect the WACC of the sample firms in the pre-, during-, and after financial crisis sub-periods as well as full data period. Higher level of leverage ratio not only increases debt servicing but even the cost of equity also increases due to the fact that increased debt adds investors' risk premium on the equity capital. Therefore overall cost of capital rises due to increase in leverage ratio. Increased market return of firms also leads to rise in WACC except for the pre-crisis period; however, accounting returns have no significant effect on the WACC. Unsurprisingly, increased expected return in equity increases WACC of firms. Furthermore, firms facing higher systematic risk also experience higher WACC for all the periods. The investors of such firms demand more risk premium, which pushes the WACC up.

Larger firms pay lower overall cost of capital. Innovative firms, who have higher proportion of R&D spending in the total revenue, experience higher level of WACC. In the post-crisis period, with the increase in ETR, representing taxation and debt-tax shield, there is decrease in WACC.

As the ratio of tangible assets to total assets increases the WACC decreases, except in the pre-crisis sub-period.

Table 6. OLS model for weighted average cost of capital: regression estimates

Dependent variables	WACC 2003-2006 (pre-crisis)	WACC 2007-2010 (during-crisis)	WACC 2011-2017 (post-crisis)	WACC 2003-2017 (full period)
Constant	0.059	0.023	0.049	0.071
	(0.323)	(0.294)	(0.301)	(0.482)
D/E	0.013*	0.003***	0.001**	0.018***
	(1.296)	(6.007)	(2.152)	(7.229)
Firm-Ret	0.021	0.127*	0.111*	0.118*
	(1.107)	(1.391)	(1.476)	(1.531)
ROE	0.002	0.000	0.000	0.001
	(0.379)	(0.015)	(0.015)	(1.134)
Re	0.929***	0.908***	0.463**	0.473**
	(11.522)	(10.711)	(1.911)	(2.121)
Rd	0.523***	-0.021	-0.028	-0.021
	(5.487)	(-0.255)	(-0.355)	(-0.278)
Sys-Risk	2.219**	3.213***	2.243**	1.721*
	(1.729)	(8.122)	(2.119)	(1.438)
Unsys-Risk	0.191	0.198**	0.023	0.027
	(1.001)	(1.783)	(0.645)	(1.119)
ETR	-0.001	-0.018	-0.024*	-0.028*
	(0.328)	(0.328)	(1.334)	(1.421)
LnTA	-0.081*	-0.072*	-0.067*	-0.072*
	(-1.484)	(-1.579)	(-1.477)	(-1.548)
RD/Revenue	0.013*	-0.002	0.019*	0.025*
	(1.297)	(-0.378)	(1.511)	(1.617)
Tangible-Assets-Ratio	0.339	-0.042*	-0.049*	-0.053*
	(1.136)	(-1.339)	(-1.492)	(-1.567)
N	117	120	210	447
R Square	0.321	0.411	0.429	0.501
Durbin-Watson test statistic	.987	2.101	2.111	2.123

Note: OLS estimates are shown in above table (t-statistics appear in parentheses). ∗∗∗ Significant at 1%. ∗∗ Significant at 5%. ∗ Significant at 10%.

5. Conclusion

The purpose of this study has been to explore the determinants of corporate capital structure in the Nordic countries, and in particular, to document what effects the financial crisis of 2007-2008 had on the determinants of capital structure. The results of this study have important practical implications for Nordic financial managers when evaluating financing decisions or when estimating project or divisional risk for investment decisions.

Since the pioneering work by Modigliani and Miller (1958), the evolution of the corporate capital structure literature has developed into one of the main issues in the world of corporate finance. While the initial claim stated that managers make financing decisions in order to maximize profits and to contribute to an optimal firm value, the irrelevance theory claimed that this optimal firm value is not dependent on the mix between debt and equity. During the past decades, multiple theories have been developed and analyzed, in order to understand the capital structure decision of firms. The literature was for long dominated by research that investigated the three main capital structure theories, including the Trade-Off Theory (developed by Kraus and Litzenberger, 1973), the Pecking order theory (developed by Myers 1984; Myers and Majluf, 1984) and the Market-timing theory (Rajan and Servaes, 1995), among several others. Considerable attention in the academic research has also been devoted to the firm's information

environment, especially from an accounting point of view. The relation on how information quality affects firms' capital structure across countries have been published extensively (see e.g. Bharath *et al.* 2009). Subsequently, market and firm related risk variables, as well as macroeconomic and institutional features have also been added to the debate when studying dynamics of capital structure. The financial crisis of 2007-08 has compelled several researchers to dynamic relation between firm capital structure and many firm specific as well as market specific explanatory variables emerged from this myriad of research. In the recent years, in particular, researchers have turned their focus on the impact of financial crisis on capital structure decisions.

The study shows that several determinants affect capital structure differently in different sub-periods. However, the study also identify another set of determinants which do not vary in terms of their effects on capital structure regardless of three distinct sub-periods categorized as pre-crisis (2003-2006), in-crisis (2007-2010) and post-crisis (2011-2017) sub-periods. For example, before the financial crisis sub-period, firm giving better performance prefer equity to debt in order to finance their operations and investments. The reason for firms' debt averseness behavior is that better performing firms prefer to avoid financial distress cost attached to debt.

Similarly, firms having higher market risk prefer debt to equity in the pre-crisis period, as any increase in debt can increase financial distress costs and investors risk premium. Firms avoid debt in order to avoid adverse stock market reaction. However, during and the financial crisis period firms facing high level of market risks start preferring debt due to inundation of market uncertainties and falling costs of debt. Interestingly, the larger firms borrow more due to lower probability of bankruptcy contributed by their stronger asset base. Furthermore, the growth firms, who spend relatively more on R&D, get lesser debt as financial institutions consider such investment projects riskier. Similarly, capital structure of firms also influence other important determinants such as systematic risks, unsystematic risks and WACC. For example, firms having more borrowings end up increasing its systematic, unsystematic risks and cost of capital.

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