Capital structure: Debt and equity decisions for firm performance

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ABSTRACT,
The main objective of this thesis is to investigate the relationship between capital structure and firm performance using a data sample of 548 technological firms listed on the NASDAQ Composite Exchange for the period of 2017-2020. This study uses three performance measures (including return on assets (ROA), return on equity (ROE) and Tobin's Q) as dependent variables and three capital structure measures (including total debt (TD), long-term debt (LTD) and short-term debt (STD)) as independent variables. The findings reveal a non-linear (U-shaped) relationship between capital structure and accounting performance variables return on equity (ROE) and market performance measure Tobin's Q. Additionally, both short-term debt and long-term debt have a negative relationship with the firm's performance measure, return on assets (ROA). Overall, this research shows that capital structure has a negative relationship with firm performance.

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1. INTRODUCTION

Capital structure has gained a great deal of interest in economics and finance as it is an integral component of a firm responsible for its success or failure. It describes how a firm is financed by a combination of debt and equity capital, involving deciding on a target capital structure, the average maturity of its debt, and the type of financing (internal or external) to use at any given time.

The capital structure of a corporation is discussed regularly by corporate executives, skilled investors, and analysts. They acknowledge that a company's capital structure affects the return it provides for its owners and whether it can escape unfavorable economic conditions. Therefore, capital structure is critical for a company's viability and development, as it plays a key role in its financial success in achieving long-term goals and objectives (Harris & Raviv, 1991).

Furthermore, capital structure is important during a recession as the global economy is in a downturn, putting domestic and international firms under increased pressure. Therefore, demand is reduced, resulting in lower earnings and a long-term impact on firm financing and the cost of capital. Consequently, firms are under pressure, and knowing how to finance is crucial. Hence, one of the most important considerations for them, in this case, is the appropriate mix of debt and equity, given that the capital structure has a significant impact on business growth and performance. A poor combination of leverage will have a significant negative impact on a firm's performance and survival. Therefore, managers must make critical decisions on the amount of debt and equity that a firm should employ in its capital structure. This is supported by several studies that have looked into the effect of capital structure on firm performance (Myers and Majluf, 1984; Heaton, 2002; MacKie-Mason, 1990; Jensen, 1986).

Many researchers have asked the question: "What is the ideal capital structure for a firm to choose?" (Myers, 2001). Modigliani and Miller (1958) were the first to pose this question. They argue in their MM theorem that under ideal capital market conditions, under which there are no bankruptcy costs, capital markets are flexible, there is no taxation, and there is no asymmetric knowledge, a firm's valuation is independent of its capital structure. Thus, according to MM theorem, the firm's expected cash flow is the factor that affects the firm's value, rendering capital structure decisions meaningless. Since that time, various theories have been developed to explain a firm's capital structure, including Pecking Order Theory, Trade-off Theory, and the Agency Cost Theory.

Additionally, as stated before, several researchers examined the relationship between capital structure and firm performance. However, they have been unable to agree on an ideal capital structure. This creates a gap in the research field since, in a competitive business setting, capital structure decisions are seen as the most important factor in deciding a firm's potential success, as seems from the research of Simerly and Li (2000, p. 46). They indicated that higher debt appears to affect firms' performance in a stable environment positively and negatively impact firms' performance in a competitive environment. This is because, as debt levels rise, the corporate governance system shifts from internal to external control, which can have a direct influence on both management decision-making and a firm's ability to successfully compete with its competitive environment (Simerly & Li, 2000, p. 46). This can be seen in the technological industry, where, owing to their innovative nature, technology companies continue to compete in the most competitive environment (rapid development of new technologies). This innovative nature and the rapidly changing business environment lead them to provide lucrative investment options that attract external investors.

Nevertheless, Myers and Majluf (1984) argued that successful firms should take debt rather than sell shares (new equity) to external investors, since selling shares to external investors may signal that the firm's future expectations are less promising, as firms would not have taken the step of splitting the firm's sales with anybody other than the initial owners. However, this signalling dilemma leads to new equity issues being underpriced, resulting in a dilution expense for the firm's initial owners. (Aghion, Bond, Klemm, & Marinescu, 2004, p. 278). On the contrary, according to some researchers (Modigliani and Miller, 1958; Kraus & Litzenberger, 1973), not taking on debt could result in the loss of tax benefits (which will be discussed further in the section on theories and hypotheses).

The purpose of the study is to shed more light on the effect of capital structure on the performance of technology firms listed on the NASDAQ Composite Exchange by utilizing OLS regression analysis with a sample of 548 firms for the period 2017-2020. Even though there is a plethora of empirical evidence on the effects of capital structure on firm performance, technological firms listed on the NASDAQ have never been studied. The study may help determine if these firms are best off funding with debt, equity, or a hybrid of the two. Additionally, the study will examine existing theories created by other researchers and put them to the test by proposing hypotheses. This type of research provides us with a comprehensive grasp of the effects of debt-to-equity ratios on firm performance. Therefore, I put forward the following research questions.

Research question: *To what extend does capital structure affect the performance of technology firms?*

2. LITERATURE REVIEW

2.1 Capital structure

2.1.1 Modigliani and Miller theorem

Modigliani and Miller's (1958) theory (MM theorem) is one of the earliest works on the position of debt in the capital structure and its effect on firm performance. For starters, they argued that if markets are perfectly competitive, firm performance is unrelated to capital structure, implying that there is no meaningful link between capital structure and a firm's performance. In a related vein, the financial structure has little bearing on the firm's value. Bringing the MM theorem to its logical conclusion, it may be argued that a firm's financial structure could be entirely composed of debt and yet have little effect on its value. Furthermore, according to Modigliani and Miller (1958), the perfectly competitive market is based on certain assumptions. The first assumption is that financial markets are frictionless, implying that there are no trading costs or taxes and no costs involved with bankruptcy. The second assumption is that all market actors have access to appropriate homogeneous information, resulting in homogeneous demands. The third assumption is that every market participant is atomistic, which implies that no one in the market will trade to influence a security's price. The fourth assumption is that the firm's capital investment program and its assets, operations, and strategies are predetermined and well-known to all market participants. Finally, the last assumption is that the capital structure is fixed once the firm's financing is chosen. However, in the real world, markets are unstable due to taxes, trading costs, information asymmetry, bankruptcy costs, agency conflicts and other unstable elements.

Although the MM theorem is only explanatory in perfect market conditions, it remains influential in today's corporate and financial literature since it serves as the basis for many other theories proposed by other researchers.

2.1.2 *Trade-off Theory*

The Trade-off Theory of Kraus and Litzenberger (1973) arose from the MM theorem (Modigliani & Miller, 1963), which argues that debt has a positive effect on firms since debt interest payments are tax-deductible from pre-tax income, which in turn reduces the taxable earnings that increase firm value.

On the contrary, the trade-off theory asserts that high debt levels have a negative impact on firm performance. This theory focuses on the market imperfections, such as taxation profits and the nature of bankruptcy penalties (Kraus and Litzenberger, 1973). According to this capital structure theory, there is an upside to financing through debt: the ability to use debt as a tax shield, as the MM theorem claims. However, there is also a commitment for an expected capital outflow related to possible interest payments on debt. Therefore, a high amount of debt may negatively affect the firm's performance and liquidity, exposing it to greater financial distress and increasing agency costs between owners and managers.

When a firm's capital structure is heavily dependent on debt, bankruptcy is inevitable, and bankruptcy also entails other significant legal and accounting expenses (Altman, 1984). In addition, firms that seek to resume after filing for bankruptcy lose the value of their properties because they must liquidate or exchange assets for less than their actual value. Furthermore, if a possible bankruptcy is on the horizon, employees leave, retailers fail to extend credit, consumers look for more stable suppliers, and lenders claim higher interest rates and stricter loan agreements. These additional high costs of bankruptcy put the firms in even more financial distress.

Moreover, according to Leland and Toft (1996), firms facing significant bankruptcy expenses may acquire debt to benefit from the tax-deductibility of debt interest payments. Although they prefer long-term debt over short-term debt when using debt tax benefits since the tax benefits of long-term debt are considerably decreased if cash flows relative to asset value are small, which could be the case in firms with great growth potential. However, this increases agency costs since regular market monitoring of the firm decreases, giving managers more freedom to make decisions based on their interests while owners bear the costs of those decisions.

As shown, the theory explains taxes and tax shields and explains the impact of financial distress caused by large amounts of debt. It believes that the optimal capital structure of a company is determined by taxation, financial distress (costs of bankruptcy) and agency conflicts (Graham, 2000, p. 1907). Therefore, Myers argued in 1984 that firms should strive for an optimal capital structure by increasing or decreasing their debt level in order to strike a balance between the debt benefits of tax savings and the debt costs that can put firms at greater risk of financial distress. Hence, to achieve the optimal capital structure, the present value of the tax shield should be substituted for the present value of the financial distress costs. In summary, a formulation of the trade-off theory would balance the various benefits and costs associated with debt financing to achieve the optimal capital structure. Many studies support this theory, such as Hovakimian, Opler and Titman (2001), Fama and French (2002), and Smith and Watts (1992).

Capon et al. (1990) discovered a positive relationship between usage of debt levels and financial performance in their review of a meta-analysis of 320 published articles relating to financial performance. Moreover, Abor (2005) also investigated the impact of debt on firm profitability using three types of debt: short-term debt over total assets, long-term debt over total assets, and total debt over total assets. In his study, profitability was exclusively measured by ROE. His findings show that short-term debt and total debt are positively correlated with profitability (ROA). However, the fact that his study only used return on assets (ROA) as a measure of firm performance places doubts on the findings since Limpkin and Dess (1996) argued that multiple performance measures should be included in firm performance studies to avoid misleading results.

Furthermore, ROE can be misleading because if a firm decreases the book value of its assets, as it believes that its assets are overpriced based on market pricing, this can drastically diminish shareholder equity without affecting the NI (net income) or EBIT (earnings before interest and taxes). As a result, the ROE measure will change, rendering it insignificant to measure firm performance. In this regard, the findings of Abor (2005) are questionable.

2.1.3 *The pecking order theory*

In 1984, Myers questioned the concept of an optimal capital structure dependent solely on the trade-off of debt-related benefits and costs in a world of information asymmetry between corporate managers and investors. He discovered that a firm's financing practice would not adhere to a simple trade-off model and suggested that the presence of a "pecking order" is significant in the financing sources used by firms. Regarding this, Myers (1984) introduced the pecking order theory of corporate capital structure. According to this theory, firms have a clear priority order for the funds required to finance their operations. Internally generated cash is at the top of the pecking order. External debt financing comes next, and external equity financing is used only as a last resort. More specifically, first, the firm uses internal equity (retained earnings), followed by short-term debt, long-term debt, and finally, external equity. This order can be justified by asymmetric information.

Asymmetric information emerges as managers have more information about the firm's condition and performance than future investors or shareholders. As a result, the manager's actions will affect shareholders' perceptions of the firm's prospects. The manager's activities are thought to convey facts about the firm's situation. According to Myers and Majluf (1984), this leads to a misconception of the stock's price with investors. Regarding debt, where additional funds are required, a firm prefers debt issues because debt issues are seen as a positive indicator by shareholders and future investors, who have less information than managers. As a result, shareholder and future investors would assume that management believes the stock is undervalued if a debt is issued. However, shareholders' and future investors' assumption that the stock is overvalued is incorrect in this situation; rather, it is a misconception created by the managers from incurring debt. Hence, there is a "pecking order" of financing sources geared toward allowing the managers and owners to retain the maximum amount of control for as long as possible.

In addition, the pecking order theory highlights that highly productive companies with high profits are supposed to use fewer debt resources than less profitable firms. However, the effect of profitability of firm leverage is researched by several researchers. Some researchers found a positive relationship between profitability and debt/assets ratio (Kester, 1986; Friend and Lang, 1988), whereas other researchers found a negative relationship between profitability and debt/assets ratio for the USA, the UK and Japan (Rajan and Zingales, 1995; Wald, 1999). Nevertheless, study findings indicating a negative relationship between profitability and leverage do not confirm the existence of the pecking order theory. On the contrary, they imply that there might be a pecking order.

2.1.4 Agency cost theory

Jensen and Meckling (1976), Jensen (1986), and Hart and Moore (1990) developed the agency cost theory to extend the MM theorem (1958). According to the agency cost theory, agency issues occur due to a conflict of interest between shareholders and management (agency cost of equity) or between shareholders and debt holders (agency cost of debt).

Based on the expectations of the agency theory, managers do not often behave to preserve the owners' interests – they usually follow their interests, which may be conflicting. In this regard, owners/shareholders are required to exert greater control over management's operations, resulting in additional expenses – agency costs. In this case, one method of connecting the needs of the above groups is to bind management compensation to the firm's securities.

Another situation is when managers undertake high-risk investment projects in the hopes of benefiting shareholders seeking a high rate of return. On the other hand, these risky actions increase the risk for debt-holders as they are only interested in secure investments. However, the debt-holders can reduce their risk by disciplining the managers through demanding more active operational practices and more efficient investment strategies (Agrawal and Knoeber, 1996). In this context, debt reduces agency costs by reducing the amount of free cash available to managers due to the debt holders' discipline approach.

Furthermore, the agency cost theory emphasizes the relevance of the debt maturity structure in addressing agency issues. It investigates the ex-ante model combination of short-term debt and long-term debt that eliminates manager-shareholder agency conflicts. According to Myers (1977), under perfect and complete capital market conditions with no corporate taxes and bankruptcy costs, managers may prefer long-term debt if they lack the proper incentives or if their priorities are not matched with those of shareholders. He also stated that short-term debt imposes further monitoring on managers as debt contracts must be renegotiated at each refinancing stage.

In addition, as mentioned earlier, the agency problem is caused by the private interests of control of managers because even if the early termination is effective, the manager will continue to execute the project. However, the findings of the study of Hart and Moore in 1998 stated that under real-world (with uncertainties) assumptions, short-term debt creditors have the ability to determine whether the project can continue by maintaining short-term demand for project cash flow. In this case, the maturity structure is a way to transfer control from the debtor to the creditor. Although short-term debt is useful in passing control rights, it can also cause creditors to liquidate more often. On the contrary, when the firm needs to repay debts, short-term debt will allow the company the flexibility to re-enter the capital market or shift back to all-equity financing. However, there are costs associated with this flexibility of short-term debt (Myers, 1977).

In addition, Hart and Moore (1990) also stated that long-term debt does not impose the same refinancing pressure in real-world conditions, thereby reducing the efficiency of restraining managers. However, in their paper of 1995, Hart and Moore argued that in the cases where simple debt and equity are optimal, managers tend to take on long-term debt if the average return on assets is high, but when it comes to making a profit from a new investment project, then the managers prefer taking on short-term debt. Due to the advantages and disadvantages of short-term debt and long-term debt in different situations, choosing a debt maturity structure to solve agency problems becomes more complicated in this regard.

3. HYPOTHESIS

3.1 Introduction

Hypotheses have been formulated based on theories to address the research question. To begin, the trade-off theory and the probability of a non-linear relationship between capital structure and firm performance are contemplated. Secondly, the agency theory has been discussed to modify the effect of short-term debt and long-term debt on firm performance.

3.2 Debt and performance

The trade-off theory implies that debt has a positive effect on firm performance through tax shield. However, this positive effect only lasts until the optimal capital structure is achieved. If the debt level increased beyond this point, this would negatively impact firm performance because the benefits of debt are then offset by the costs of debt, which include financial distress and agency cost debt. Meaning, that trade-off theory suggests at first, debt has a positive effect on firm performance, but once the debt level exceeds a certain point (optimal capital structure), the effect becomes negative. Therefore, this study enables the existence of both positive and negative effects of debt level on firm performance.

Hypotheses 1*: The relationship between capital structure and the firm performance of NASDAQ Composite-listed technology firms is non-linear, inverted U-shaped.*

3.3 Long-term debt and firm performance

As it can be concluded from the theories in the introduction, firms benefit from debt capital in a variety of areas. These areas include providing a tax shield (Modigliani & Miller, 1963), reducing agency conflicts between firm managers and owners (Jensen & Meckling, 1976), and communicating positive signals about business performance as managers have internal insight about the firm's potential increased productivity (Richardson, 2000). However, the benefits differ when it comes to the debt maturity structure. Regarding this, the capital structure theories predict different relationships between firm performance and debt. The trade-off theory argues that long-term debt can benefit firms as it allows them to use the tax advantage for an extended period to increase firm value. However, this borrowing is dependent on the bankruptcy costs that can arise as a result of it. However, firms facing bankruptcy prefer long-term debt because the tax benefits of long-term debt are lower for firms with high future growth opportunities as their cash flows related to the value of their assets are low.

Furthermore, long-term debt can also be associated with higher interest, as lenders demand a higher return in exchange for taking on the greater risk of loaning money over a long period. However, lenders analyze a company's creditworthiness and do not assign long-term loans to potentially bankrupt companies. Within this regard, a firm that incurs long-term debt is seen as a successful business that is creditworthy for debt, which is a positive signal to potential investors. On the contrary, the agency cost theory argues that long-term debt increases the agency costs as regular market monitoring of the firm decreases, giving managers more freedom to make lucrative decisions while owners bear the costs of those decisions.

The data sample for this study consists solely of large firms, and large firms are known for having more stable cash flow and retained earnings, reducing the likelihood of potential bankruptcy and allowing them to take on high levels of debt. Therefore, the capital structure of these firms is more likely to be based on long-term debt. As a result, the following hypothesis is established.

Hypothesis 2*: Long-term debt has a positive relationship with the performance of the technology firms.*

3.4 Short-term debt and firm performance

A logic-based argument can be made that the factors that affect the amount of long-term debt financing a firm uses frequently influence the level of short-term debt financing it uses. According to the agency cost theory, short-term debt has the capacity to eliminate agency conflicts arising from free cash flow. Short-term claims on the project's cash flow, held by creditors, create a strong position for the creditors to decide on the project's proceedings. This shifts the control from debtors to creditors. Furthermore, short-term debt imposes monitoring on managers because debt contracts must be renegotiated at each refinancing stage. This control will motivate the firm's managers to achieve high organizational productivity to maximize their personal wealth, resulting in an alliance of owner-manager interests. However, Myers (1997) argued that renegotiation and monitoring are costly and can reduce the present market value of a firm. Therefore, only profitable companies may use short-term debt to reduce agency conflict. Hence, the following hypothesis is set regarding short-term debt.

Hypothesis 3*: Short-term debt has a positive relationship with the performance of the technology firms.*

4. DATA AND METHODOLOGY

4.1 Variables

A comprehensive data analysis was carried out to investigate the performance of firms in relation to their capital structure. An OLS regression analysis of three capital structure variables and three firm performance variables is performed to accomplish this. These variables were chosen in accordance with Abor's (2005) and Rajan and Zingales (1995) research on the effect of capital structure on profitability. In addition, this analysis also consists of four control variables. The variables' definitions and calculations are shown in Table 1.

4.1.1 Capital structure variables

The capital structure variables are the independent variables with three proxies: total debt ratio (TD), short-term debt ratio (STD) and long-term debt ratio (LTD). Total debt financing is defined as the ratio of total debt to total assets. The short-term debt ratio is computed as short-term debt divided by total assets. Finally, the long-term debt ratio is computed by dividing the long-term debt by total assets.

4.1.2 Firm performance variables

The firms' performance will be evaluated using three dependent variables: return on equity (ROE), return on assets (ROA), and Tobin's Q.

ROE is a measure of profitability calculated by dividing net income by the shareholders' equity. In addition, ROA is the net income to total assets ratio. Tobin's Q is a performance measure that indicates the future and present investment opportunities of a firm aligned with the firm's performance. To calculate Tobin's Q, the approximate q formula from Chung and Pruitt's (1994) study is used, which requires balance sheet and stock data. They found in their research that Tobin's Q is at least 96.6% explained by the approximate q, which is sufficient for this study. Tobin's Q is calculated by the product of the firm's share price and the shares outstanding plus the book value of the total debt divided by the book value of the firm's total assets.

4.1.3 Control variables

In accordance with the literature (Abor, 2005, Rajan & Zingales, 1995), in this analysis, size (SZ), growth in sales (GS), tangibility (TAN), and risk (RK) are used as control variables and are classified as follows. The natural logarithm (Ln) of total assets is used to calculate SZ. GS is calculated by operating revenue at time t divided by the operating revenue at time t-1. TAN is classified as the ratio of tangible fixed assets to total assets. The standard deviation of net income over total assets of 3 years is used to calculate RK.

Table 1 Definitions, abbreviations and formulas of variables

Variable	Abbreviation	Formula
Return on Equity	ROE	$ROE = \frac{NetIncome}{ShareholdersEquity}$
Return on Assets (Net income)	ROA (NI)	$ROA = \frac{NetIncome}{TotalAssets}$
Return on Assets (Earnings before interests, taxes)	ROA (EBIT)	$ROA = \frac{EBIT}{TotalAssets}$
Tobin's Q	TQ	$TQ = \frac{(SharePrice * SharesOutstanding) + BookValueOfTotalDebt}{BookValueOfTotalAssets}$
Book value short term debt	STD	$STD = \frac{ShortTermDebt}{TotalAssets}$
Book value Long term debt	LTD	$LTD = \frac{LongTermDebt}{TotalAssets}$
Book value Total debt	TD	$TD = \frac{TotalDebt}{TotalAssets}$
Risk	RK	$RK = SD\left(\frac{NetIncome}{TotalAssets}\right)$
Tangibility	TAN	$TAN = \frac{TangibleFixedAssets}{TotalAssets}$
Growth in sales	GS	$GS = \frac{OperatingRevenueInTime_t}{OperatingRevenueInTime_{t-1}}$
Size	SZ	$SZ = Ln(TotalAssets)$

Footnote: The variables' units are in thousands of US-Dollars.

4.2 Data and sample

This study uses a set of financial data of publicly listed technology firms part of the NASDAQ Composite Exchange. The financial data is from these firms' balance sheets and income statements obtained from the Orbis database. The period under study covers the years 2017-2020. To identify the technology firms from the NASDAQ Composite Exchange, four BVD (Bureau van Dijk) sectors were selected for the sample: (21) Industrial, Electric & Electronic Machinery, (22) Computer Hardware, (30) Computer Software and (35) Biotechnology and Life Sciences. The codes used by BVD are included in parentheses. Moreover, firms with no market capitalization value were excluded, leading to a final sample size of 548 firms.

In addition, the research developed by Rajan and Zingales (1995) is considered for the validity of this study. Their study used panel data to develop a regression model to determine the effect of capital structure variables on firm performance variables.

4.3 Model

To investigate the effect of capital structure on technology firms' performance, this study uses data from 548 firms obtained from Orbis. The following is the basic OLS regression model, which will be used to determine the effect of capital structure on firm performance. Moreover, SPSS is used for the OLS regression analysis, while Excel is used for variable computations.

$$Y_{it} = \alpha + \beta_0 X_{it-1} + \beta_1 C_{it-1} + \varepsilon_{it}$$

Here, i (firms) = 1, 2, …. , N;
t (years) = 2017, 2018, 2019 and 2020

Y_{it} represents the performance measures, ROE, ROA and Tobin's Q. X_{it} represents the capital structure variables, STD, LTD and TD, and C_{it} represents the control variables, size, risk, tangibility and growth in sales. Furthermore, α is the intercept, β is the coefficient that measures the steepness of the regression line, and ε_{it} is the error term. The ε_{it} is the difference between the dependent variable Y_{it} and the estimated systematic influence of X_{it} on Y_{it}.

For the first hypothesis, the inverted U shape is tested, wherein this study hypothesized that more X_{it} leads to more Y_{it}, but eventually more X_{it} leads to less Y_{it}. This is tested by squaring the X_{it-1} in the regression with the following model:

$$Y_{it} = \alpha + \beta_0 X_{it-1} + \beta_2 X_{it-1}^2 + \beta_2 C_{it-1} + \varepsilon_{it}$$

Where the $\beta_2 > 0$, the X_{it} (LTD, STD and TD) has a positive effect on the Y_{it} (ROA, ROE and Tobin's Q), but where the $\beta_2 < 0$, the X_{it} has a negative effect on the Y_{it} (inverted U-shape).

For the second and third hypotheses, the basic regression model described above was utilized to find and compare the correlation between short-term debt and firm performance and long-term debt and firm performance for the period 2017-2020.

4.3.1 Outliers

Outliers are extreme values that must be identified and managed in data sets since they can make analytical results unreliable. In this study's data set, the Z-score at a 95 per cent confidence level was used to distinguish outliers. As a result, several outliers were identified, and a winsorization was carried out. This suggests that the 2.5th and 97.5th percentiles have been winsorized, which entails two standard deviations above and below the mean (Kettaneh et al., 2005). Outliers, all falling between 2.5th and above the 97.5th percentiles, are replaced with the values of the first one below and upside that percentile. Winsorization is applied to the dependent, independent, and control variables. This would improve the distribution of the variables within the sample.

4.3.2 Multicollinearity, autocorrelation and heteroskedasticity tests

Likely, two independent variables are highly correlated when performing OLS regression. When two or more independent variables are intercorrelated, multicollinearity can emerge, making it difficult to distinguish the influence of one independent variable on the dependent variable (Bertsimas & Freund, 2004). In this study, the Variance Inflation Factor (VIF) is evaluated to ensure that multicollinearity has no effect. A VIF value of 10 is a standard cutoff threshold, while values significantly lower than the specified limit (in Finance, VIF values greater than 4) might create interpretation issues (Hair et al., 2014).

During the VIF value evaluation, it was discovered that there was multicollinearity between TD, LTD, and STD. When the TD was removed from the model, it was discovered that LTD and STD do not have multicollinearity. This might be explained by the fact that TD is the total of short-term debt and long-term debt. To prevent multicollinearity issues in the results, TD will be used independently of STD and LTD in the OLS regression but listed under one table. Furthermore, the models had to be checked for autocorrelation and heteroscedasticity, as these factors commonly impact OLS models and lead to inaccurate results and conclusions. To control for autocorrelation and heteroskedasticity, the Durbin-Watson and Breusch-Pagan tests were used. The variables in this analysis revealed heteroskedasticity and autocorrelation. To reduce the effects of heteroskedasticity and autocorrelation, the heteroskedasticity-consistent standard error estimator (HCSE) of Hinkley (1977), Long and Ervin (2000), White (1980), and MacKinnon and White (1985) was used.

5. RESULTS

5.1 Descriptive statistics

Tables 2 (see Appendix A) present the descriptive statistics for all the measures used in this analysis over the period of 2017 to 2020.

The mean ROA (NI) and ROA (EBIT) are -0.242 and -0.225, respectively, with standard deviations of 0.586 and 0.553, minimums of -4.038 and -3.455, maximums of 0.825 and 1.002. The mean of TQ is 3.125 with a standard deviation of 3.002, a minimum of 0.099 and a maximum of 18.090. The value of the mean of TQ being higher than one indicates that the firms' stock is more costly than the book value of its assets, implying that the stocks are overvalued. The values of the mean of STD, LTD, and TD are 0.038, 0.134, and 0.184, respectively. Their standard deviations of 0.128, 0.185, and 0.264, and the value range between the minimum and maximum, are low.

The sample's mean ROE is -0.360 with a standard deviation of 3.397 and a minimum and maximum value of -36.324 and 28.569. The negative value of the mean of ROE implies that a high portion of technological firms incurred greater costs than net income over the period of 2017-2020. However, this does not suggest that the firms are failing because costs can also occur due to restructuring to enhance the firm's operations. Especially in technology firms, there is a need for massive investment in the necessary tech needed for the companies. Furthermore, a negative ROE value might also occur due to a negative shareholders equity value, which can be created by high debt. For firms with a high level of debt, liabilities exceed assets, resulting in negative shareholder equity. In addition, the high standard deviation value and the values of minimum and maximum indicate that there is high dispersion around the value of the mean of ROE.

Furthermore, the technology firms listed on the NASDAQ Composite have a modest degree of RISK and TAN, with average values of 0.270 and 0.106, respectively. Moreover, the high value of the mean of SIZE being 12.351 suggests that they are large firms, with a range of 4.522 to 16.601. Additionally, the mean of 1.714 of the GS indicates that the firms are experiencing strong financial growth. The standard deviation of GS is 5.002, indicating that there is a large degree of dispersion in the values of GS.

5.2 Correlation analysis

Table 3 (see Appendix A) shows the Pearson correlations between variables. These correlation values indicate the direction and intensity of the relationship between two variables. Low or weak correlations are defined as those below 0.35, while modest or moderate correlations are defined as those between 0.36 and 0.67. Furthermore, correlations ranging from 0.68 to 1.0 imply strong or high correlations, with correlations greater than 0.90 indicating a very high correlation (Taylor, 1990).

Only correlations with a significance of 5 per cent or above were considered in Table 2. Furthermore, significant correlations with a p-value less than or equal to 0.01 and 0.05 have been highlighted with one and two stars (*)(**), whereas correlations with a p-value more than or equal to 0.001 and less than 0.05 have been indicated with three stars (***).

TD and STD are shown to be negatively correlated with ROA (NI) and ROA (EBIT) at -0.236, -0.362, -0.195 and -0.338, respectively. On the other hand, TQ shows a positive correlation with TD, LTD and STD with values of 0.164, 0.045 and 0.186. The capital structure measures being positively correlated with the firm performance measure TQ is congruent with the findings of Kester (1986), Friend and Lang (1988). In contrast, the significant negative correlations of the capital structure measures with the firm performance measures ROA (NI) and ROA (EBIT) are consistent with the findings of Rajan and Zingales (1995) and Wald (1999).

Furthermore, the firm performance measures ROA (NI), ROA (EBIT), and ROE are negatively correlated with RISK, with values of 0.515, -0.486, and -0.123, respectively. With a value of 0.189, RISK shows a positive correlation with TQ. Additionally, RISK displays a significant positive correlation with TD and LTD, with values of 0.077 and 0.093, respectively.

TAN is positively correlated with firm performance measures ROA (NI) and ROA (EBIT) at 0.137 and 0.138, respectively, but negatively correlated with TQ at -0.090. This suggested that asset tangibility has a positive impact on debt and return on assets. This is in line with the observations of Jensen and Meckling (1976), who observed that since tangible assets can be used as collateral in debt financing by firms with more tangible assets, it is positively correlated with debt. Furthermore, their study showed that collateralizing tangible assets is easy, which reduces the agency cost of debt and improves firm performance.

Moreover, GS has a negative correlation with ROA (NI) and ROA (EBIT) at -0.046 and -0.044, respectively.

SIZE seems positively correlated with ROA (NI) and ROA (EBIT) and ROE with the values of 0.552, 0.565 and 0.119. However, SIZE is negatively correlated with TQ, with a value of -0.113. In addition, SIZE is also positively correlated with LTD and negatively correlated with STD, with a value of 0.241 and -0.251. The positive correlation between SIZE and ROA, ROE, and TD is supported by the research of Myers (1977), who claimed that large firms might obtain higher returns on assets and equity due to economies of scale and cheaper access to capital.

5.3 Results of OLS regression analysis

5.3.1 Summary of the main results

In this section, the hypotheses of this study are addressed. As stated in the introduction, the effect of capital structure on firm performance is investigated in this paper. Therefore, an OLS regression was conducted. The first hypothesis is explicitly explored if capital structure variables have an adverse (inverted U-shape) effect on firm performance when they surpass a certain point. Accordingly, the approach of Margaritis and Psillaki's (2010) study was used, and the independent variables were transformed into squared variables in order to allocate the inverted U-shaped relationship between capital structure and firm performance. In addition, to identify the relationship between short-term debt, long-term debt, and firm performance measures, the linear OLS regression values were examined for the second and third hypotheses. Tables 4, 5, 6 and 7 exhibit the β (unstandardized beta coefficient) values of the linear regression of the independent variables (STD, STD^2, LTD, LTD^2, TD and TD^2) with the dependent variables (ROA (NI), ROA (EBIT), Tobin's Q and ROE (NI)). In addition, the adjusted r-square will be used to determine how much of the data each regression analysis explains. Models 2, 3 and 4 in the tables represent the β (unstandardized beta coefficient) of the squared independent variables. Only the significant values will be examined, as the non-significant values do not provide any evidence to support the hypotheses.

Table 4 shows in model 1 the relationship between ROA (NI) and the control variables. RISK has a negative relationship with ROA (NI), whereas SIZE shows a positive relationship with ROA (NI). This is also the case in all the other models in table 4. Model 2 displays a negative relationship between low levels of TD and ROA (NI). In addition, TAN seems to positively impact this relationship as it does on the relationship between STD, STD^2 and ROA (NI) in model 4. However, the relationships of STD, STD^2 with ROA (NI) are non-significant. Models 5, 6 and 7 represent the linear models where TD, LTD and STD have a negative relationship with ROA (NI). Again, TAN has a significant positive impact on LTD and ROA (NI) and STD and ROA (NI) relationships. Overall, the adjusted R^2 values show that most (32.2%) of the variation of ROA (NI) is explained by models 2 and 5, whereas model 1 explains the least (29.1%) of the variation of ROA (NI).

As the relationship between ROA (EBIT) and the independent variables in table 5 is similar to those between ROA (NI) and the independent variables in table 4, they will not be discussed to avoid repetition.

Table 6 shows in model 1 that Tobin's Q has a significant positive relationship with the control variable RISK, whereas a significant negative relationship with TAN in all the models. Models 2 and 3 show that Tobin's Q has a negative relationship with low levels of TD and LTD while a positive relationship with the increased level of total debt (TD^2) and long-term debt (LTD^2). In addition, it seems that RISK has a significant positive impact on the relationship between Tobin's Q and LTD, LTD^2 in model 3. Furthermore, model 5 shows the relationship between TD and Tobin's Q, which is positive. Again, RISK seems to positively impact the relationship between LTD, STD and Tobin's Q in models 6 and 7. However, the values of the relationship between LTD, STD and Tobin's Q are non-significant. Finally, the adjusted R^2 shows that the control variables in model 1 explain 29 % of the variation of Tobin's Q. In the models with debt, it appears that TD and TD^2 in model 2 explain most (4.7%) of the variation of Tobin's Q.

Table 7 shows the relationships between the control variables and ROE in model 1, where only the value of SIZE is significant, as it is in all of the models. SIZE shows a positive relationship with ROE in all the models, implying that as the return on assets of technological firms increases, so will their size. Models 2 and 3 show that low levels of TD and LTD have a negative relationship with ROE. However, as the levels of total debt and long-term debt increase (LTD^2 and TD^2), the relationship with ROE becomes positive. In addition, model 2 reveals that RISK has a significant effect on the relationship between low levels of TD and increased levels of TD^2 with ROE. The relationship between STD, STD^2, and ROE is also impacted by RISK. However, the relationship values of STD, STD^2 and ROE are non-significant. Ultimately, the adjusted R^2 values of table 4 show that TD and TD^2 in model 2 explain most (3.2%) of the variation of ROE, whereas LTD in model 6 explains the least (2%) of the variation of ROE.

Table 6 Regression results Tobin's Q

	Tobin's Q						
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
TD		-2.122***			1.069*		
		(-3.398)			(2.659)		
TD^2		3.079***					
		(5.181)					
LTD			-5.088***			0.602	
			(-4.917)			(1.224)	
LTD^2			9.531***				
			(5.195)				
STD				-1.818			1.348
				(-1.113)			(1.406)
STD^2				3.597			
				(1.774)			
Risk	0.444**	0.146	0.366**	0.328	0.327	0.42**	0.378**
	(2.19)	(0.994)	(1.991)	(1.773)	(1.832)	(2.142)	(2.016)
TAN	-2.173***	-2.199***	-2.019*	-2.22***	-2.392***	-2.237***	-2.289***
	(-3.186)	(-3.235)	(-2.997)	(-3.184)	(-3.471)	(-3.273)	(-3.296)
GS	-0.003	0.001	-0.004	-0.001	-0.001	-0.002	-0.002
	(-0.349)	(0.175)	(-0.443)	(-0.134)	(-0.061)	(-0.258)	(-0.236)
SIZE	-0.013	0.018	0.028	-0.01	-0.032	-0.029	-0.002
	(-0.319)	(0.441)	(0.634)	(-0.245)	(-0.793)	(-0.662)	(-0.059)
Intercept	3.338***	3.114***	3.035***	3.349***	3.425***	3.462***	3.188***
	(6.35)	(5.942)	(5.495)	(6.065)	(6.525)	(6.321)	(5.829)
Adj.R^2	0.290 (29%)	0.047 (4.7%)	0.037 (3.7%)	0.019 (1.9%)	0.020 (2%)	0.013 (1.3%)	0.014 (1.4%)
No. of Obs.	1932	1838	1838	1845	1838	1838	1845

Footnote: For the variable definitions see table 1. TD^2 = Squared form of total debt; LTD^2 = Squared form of long-term debt; STD^2 = Squared form of short-term debt. This table shows the degree of change (unstandardized beta coefficient "β") in the dependent variable Tobin's Q for every 1-unit of change in the independent variables STD, STD^2, LTD, LTD^2, TD and TD^2 from a sample of 548 technological firms listed on NASDAQ Composite in the period of 2017-2020. The *, ** and *** indicate statistical significance at the 1%, 5% and 10% level, respectively. Robust standard errors are used. The intercepts are reported and the Adj-R^2 is the value of adjusted-R^2 for the regression. Numbers in parentheses are asymptotic t-values.

Table 7 Regression results ROE (NI)

	ROE (NI)						
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
TD		-1.801**			0.379		
		(-1.972)			(0.753)		
TD^2		2.103***					
		(3.461)					
LTD			-3.011*			-0.063	
			(-2.702)			(-0.09)	
LTD^2			4.987**				
			(2.077)				
STD				-2.182			0.838
				(-0.716)			(0.468)
STD^2				3.433			
				(1.737)			
Risk	-0.464	-0.63**	-0.488	-0.555**	-0.506	-0.459	-0.508
	(-1.837)	(-2.345)	(-1.916)	(-2.026)	(-1.917)	(-1.792)	(-1.867)
TAN	0.642	0.678	0.785	0.615	0.546	0.652	0.55
	(1.12)	(1.124)	(1.368)	(1.007)	(0.903)	(1.108)	(0.911)
GS	0.007	0.011	0.006	0.01	0.009	0.007	0.009
	(0.725)	(1.023)	(0.649)	(0.954)	(0.923)	(0.714)	(0.873)
SIZE	0.135***	0.164***	0.167***	0.134***	0.13*	0.138***	0.141***
	(3.777)	(3.479)	(4.068)	(4.52)	(3.091)	(3.263)	(4.53)
Intercept	-1.996***	-2.192***	-2.251***	-1.934***	-1.98***	-2.028***	-2.084***
	(-3.917)	(-3.766)	(-4.093)	(-4.56)	(-3.581)	(-3.611)	(-4.626)
Adj.R^2	0.021 (2.1%)	0.032 (3.2%)	0.026 (2.6)	0.025 (2.5%)	0.021 (2.1)	0.020 (2%)	0.021 (2.1%)
No. of Obs.	1932	1838	1922	1845	1838	1922	1845

Footnote: For the variable definitions see table 1. TD^2 = Squared form of total debt; LTD^2 = Squared form of long-term debt; STD^2 = Squared form of short-term debt. This table shows the degree of change (unstandardized beta coefficient "β") in the dependent variable ROE (NI) for every 1-unit of change in the independent variables STD, STD^2, LTD, LTD^2, TD and TD^2 from a sample of 548 technological firms listed on NASDAQ Composite in the period of 2017-2020. The *, ** and *** indicate statistical significance at the 1%, 5% and 10% level, respectively. Robust standard errors are used. The intercepts are reported and the Adj-R^2 is the value of adjusted-R^2 for the regression. Numbers in parentheses are asymptotic t-values.

5.3.2 Discussion of the results: Debt and performance hypothesis

In this section, the result of the squared independent variables in the regression model will be evaluated and discussed to determine if the capital structure has a non-linear, inverted U-shaped relationship with firm performance. If these results suggest that the relationship between capital structure and firm performance of NASDAQ Composite-listed technology firms is non-linear, inverted U-shaped, then hypothesis 1 will be accepted; otherwise, it will be rejected.

As stated in the previous section, the results show that low levels of TD seem to have a negative relationship with all the firm performance variables. In contrast, the increased levels of total debt (TD2) seem to have a significant positive relationship with ROE (NI) and Tobin's Q. Indicating that at first, the impact of TD on return on assets and market value of the technology firms is negative, but this impact becomes positive when total debt levels are increased. Likely, the tax shield of low debt levels is not beneficial to technology firms since their debt expenses and additional costs surpass the debt tax shield. However, when these firms take on more debt, the amount of tax-deductible debt grows and becomes more beneficial, increasing their net income and firm value. This is consistent with the proposition of the agency cost of Jensen (1986), where he argued that debt might enhance firm performance in appropriating free cash flow. Therefore, the greater the debt, the higher the firm's value. In addition, Margaritis and Psillaki (2007) also found in their study that an increase in debt level increases firm performance. However, these results contradict Rajan and Zingales' (1995) and Fama and French (2002) results, where they found a negative relationship between higher debt levels and firm performance. Overall, these findings imply that the relationship between capital structure and firm performance of NASDAQ Composite-listed technology firms is not a non-linear inverted U-shaped, and it is contradicting with the trade-off theory of Kraus and Litzenberger (1973) that predicted a non-linear, inverted U-shaped relationship between increased debt and firm performance. Therefore, hypothesis 1 is rejected.

Additionally, the values of the control variables in the various models do not change significantly with the various debt levels.

5.3.3 Discussion of the result: Long-term debt and firm performance hypothesis

The linear OLS regression results will be outlined in this section regarding the second hypothesis about long-term debt and the performance of technology firms. According to the second hypothesis, long-term debt has a positive relationship with technology firms' performance. The hypothesis will be accepted or rejected based on any significant relationship between LTD and firm performance measures ROE, ROA (NI), ROA (EBIT), and Tobin's Q.

According to the results, LTD has a negative relationship with ROA (NI), ROA (EBIT) and ROE and a positive relationship with Tobin's Q. However, only the results of the relationship of LTD with ROA (NI) and ROA (EBIT) are significant, with one increase in the unit of LTD in the capital structure of technology firms resulting in a -0.306 decrease in the ROA (NI) and -0.225 decrease in ROA (EBIT) of the technology firms. These findings are consistent with the study of Kester (1986), Friend and Lang (1988), Titman and Wessels (1988), Rajan and Zingales (1995) and Wald (1999). In addition, these results also provide evidence in support of the study of Myers (1984), who argued that firms operating below the optimal capital structure would experience an adverse effect of debt on return on assets due to agency cost where managers would prioritize their personal interests above the interests of the shareholders and use debt cash flow to increase just their own wealth, leading to the firm's low performance. As a result, it is logical to argue that the debt levels of the technology firms in this study are below their capital structure's optimal level. Additionally, it could be argued that these firms are dealing with agency costs, which precludes them from increasing their net income from the tax benefits of debt.

Furthermore, the control variables do not affect the significant relationship between LTD and firm performance measure ROA. Based on this significant evidence about the relationship between ROA and LTD of technology firms, hypothesis 2 is rejected. The hypothesis is also rejected because the values of the relationship between LTD and ROE and Tobin's Q are non-significant, providing no evidence to support the claim that LTD has a positive effect on the performance of technology firms.

5.3.4 Discussion of the results: Short-term debt and firm performance hypothesis

In this section, the linear OLS regression results will be outlined related to the third hypothesis about short-term debt and the performance of technology firms. This third hypothesis states that short-term debt has a positive relationship with technology firms' performance. This hypothesis will also be accepted or rejected if a substantial relationship is discovered between STD and the firm performance measures ROE, ROA, and Tobin's Q.

The results of the linear OLS regression indicate a significant negative relationship between ROA (NI), ROA (EBIT) and STD with an adjusted R^2 of 31.8 % and 31.1%, indicating that the variation of ROA (NI) is 31.8% explained by STD and STD explains the variation of ROA (EBIT) for 31.1%. The use of short-term debt in the capital structure of the technology firms can be explained by the agency theory of Jensen and Meckling (1976), Jensen (1986), and Hart and Moore (1990), where they argued that firms use short-term debt in order to subject themselves to more monitoring which decreases the agency cost. In addition, the negative relationship of short-term debt with ROA (NI) and ROA (EBIT) can be explained by the study of Myers (1977), where he proposed that there are costs related to monitoring that can have a negative effect on firm performance. These findings also support the pecking order theory of Myers (1984), which argues that there is a negative relationship between debt and profitability as highly profitable firms prefer using retained earnings instead of debt. Overall, based on this evidence, the third hypothesis is also rejected, and it can argue based on agency cost related study that the technology firms listed on NASDAQ Composite are experiencing high agency cost, which leads to lower return on assets due to their short-term debt used to lower agency cost. On the contrary, based on the pecking order theory, it can be argued that these technology firms are not highly profitable.

5.3.5 Robustness

The robustness of the regression results is tested to see whether they change when the regression requirements are changed in any manner. This was done by substituting the dependent variable ROA (NI) with ROA measures (EBIT) to see if the independent variables affected both equally. There have been no significant differences between the ROA (NI) and ROA (EBIT) regression models, as can be seen in regression tables 4 and 5 (see Appendix B). The only difference that can be observed is the adjusted R^2 values, which indicate that most (31.1%) of the variation of ROA (EBIT) is explained by STD and STD2 in model 4 and 7, while in table 4, most (32.2%) of the variation of ROA (NI) is explained by models 2 and 5. Overall, the test results show that the study's findings are robust.

6. CONCLUSION

Any firms' capital structure selection is critical. This is because firms have to optimize returns to diverse organizational stakeholders, and such a selection influences an organization's capacity to deal with its challenging environment.

This paper's research focuses on the extent to which capital structure affects technology firms' performance. The inverse effect of debt on firm performance and the effects of short-term and long-term debt are investigated using a sample of 548 technology firms listed on the NASDAQ Composite for the period 2017-2020. With the use of square of the capital structure variables (STD2, LTD2 and TD2) in an OLS regression analysis, the results of this study indicated that the influence of debt on firm performance measures ROE, ROA, and Tobin's Q is significant and negative at low debt levels, but significant and positive at high debt levels for only ROE (NI) and Tobin's Q. This evidence supports Jensen's (1986) agency theory and Margaritis and Psillaki (2007) work. More specifically, the prediction of agency cost theory, which suggests that more leverage is associated with higher performance, is found to be supported. This implies that greater total debt levels are profitable for the technology firms listed on the NASDAQ Composite Exchange.

In the second and third hypotheses, LTD and STD are thought to have a positive relationship with firm performance. However, the findings revealed that LTD and STD had a negative impact on the technology firms' ROA (NI) and ROA (EBIT). This is supported by the findings of Myers (1984), who claimed that because of agency conflict, firms with capital structures below the optimal capital structure would perform poorly since managers will act in their own best interests by utilizing debt cash flow to increase their own wealth. Hence, indicating that the technology firms listed on the NASDAQ Composite Exchange are coping with agency conflict, causing LTD and STD to negatively impact their return on assets. Additionally, the agency theory of Jensen and Meckling (1976), Jensen (1986), and Hart and Moore (1986) provide support for the use of short-term debt by the technology firms, arguing that firms utilize short-term debt to increase monitoring to reduce agency conflict.

Furthermore, Myers (1977) explained why STD has a negative effect on firm performance. He claimed that monitoring is related to costs, which might lead to poor firm performance. With his pecking order theory (Myers, 1984), he suggested that since debt has a negative impact on profitability, profitable firms choose to finance their activities with retained earnings.

Owing to the study's constraints, it was impossible to logically explain why the technology firms exhibit a negative relationship between capital structure and firm performance in an empirical setting. To sum, the findings suggest that higher levels of long-term debt (LTD2) and total debt (TD2) have a positive effect on accounting-based performance measure ROE and the market-based performance measure Tobin's Q of the technology firms, whereas the low levels of long-term debt (LTD) and total debt (TD) have a negative effect on these performance measures. The results also show a significant negative effect of low levels of total debt (TD) on ROA (NI) and ROE (EBIT). Furthermore, the results show a significant negative effect of short-term debt and long-term debt on ROA (NI) and ROA (EBIT). To conclude, debt has a positive effect on the performance of technology firms listed on the NASDAQ Composite Exchange when the levels are high, whereas a negative effect when the debt levels are low. Short-term debt and long-term debt have a negative effect on the performance of the technology firms listed on the NASDAQ Composite exchange.

Control variables RISK and SIZE had the highest significant values throughout the analysis, followed by TAN. This study also identifies several limitations that might be used as a foundation for future research. The reader is advised not to regard the findings of this study as definitive but rather as a starting point for further research.

6.1 Academic and Practical contributions

It can be assumed that this thesis has contributed to the general area of corporate finance study based on the answers provided for the research question—the investigating of the effect of capital structure on firm performance among listed companies in particular.

The results of this thesis, which are presented by testing the relationship between capital structure and firm performance variables, provide a contribution to the academic world. However, these findings might be extended by including more variables to test the extent to which capital structure affects firm performance.

The findings add to the academic literature by demonstrating that greater levels of total debt and long-term debt are positively related to the performance of NASDAQ Composite listed technology firms. Furthermore, it was shown that in the context of technology firms, low debt levels had a negative impact on firm performance. These findings support the agency theory of capital structure and demonstrate that the behavior of the managers to act in their own interest has a negative impact on the firm's performance when debt is involved. Furthermore, the findings indicate that debt may be utilized as a management control tool.

The potential practical contribution of this thesis is that it gives practical insight for technology firms on how to optimize their capital structure to improve financial performance. Furthermore, the results of this study also have the potential to notify management of technology firms that their activities regarding capital structure do not have a positive impact on firm performance.

6.2 Limitations

The study focused on the large technology firms listed on the NASDAQ Composite Exchange; thus, the results cannot be applied to all technology firms.

This research aimed to investigate the relationship between capital structure and performance of NASDAQ Composite listed technology firms. Hence, the research study's conclusions are confined to these firms, not to other technology firms. In addition, the period studied in this thesis was only four years. A more extended period may have provided better results about the capital structure of the technology firms. The adjusted R^2 ranges from 32.2 % to 1.3 % in this study, indicating that the independent variables can explain 1.3 % to 32.2 % of firm performance. Therefore, other variables should be considered in this study. Furthermore, as the research focused on non-financial firms, the findings cannot be extended to financial firms. They can, however, be used as a model for other technology firms since they endure comparable challenges owing to similar markets.

Furthermore, since the required information was not easily accessible, this study relied heavily on secondary data to examine the effect of capital structure on the financial performance of the technology firms listed on the NASDAQ Composite Exchange. Consequently, the statistical findings are dependent on the accuracy of the data derived from the financial reports. It is also worth noting that, like many other studies, this study's results are sensitive to measurement errors. It has been attempted to address this challenge by employing various measurements of the variables. Furthermore, the findings of this study should not be seen as definitive but rather as a starting point for further research. Finally, like all quantitative research, the methodological approach is a limitation in itself since the issue as to why a relationship may or may not occur can never be adequately answered.

6.3 Recommendations for future research

The study's main recommendations are that investors should be informed and familiarized with performance criteria to make better decisions and meet high standards. One of the most significant ways to enhance a company's performance is to uncover investment flaws since this reveals the place where issues occurred. Furthermore, firms should be encouraged to employ greater debt in their capital structure since a higher debt level appears to increase firm performance. Firms should also work hard to seek the optimal capital structure in order to optimize their performance and avoid bankruptcy costs.

Recommendations for future research would be that similar research studies should be done over a more extended period, integrating additional accounting and financial variables. Furthermore, this research proposes that comparable studies be done in various industries but on the same topic and over a more extended period. Future research should look at additional factors that influence financial performance and their impact on financial firms listed on the NASDAQ Composite Exchange. Additionally, future studies should perform case study research among technological firms listed on the NASDAQ Composite to fully understand why they choose their capital structure the way they do. Finally, qualitative or quantitative research can be done to determine how capital structure choices are taken in these technological firms and how probable agency conflicts influence the decision.

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8. APPENDIXES A

Table 2 Descriptive statistics

	Mean	Median	Std. Deviation	Minimum	Maximum	No. of Obs.
ROE (NI)	-0.360	-0.048	3.397	-36.324	28.569	2188
ROA (EBIT)	-0.242	-0.045	0.586	-4.038	0.825	2188
TQ	3.125	2.153	3.002	0.099	18.090	2068
ROE (EBIT)	-0.225	-0.038	0.553	-3.455	1.002	2188
TD	0.184	0.098	0.264	0.000	2.026	2068
LTD	0.134	0.035	0.185	0.000	0.803	2163
STD	0.038	0.001	0.128	0.000	1.506	2086
RISK	0.270	0.074	0.731	0.001	5.511	2152
TAN	0.106	0.079	0.093	0.000	0.342	2182
GS	1.714	1.076	5.002	-0.405	58.730	1958
SIZE	12.351	12.269	2.055	4.522	16.601	2188

Footnote: This table presents the descriptive of different variables of capital structure and firm performance. The mean, median, standard deviation, minimum, maximum and the number of observations of these variables are shown in this table. For the variable definitions see table 1.

.

Table 3 Correlation matrix

	ROA (NI)	ROA (EBIT)	TQ	ROE (NI)	TD	LTD	STD	RISK	TAN	GS
ROA (NI)	1									
ROA (EBIT)	0.954***	1								
	(0.000)									
TQ	-0.251***	-0.224***	1							
	(0.000)	(0.000)								
ROE (NI)	0.156***	0.144***	0.021	1						
	(0.000)	(0.000)	(0.343)							
TD	-0.236***	-0.195***	0.164***	0.028	1					
	(0.000)	(0.000)	(0.000)	(0.203)						
LTD	-0.012	0.021	0.045*	0.029	0.820***	1				
	(0.585)	(0.337)	(0.042)	(0.172)	(0.000)					
STD	-0.362***	-0.338***	0.186***	-0.01	0.541***	0.04	1			
	(0.000)	(0.000)	(0.000)	(0.649)	(0.000)	(0.072)				
RISK	-0.515***	-0.486***	0.189***	-0.123***	0.193***	-0.006	0.330***	1		
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.787)	(0.000)			
TAN	0.137***	0.138***	-0.090***	0.041	0.077***	0.093***	0.028	-0.142***	1	
	(0.000)	(0.000)	(0.000)	(0.054)	(0.000)	(0.000)	(0.198)	(0.000)		
GS	-0.046**	-0.044	0.018	-0.011	-0.01	-0.03	0.017	0.206***	-0.078***	1
	(0.044)	(0.051)	(0.427)	(0.612)	(0.664)	(0.189)	(0.453)	(0.000)	(0.001)	
SIZE	0.552***	0.565***	-0.113***	0.119***	0.02	0.241***	-0.251***	-0.394***	0.104***	-0.037
	(0.000)	(0.000)	(0.000)	(0.000)	(0.366)	(0.000)	(0.000)	(0.000)	(0.000)	(0.098)

Footnote: This table presents the Pearson correlation outputs of the capital structure and firm performance variables for the sample of 548 technology firms listed on NASDAQ Composite Exchange for the period of 2017-2020. For the variable definitions see table 1. P-values are reported in parentheses and * indicates p<0.01 ** indicates p<0.05 and *** indicates p<0.001 (two-tailed).

9. APPENDIXES B

Table 4 Regression results ROA (NI)

	ROA (NI)						
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
TD		-0.315**			-0.344***		
		(-2.394)			(-4.207)		
TD^2		-0.027					
		(-0.172)					
LTD			-0.173			-0.306***	
			(-1.475)			(-4.214)	
LTD^2			-0.226				
			(-0.853)				
STD				-0.701			-0.726**
				(-1.695)			(-2.332)
STD^2				-0.028			
				(-0.043)			
RISK	-0.233***	-0.194***	-0.218***	-0.198***	-0.195***	-0.22***	-0.198***
	(-4.461)	(-4.08)	(-4.349)	(-4.07)	(-4.026)	(-4.347)	(-4.056)
TAN	0.144	0.22**	0.173	0.214**	0.221**	0.179	0.215**
	(1.579)	(2.396)	(1.867)	(2.4)	(2.408)	(1.918)	(2.409)
GS	0.003	0.003	0.002	0.003	0.003	0.002	0.003
	(0.807)	(0.94)	(0.673)	(1.101)	(0.942)	(0.666)	(1.104)
SIZE	0.083***	0.089***	0.091***	0.078***	0.09***	0.092***	0.078***
	(12.495)	(11.726)	(13.104)	(11.946)	(12.175)	(12.897)	(11.678)
Intercept	-1.177***	-1.205***	-1.238***	-1.095***	-1.208***	-1.248***	-1.094***
	(-12.813)	(-12.354)	(-13.218)	(-12.217)	(-12.635)	(-13.154)	(-11.697)
Adj.R^2	0.291	0.323	0.307	0.317	0.323	0.307	0.318
	(29.1%)	(32.2%)	(30.7%)	(31.7%)	(32.2%)	(30.7%)	(31.8%)
No. of Obs.	1932	1838	1922	1845	1838	1922	1845

Footnote: For the variable definitions see table 1. TD^2 = Squared form of total debt; LTD^2 = Squared form of long-term debt; STD^2 = Squared form of short-term debt. This table shows the degree of change (unstandardized beta coefficient "β") in the dependent variable ROA (NI) for every 1-unit of change in the independent variables STD, STD^2, LTD, LTD^2, TD and TD^2 from a sample of 548 technological firms listed on NASDAQ Composite in the period of 2017-2020. The *, ** and *** indicate statistical significance at the 1%, 5% and 10% level, respectively. Robust standard errors are used. The intercepts are reported and the Adj-R^2 is the value of adjusted-R^2 for the regression. Numbers in parentheses are asymptotic t-values.

Table 5 Regression results ROA (EBIT)

	ROA (EBIT)						
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
TD		-0.275**			-0.269***		
		(-2.354)			(-3.755)		
TD^2		0.006					
		(0.044)					
LTD			-0.222			-0.225***	
			(-1.943)			(-3.329)	
LTD^2			-0.005				
			(-0.019)				
STD				-0.69			-0.639**
				(-1.849)			(-2.381)
STD^2				0.057			
				(0.1)			
RISK	-0.204***	-0.175***	-0.194***	-0.174***	-0.175***	-0.194***	-0.173***
	(-4.383)	(-4.108)	(-4.317)	(-3.992)	(-4.024)	(-4.3)	(-3.948)
TAN	0.123	0.184**	0.147	0.186**	0.184**	0.147	0.185**
	(1.365)	(1.986)	(1.598)	(2.064)	(1.98)	(1.588)	(2.053)
GS	0.002	0.003	0.002	0.003	0.003	0.002	0.003
	(0.708)	(0.899)	(0.604)	(1.018)	(0.898)	(0.605)	(1.013)
SIZE	0.087***	0.092***	0.093***	0.081***	0.092***	0.093***	0.082***
	(13.628)	(12.756)	(13.877)	(12.971)	(13.324)	(13.746)	(12.7)
Intercept	-1.209***	-1.233***	-1.262***	-1.132***	-1.232***	-1.262***	-1.134***
	(-13.835)	(-13.316)	(-14.016)	(-13.14)	(-13.63)	(-13.984)	(-12.649)
Adj.R^2	0.290 (29%)	0.309	0.298	0.311	0.310 (31%)	0.299	0.311
		(30.9%)	(29.8%)	(31.1%)		(29.9%)	(31.1%)
No. of Obs.	1932	1838	1922	1845	1838	1922	1845

Footnote: For the variable definitions see table 1. TD^2 = Squared form of total debt; LTD^2 = Squared form of long-term debt; STD^2 = Squared form of short-term debt. This table shows the degree of change (unstandardized beta coefficient "β") in the dependent variable ROA (EBIT) for every 1-unit of change in the independent variables STD, STD^2, LTD, LTD^2, TD and TD^2 from a sample of 548 technological firms listed on NASDAQ Composite in the period of 2017-2020. The *, ** and *** indicate statistical significance at the 1%, 5% and 10% level, respectively. Robust standard errors are used. The intercepts are reported and the Adj-R^2 is the value of adjusted-R^2 for the regression. Numbers in parentheses are asymptotic t-values.