THE STUDY OF DETERMINANTS OF CAPITAL STRUCTURE:
EVIDENCE FROM UK PANEL DATA

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MSc FINANCE AND INVESTMENT
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BY

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Abstract
The paper examines the determinants of capital structure of firms listed on FTSE 350 over a period from 2002 to 2011 using panel data. The sample of this study involves 178 listed firms from nine different industries. Several theories of capital structure are reviewed in order to achieve the testable hypothesis regarding the capital structure decision of UK based firms. To test the hypothesis we have utilised pooled ordinary least square, random effects, fixed effects models and ANOVA test. Our results suggest that profitability and firm size are positively related to both long-term and short-term leverage. Whereas, growth opportunities and earning volatility is negatively related to both type of gearing ratio. Tangibility is negatively associated with short-term leverage and positively related to long-term leverage. The presence of non-debt tax shield has a positive impact in short-term leverage and opposite effect in the long-run. Overall, from the results we can say that firm size and profitability shows significant relation with both the gearing ratios and non-debt tax shield with short-term leverage and growth with long-term leverage. Hence, these independent variables have statistically significant impact on the capital structure of the UK based firms.
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Chapter 1: Introduction

1.1 Background Information:

Capital Structure Theory is one of the most popular theories in the financial sector from the past half century. Modigliani and Miller in 1958 and 1963 proposed the initial theory, which suggested that in perfect market, the value of the firm is independent of its financial decisions and the corrected model in 1963 included the effect of tax in the capital structure. After that, a great number of theories have been proposed to provide a better understanding of the variation in the amount of leverage level across firms. The theories argue that the decision of capital structure depends upon characteristics that would determine various cost and benefits associated with different kind of capital options i.e. debt and equity. Because of this there has been massive amount of empirical and theoretical work with the aim of providing a perfect capital structure theory but none of them in the past 50 years has been able to provide a conclusive theory and most the these theories revolve around a few theoretical models of the past.

The initial theory of capital structure based on two irrelevant propositions given in the MM theory, which avoids real life things like taxes, cost of financial distress, bankruptcy cost, agency cost, transaction cost and asymmetric information. With all these missing aspects, the capital structure theory will not give us a perfect capital structure.

The new and improved theory for capital structure started to include all the real life essential elements and majorly based on two rival and opposing theories, Static Trade-Off Theory of Capital Structure and Pecking Order Theory of Capital Structure. Alan Kraus and Robert H. Litzenberger in 1973 brought in the Static Trade-Off Theory that mainly highlighted the cost and benefits of including debt in the capital structure. The main advantage mentioned was the tax deduction of interest paid but debt financing also increases the probability of bankruptcy cost and increases the agency problem between stockholders and bondholders.

The next theory, which is the opposing theory to the Static Trade-Off Theory, is the Pecking Order Theory of Capital Structure. The Theory was originated with research of Donaldson in 1961 and later the research was used by Myers and Majluf in 1984 they came up with the Pecking Order Theory. The theory suggested that the firm should follow a certain predefined order while raising finance. The order suggested in the theory mentioned that retained earnings are the first preference for financing followed by debt as the second choice and equity as the last resort for raising finance. The theory does not predict any optimal debt ratio rather it suggest that firm capital structure is the result of firms financing requirement over the time and its attempt to minimise adverse selection cost. (Baker & Martin, 2011)
Beside this, there are few more theories to help us to get a better view on the capital structure puzzle. The Agency Cost Theory gives us the information about the conflict between the shareholders and the manager and the conflict between debt holders and equity holders because of the financing decision. Baker and Wurgler in 2002 gave the other theory which is known as Market Timing Theory, which argues that the capital structure is majorly related to historical market value. “Capital structure is the cumulative outcome of the past attempt to time the equity market” (Baker & Wurgler, 2002)

To choose the best theory among all the theories is not easy. Every theory is unique and provides explanation under different conditions. Therefore, there are many empirical studies attempting toanalyse the capital structure decisions. Titman and Wessels (1988), Bevan and Danbolt (2002) and many other researchers and scholars used cross sectional data to test the theoretical determinants of capital structure and Scholars like Ozkan (2001) used panel data to explain the determinants of capital structure.

1.2 Research Objectives:
The main idea behind this dissertation is to provide a detailed understanding of how firms adjust their capital structure. The results of the research will be analysed and compared with the previously established theories and researches. We have used UK market as the target market, as it is a developed market and gives us the results in accordance to that. The research will help us to understand the following question:

- What are the determinants related to firms’ short-term and long-term leverage?
- How these determinants affect the firm’s capital structure decision?
- Is there any particular theory that turns out to be more significant because of the empirical results?

Apart from the above-mentioned questions, the research will help us to establish a better theoretical and practical intellect about how the firms determine the optimal mixture of the capital structure. The paper also works to develops further information on capital structure of UK specific firms. In the research conducted by Ozkan (2001), he mentioned that there is not a very great amount of empirical work done on capital structure of UK based firms.

1.3 Research Motivation
The decision of financing is one of the most difficult tasks for the finance managers. Even after half a decade there is no concrete way through which a firm can choose between the debt financing and equity financing. Both the methods of financing have their own merits and de-merits. There is always new conflicts occurring with every new research and studies conducted by scholars. The
inconsistency among the arguments of various scholars and researchers motivated me to take on this topic as my research topic. Now we have various new statistical tools and software that will help us to get a more precise result. The research is based on FTSE 350 listed on London Stock Exchange helped the research to have a developed economies perspective as the companies listed in FTSE 350 represent the companies based in UK. With the comments of scholars like Ozkan and more about the unavailability of much empirical evidences on UK based firms regarding the capital structure decisions motivated me more to explore this topic in respect to UK based firms.

1.4 Structure Overview

The dissertation has been organised into six different chapters. We have discussed the extensive amount of literature available on the topic capital structure in Chapter 2. Modigliani and Miller gave the initial theory and later many scholars introduced various modern theories of capital structure. In the next chapter, we have discussed the various determinants and its impact on the capital structure of the firm with the support of empirical studies done previously. Later Chapter 4 discussed the methodology adopted for the research and the main model of research presented in that chapter along with the proxies used for the independent and dependent variables. Chapter 4 also discussed the data collection and sample set creation techniques. In Chapter 5, we have discussed and analysed the results. Moreover, in the last chapter, we have discussed the summary of the findings along with the conclusion and limitations of the study are mentioned.
Chapter 2: Literature Review

The Capital Structure Theory is a theory that focuses on explaining the mix of debt and equity as source of raising real finance by the corporate. There is a lot of research on capital structure and most of them focus on the equity and debt proportions in balance sheets. There is no universally accepted theory of the debt and equity choice (Myers S. C., 2001). The overall understanding of the optimal capital structure is one of the most questionable theories because there are so much different results from different researchers.

The origin of the literature for the capital structure started with the paper presented by Franco Modigliani and Merton H. Miller presented almost 50 years back. The paper based on certain irrelevance proposition and there have been a lot of further papers put forward by researchers and scholars supplementing the original paper by adding friction to the research which was previously omitted in the original research framework Modigliani and Miller (1958) (Chirinko & Singha, 2000). Previous literature said that some of the most productive responses to the MM results have come from those who did not feel able to accept the conclusion that the financial policy is irrelevant (Stiglitz, 1988).

According to Schwartz (1959), in real world there is uncertainty, lack of knowledge as to relevant variables make optimum solution for capital structure a difficult achievement. In addition, financing is matter of taste and preference of risk and hence ownership or firm decision or a unique decision is not possible. Myers also said that there is no universal theory of debt and equity choice but there are few useful ones. "The capital structure of the firm" seems to include only those sources of funds that are part of securities, which seems to be a very narrow approach (Schwartz, 1959). In addition, there is great amount of research work available to shed light on the difference levels of debt and equity levels of the firm.

We can explain the capital structure by using different theories although these theories based on different ideas but they are not mutually exclusive. These include the Modigliani and Miller (MM) Propositions, Trade-Off Theory, Pecking Order Theory, Agency Cost Model and Market Timing Theory. In addition, some of the basic concepts of the following theories are mention below:
The value of the firm is determined by the left hand side of balance sheet i.e. real assets and irrelevant of the how much debt is there in the liability side. Therefore, the firm should invest in positive NPV projects (Brealey, Myers, & Allen, 2010).

The firms seek debt levels that balance the tax advantages of additional debt against the costs of possible financial distress (Myers S. C., 2001).

The firm will borrow, rather than issuing equity, when internal cash flow is not sufficient to fund capital expenditures (Myers S. C., 2001).

The agency cost arises because of the conflict between different stake holder and it can be reduced by involving more debt (Jensen & Meckling, Theory Of The Firm: Managerial Behaviour, Agency Costs and Ownership Structure, 1976).

There is significant difference for debt employed by different firms; the reason for this can be explained by examining the different theories mentioned above.

2.1 The Modigliani and Miller Propositions:

The framework produced by Franco Modigliani and Merton Miller in 1958 gave the idea behind one of the most important and debated topic of corporate finance. All the research paper related to capital structure theory mainly based on the initial idea given by the Modigliani and Miller. Their paper is one of the most discussed, researched and criticized paper. “The Cost of Capital, Corporation Finance and the Theory of Investment” paper opened door for numerous research, empirical studies and theoretical studies in the field of corporate finance literature.

The paper put forwarded by Modigliani and Miller was based on certain propositions that are known as “The Capital Structure Irrelevancy Propositions”. There are certain assumptions to the model of Modigliani and Miller (1958) theorem. The main assumption for the model was that there is no transaction cost and tax and there is a perfect capital market. Other assumptions along the above two are there is homogenous expectation for the investor regarding the payoff and risk, homogenous risk class for all the firms, perpetual growth rate, there is no taxes for individuals and firms, no information and transaction cost, firms and investors can borrow and lend at same rate, no bankruptcy cost associated in raising debt, equal information available to insiders and the outsiders, firm issue only risk free debt and risky equity. (Villamil, 2008)

The Modigliani-Miller Theorem comprises four distinct results from a series of papers (1958, 1961, and 1963). The first proposition establishes that under certain conditions, a firm’s debt-equity ratio
does not affect its market value. The second proposition establishes that a firm’s leverage has no
effect on its weighted average cost of capital (i.e., the cost of equity capital is a linear function of the
debt-equity ratio). The third proposition establishes that firm market value is independent of its
dividend policy. The fourth proposition establishes that equity-holders are indifferent about the firm’s
financial policy (Villamil, 2008). The capital structure can be explained with the first two
propositions.

2.1.1 Proposition I
The first proposition under the M&M Theory states that the debt-equity ratio does not affect the
firm’s market value, in other word the firm is independent of the financial policy it follows. The
firm’s value depends upon the returns of the projects it invest in and not by the securities it issues for
raising finance. Proposition I says that value of firm is a constant, regardless of the proportions of debt
and equity, provided that the assets and growth opportunities on the left-hand side of the balance sheet
are held constant. “Financial leverage" - that is, the proportion of debt financing is irrelevant. This
leverage-irrelevance result generalizes to any mix of securities issued by the firm (Myers S. C., 2001).

Therefore,

\[ V_U = PV(\text{CF}) \quad \text{and} \quad V_L = V_E + V_D \]

And according the proposition I both of them are equal

\[ V_U = PV(\text{CF}) = V_L = V_E + V_D \]

Where: \( V_U \) is value of unlevered firm

\( PV(\text{CF}) \) is present value of cash flows from real asset

\( V_L \) is value of unlevered firm

\( V_D \) is value of Debt

\( V_E \) is value of Equity.
The independence of the firm value can be graphically represented as:

![Figure 2.1](image)

Myers (2001) has illustrated the Modigliani and Miller Proposition I with the help of market value balance sheet where total firms value $V$ equals to the market value of debt $D$ plus equity $E$. MM Theory says that the value of the firm remains constant regardless of the proportion of debt and equity in capital structure provided that the assets and growth opportunities on the left-hand side of the balance sheet are held constant (Myers S. C., 2001).

<table>
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<tr>
<th>Asset-in-place and growth opportunities</th>
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Table 2.2: Market-value Balance Sheet (Myers S. C., 2001)
Therefore, we can be seen that according the proposition I the value of the firm is due to the assets on the left hand side and not by the proportions of debt and equity issued by the firm to raise finance.

2.1.2 Proposition II

The M&M theory’s second important insight is that even debt is less costly for firms to issue than equity, issuing debt causes the required return on the remaining equity to rise (Megginson, Smart, & Gitman, 2007). It is also said that according to the core financial principle, the shareholders of levered firm ask for more returns as compared to all-equity firms. The expected rate of return on the common stock of a levered firm increases in proportion to the debt-equity ratio, expressed in market value; the rate of increase depends on the spread between the expected rate of return on a portfolio of all the firm’s securities and the expected return on the debt (Brealey, Myers, & Allen, 2010). Therefore, the proposition II states that the cost of equity is a linear function to the debt-equity ratio of the firm. The equation for the second proposition is shown below:

$$r_A = \left(\frac{D}{D+E} \times r_D\right) + \left(\frac{E}{D+E} \times r_E\right)$$

Where:

- $r_A$ is expected return on assets
- $r_D$ is expected return on debt
- $r_E$ is expected return on equity
- $D$ is proportion of debt
- $E$ is proportion of equity.

The above equation is the weighted average cost of capital that is independent of capital structure if the proposition holds and return on the assets is constant. As the M&M second proposition state that any change in the leverage cause an offsetting change in the required return in equity. Thus making the left hand side of the equation unchanged. Moreover, by rearranging the above equation we can get:

$$r_E = r_A + \left(r_A - r_D\right) \frac{D}{E}$$

The working of proposition II on the equation with weighed average cost of capital can be explained with the help of a graph:
The M&M Theory is based on certain assumption that is very difficult to achieve in real life. This led new researchers to modify and reject some of the assumptions to provide a more conclusive result for a better and optimum capital structure. The omission of tax and other real life elements were the major weak point of the theory. Ignoring tax during the time where corporate taxes were high and the interest on debt was low was a major point that was ignored in this theory. Modigliani and Miller themselves included the corporate tax into consideration by making a correction paper in 1963. The correction made the benefits of tax advantage of debt financing made debt a more attractive option for finance.

MM propositions were ideal but not realistic. The model overlooked so many real world element that it became one of the most controversial and contradictory theory. The theory ignored elements like bankruptcy and distress cost, corporate taxes, agency issues and market imperfections. It also ignored the use of hybrid financial instruments such as convertible bonds, etc. (Brealey, Myers, & Allen, 2010). This omission leads to a weaker theory that requires a lot more research to provide a better answer for the optimal capital structure.

2.2 The Trade-Off Theory

The M&M Theory is criticized because of the ignorance of some of the essential real life elements in the theory. The Trade-Off Theory suggested that the optimum level is attained when the present value of tax saving due to further borrowing is just offset by increases in present value of cost of distress.
In simple terms when a company includes debt in the capital structure and the interest paid for the debt is tax deductible and known as tax shield. However, with the inclusion of debt the firm gets exposed to bankruptcy cost. In case if the company is not performing well and the cash generated from its operations is not enough to pay the debt obligation then the company will go bankrupt. The tax shield on interest is the difference between the tax that would be paid by the firm which has no debt and the firm which has debt (Wrightsman, 1978). The Trade-Off Theory originated from the M&M Theory with adding real life essential elements like market imperfections, taxes and distress cost. It states that the firm will borrow up to the point where the marginal value of tax shield on additional debt is just offset by the increase in the present value of possible costs of financial distress. Financial distress refers to the costs of bankruptcy or reorganization, and to the agency costs that arise when the firm's creditworthiness is in doubt (Myers S. C., 2001). The theory suggests that the target debt ratio can vary from firm to firm. The firms with safe and tangible assets and with plenty of taxable tend to have high target debt ratio as compared to the companies with risky and intangible assets. The firms with less taxable income prefer majorly on equity financing rather than debt. Firms choose the debt level that steadies the tax advantage of adding addition debt against the cost of distress it brings.

2.2.1 Taxes

The omission of taxes in M&M Theory was one of the main controversial aspects of the theory. The interest paid by the company to its debt holders is tax-deductible expense according to corporate income tax. This led the bondholders to escape the taxation at the corporate level. Modigliani and Miller also edited their model in 1963 by adding the impact of corporate tax on the capital structure. According to the new model:

\[ V_L = V_U + PV \text{ (tax-Shield)} \]

Where: 
- \( V_L \) is the value of the levered firm
- \( V_U \) is the value of the unlevered firm
- \( PV \text{ (tax-Shield)} \) is the present value of the tax-shield.

So according to the above equation the value of the levered firm is a linear function with the tax shield. According to that, by increasing the debt to the maximum level will provide us with the maximum value of the firm. This makes the optimum capital structure extreme and embarrassing, i.e. 100% debt financing (Brealey, Myers, & Allen, 2010). Brealey, Myers and Allen (2010) stated several reasons that lead to the overstatement of the interest tax-shield. First, the firms think debt as perpetual and constant but it is difficult to do that as the debt level changes with the profit and fluctuation in the value of the firm. Secondly, the firms not always get the marginal tax rate as 35% as
mentioned in the M&M revised article. And interest tax shield is only useful if the firm has profits against which the tax shield can be utilised and no firm can be sure about future profits and in case of no profits the tax-shield is of no use.

The debt shield depends majorly on the tax system of the countries. If the countries does not allow carry back or carry forward of losses then the debt financing doesn’t provides the advantage of debt shield always as for the companies situated in countries whose tax system allows carry forward or carry back the losses. Adedeji (1998) found that the UK system discourages debt financing, as does the classical tax system in US. The tax system in US allows the companies to carry back or carry forward the losses of a particular financial year. In simpler words, the firms are allowed to get a tax refund prior to their tax payments and reduction of taxes in future. This led the US firm to bank heavily on debts to finance even after their leverage deviates from the target ratio.

DeAngelo and Masulis (1980) say that the Miller’s irrelevancy theorem is very sensitive to realistic and simple modification in corporate tax code. They said that the existence of non-debt corporate tax shields such as depreciation deductions and investment tax credit is enough to upturn the leverage irrelevancy theorem. The presence debt shield will reduce the need of the non-debt tax shield. So by involving more debt in the capital structure it gets more expensive to add more debt financing as it turns out to be more expensive as the non-debt tax shield becomes less useful. Even Myers (1984) suggested that the theory presented by DeAngelo and Masulis (1980) is better than Modigliani and Miller (1958) because it is less extreme.

2.2.2 Financial Distress and Bankruptcy Cost
According to Modigliani and Miller (1958), a firm can increase its value to the maximum level by adding as much debt as possible. But this is based on the assumption that there is perfect market, but in real life this is not possible and there are elements like bankruptcy cost and financial distress which makes debt a not so attractive option for achieving the maximum level of firm’s value and force the value maximising firm to trade-off between the cost and benefits of debt.

Myers (2001) explained the financial distress as the bankruptcy cost and reorganization cost and the agency cost arises when the firm loses it creditworthiness. Myers in the article The Determinant of Capital Borrowing (1977) explained the gap in the modern financial theory in respect to the debt financing. He explained that even after the presence of debt-tax shields the companies do not prefer to maximise the value of the firm by going for all debt financing. He gave the reason that discourage borrowing even after the presence of the tax shield is the presence of the bankruptcy cost which includes cost like transaction cost and cost of reorganization. The use of debt exposes the firms to the bankruptcy risk and financial distress. Robichek and Myers (1966) said that the cost of bankruptcy emerges when the company is under the threat of bankruptcy and even if it saves itself from that the cost still exists. Initial work on this matter also includes Kraus and Litzenberger (1973), Robichek and
Myers (1966), among others have debated that debt policy is irrelevant in the presence of bankruptcy and reorganization cost.

Haugen and Senbet (1978) explained the bankruptcy as an event when fixed obligations towards creditors cannot be fulfilled and which lead to transfer of ownership and reorganization of capital structure of the firm. The cost related to transfer can be categorized under two categories i.e. direct and indirect. In the direct cost items like legal, accounting and trustee fees and possible denial of income tax loss carry-overs and carry-backs are included. Whereas indirect cost includes cost related to the opportunity costs resulting from disruption in firm-supplier or firm-customer relationships that are associated with the transfer of ownership or control. They also mentioned that the indirect costs are insignificant or non-existent if the customer or the supplier act rationally. The indirect costs are hard to measure but usually the magnitude of indirect cost is much more than the direct cost of bankruptcy.

Myers (1984) mentioned that the literature on cost of financial distress supports two qualitative thoughts concerning mainly the bankruptcy cost and financial distress cost in accordance to capital structure. He suggests that risky firms should borrow less because of the high variance level in income, which makes the probability of default and not meeting the interest obligation high. Whereas the safer firms with stable cash flows and income should borrow more debt before the expected cost of financial distress offsets the tax advantage of adding debt to the capital structure. And the next thing Myers (1984) mentioned is the firms with tangible assets in place having active second hand markets tends to borrow less when compared with firms with specialised, intangible assets or valuable growth opportunities. The reason behind this given was that the expected cost of financial distress not only depend upon the probability of trouble but also on the value lost if any trouble happens. Therefore, the firms with intangible specialised and growth opportunities tend to lose more value as compared to other firms (Myers S. C., 1984).

The presence of financial distress will reduce the wealth of shareholders, debt holders and equity holders. Myers (1984), Fama and French (2002) and Titman and Wessels (1988) and many other scholars stated that bankruptcy cost and financial distress is necessary for the firms to get to a decision of optimal capital structure. They mentioned that large firms and firms with huge profits tend to have less cost of financial distress and thus they prefer to have higher debt in comparison to book assets of theirs.

2.2.3 Optimal Capital Structure

The idea of optimum capital structure was given in the theory proposed by Modigliani and Miller (1958) but the theory was based on certain irrelevance propositions. Further the effect of tax benefits and cost of financial distress and bankruptcy cost has been included in the modern theory of optimal capital structure. Firm’s optimum debt ratio is determined by the trade-off between cost and benefits.
of borrowing debt. The benefit of having tax shield due to extra debt is compensated with the cost of financial distress, which helps to determine the optimum debt level for the firm. There are some previous papers on optimal capital structure by Robichek and Myers (1966) and Baxter (1967) etc. Later scholars like Bradley et al. (1984), Harris and Raviv (1990) formed the model for optimal structure. The model to attain optimum capital structure given by them,

\[
V_L = V_U + PV \text{ (Tax-Shield)} - PV \text{ (Financial Distress Costs)}
\]

The value of the levered firm is equal to the value of the unlevered firm and adding the present value of the tax shield arises due adding debt in the capital structure and subtracting the present value of the cost of financial distress due to debt. This gives us the idea about the cost and benefits attached with the debt financing. This leaves the firm to choose a perfect combination in which the tax shield advantage is more than the cost of financial distress so that they can maximise the firm’s value. As we increase the level of debt then the probability of financial distress and cost tends to increase. And this will reduce the advantage of the tax shield and eventually the advantage of tax shield will disappear.

![Figure 2.3: The Static Trade-Off Theory of Capital Structure (Shyam-Sunder & Myers, 1999)](image)

From the Figure 2.3 we can see that the cost of financial distress is quite less till a certain point and from that on it increases rapidly with increase in borrowing. And if the firm keeps on borrowing debt then the firm loses the tax shield advantage from borrowing additional debt and eventually the tax advantage disappears as the firm is likely to go bankrupt (Brealey, Myers, & Allen, 2010).

### 2.3 Pecking Order Theory

The theory that challenges the Trade-off Theory for providing the solution for the capital structure puzzle is the Pecking Order Theory. The theory took shape from the study done by Donaldson (1961).
The Pecking Order Theory is considered the main alternative and the strongest challenge to the Static Trade-Off Theory (Megginson, Smart, & Gitman, 2007). Myers and Majluf (1984) further developed the study. Donaldson (1961) mentioned in his paper that the management prefer to finance their need with internal funds rather than opting for issue of common stock. Based on the results of Donaldson (1961) that managers prefer internal financing rather than issuing new shares; Myers and Majluf (1984) assumed that the investors are unaware of the true value of the existing assets and the future opportunities available to the firm except in the perfect financial market. Moreover, they argued that managers act in the interest of existing shareholders, and refuse to issue undervalued shares unless the transfer from old to new stockholders is more than offset by the net present value of the growth opportunity (Myers S. C., 2001). The value of share falls because of the information with the investors is interpreted as bad news and even some companies prefer not to issue if the asset-in-place is undervalued even if they have a positive net present value opportunity. Megginson et al. (2007) explained the two main assumptions behind the Pecking Order Theory. First, that the managers have better information about their own firm’s prospects than the investors in from the outside (asymmetric information) and managers works in the best interests of the existing shareholders. There were many other scholars (Narayanan, 1988; Heinkel and Zechner, 1990) who later followed the model of Myers and Majluf (1984) and came with the similar results.

The information asymmetry causes the firms to choose internal capital rather than debt financing or equity financing. The adverse selection model of Myers and Majluf (1984) argues that information asymmetry can cause the investors to be less informed about the firm and lead to the problem of under-investment and the firm may give up on positive NPV projects if they feel that the equity is undervalued. According to Myers and Majluf (1984), managers find it difficult to convey all the information to the outsiders and the problem will vanish if the information can be conveyed without any cost. The model by Myers and Majluf (1984) was based on certain assumptions and some of them are, (1) Perfect Capital Markets; (2) No Transaction Cost for issuing Stocks; (3) market value of the firm’s shares equals their expected future value conditional on whatever information the market has; (4) The firm has one existing asset and one opportunity requiring investment which can be financed by issuing stock, using cash balance or selling a marketable security which is known as financial slack in the model (Myers & Majluf, 1984).

In order to deal with the problem of adverse selection, firms try to follow the pecking order of the funds available and will utilise the least risky funds. The Pecking Order Theory of capital structure shows that the firm uses a hierarchy while making the financing decisions. The order of preference used by the firms is (1) Internal financing; (2) Debt; (3) Convertible securities (4) Preferred stock (5) Common stock (Brealey, Myers, & Allen, 2010). Shyam-Sunder and Myers (1999) said that the Pecking Order Model is not for choosing the target debt level; the model is more of treating the debt ratio as cumulative consequences over a period of time due to financial decisions compatible to
hierarchy. They also said that the problem of financial deficit arises when the firm’s internal funding is not sufficient for investments and paying of dividends.

According to Shyam-Sunder the Pecking Order Theory does not define a target debt ratio, according to the theory firm’s priority is not the advantage of tax-shield and cost of financial distress. Firm’s leverage alters because of imbalance of external and internal financing. Specially like internal cash flow, dividend payment, investment opportunity. The firms with high profits and limited investment opportunity prefer to have low debt ratios. If the firm in not able to finance an investment opportunity then it opt for increasing the debt ratio. The model predicted that the leverage is related with the two determinants which are profitability and investment opportunity.

Overall Pecking Order Theory implies:

1) Firms prefer internal to external finance. (Information asymmetries are assumed relevant only for external financing.)

2) Dividends are "sticky," so that dividend cuts are not used to finance capital expenditure, and so that changes in cash requirements are not soaked up in short-term dividend changes. In other words, changes in net cash show up as changes in external financing.

3) If external funds are required for capital investment, firms will issue the safest security first, that is, debt before equity. If internally generated cash flow exceeds capital investment, the surplus is used to pay down debt rather than repurchasing and retiring equity. As the requirement for external financing increases, the firm will work down the pecking order, from safe to riskier debt, perhaps to convertible securities or preferred stock, and finally to equity as a last resort.

4) Each firm's debt ratio therefore reflects its cumulative requirement for external financing (Myers S. C., 2001).

2.3.1 Criticism of Pecking Order Theory
As most of the theories of Capital Structure, the Pecking Order Theory is not free from criticism. Liesz (2001) mentioned some of the major errors in the theory, according to the author the Pecking Order theory wasn’t able to explain the influence of taxes, financial distress, security issuance costs, agency costs, or the set of investment opportunities available to a firm upon that firm’s actual capital structure. It also ignores the problems that can arise when a firm’s managers accumulate so much financial slack that they become immune to market discipline. In such a case, it would be possible for a firm’s management to preclude ever being penalized through a low security price and if augmented with non-financial takeover defences, immune to being removed in a hostile acquisition. For these reasons pecking order theory is offered as a complement rather than a substitution for the traditional trade-off model (Liesz, 2001). The theory ignores significant agency problems that arise when too
much financial slack makes managers immune to market discipline. And empirical studies do not find a negative relation between leverage and profitability (Megginson, Smart, & Gitman, 2007). Research by Frank and Goyal (2003) suggested that equity also work same as debt in case of financial deficit, the results contradicts the pattern which was given according to the Pecking Order Theory.

2.3.2 Pecking Order Theory vs. Trade-Off Theory

Both of these theories are not fully independent of each other in explaining the optimal capital structure and thus criticized by many researchers. There is literature which has compared the two theories empirically and theoretically [Fama and French (2002), Shyam-Sunder and Myers (1999), Watson and Wilson (2002) and Griner and Gordon (1995)]. Both the theories are not totally exclusive so here is a comparison between both the theories.

The Trade-Off Model is useful for explaining corporate debt levels; Pecking Order Theory is superior for explaining capital structure changes (Liesz, 2001). The Trade-Off Theory is more of explaining the Optimal Capital Structure by weighing the cost of financial distress and benefits of tax-shield gained because of additional debt in the capital structure. Whereas the Pecking Order theory helps in the explanation of capital structure changes, which allows for the dynamics of the firm to dictate an optimal capital structure for a given firm at any particular point in time (Copeland, Weston, & Shashtri, 2003). The major difference between the two theories has been well defined and explained by Liesz (2001).

<table>
<thead>
<tr>
<th>Pecking Order Theory</th>
<th>Trade-Off Theory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Considers managerial motivations</td>
<td>Conforms with value maximizing construct</td>
</tr>
<tr>
<td>Allows for a dynamic capital structure</td>
<td>Assumes a relatively static capital structure</td>
</tr>
<tr>
<td>Considers the influence of financial slack and availability of positive-NPV projects</td>
<td>Considers the influence of taxes, transaction costs, and financial distress</td>
</tr>
<tr>
<td>Acknowledges capital market “signals”</td>
<td>Ignores the impact of capital market “signals”</td>
</tr>
<tr>
<td>Acknowledges proprietary data concerns</td>
<td>Ignores concerns regarding proprietary data</td>
</tr>
<tr>
<td>Explains many real-world practices</td>
<td>Cannot explain many real-world practices</td>
</tr>
</tbody>
</table>

Table 2.3: Comparison of Trade-off and Pecking Order Theory Traits (Liesz, 2001)
Both the theories were able to give some information about the optimal capital structure but none of theory provides a complete and sufficient answer to the optimal capital structure model. Both the theories have to supplement each other in order to provide a more precise answer to the capital structure puzzle. There are more theories available which helps in explaining the capital structure puzzle with some new and discussed elements.

2.4 Agency Cost Model

According to the Agency Cost Theory, the optimal capital structure can be achieved by minimising the cost arising from the conflicts between the parties involved. The basics for the theory was laid by Fama and Miller (1972) which was later on developed by Jensen and Meckling (1976). According to the agency relationship as a contract under which one or more persons (the principal(s)) engage another person (the agent) to perform some service on their behalf which involves delegating some decision making authority to the agent (Jensen & Meckling, 1976). Jensen and Meckling (1976) and Jensen (1986) argued that the debt is not just included in the capital structure because of the tax-benefits associated with debt but also included because debt reduces the problem of agency cost between the shareholders and managers. According to the Jensen and Meckling (1976) the incentive problems arises because of partition of the people who owns and control the firm and they found two major type of conflict that arises within agency cost, between shareholders and managers and between debt holders and shareholders.

2.4.1 Conflict between Shareholders and Managers

Payouts to shareholders reduce the resources under managers’ control, thereby reducing manager’s power, and making it more likely they will incur the monitoring of the capital markets which occurs when the firm must obtain new capital (Jensen, 1986). According to Jensen (1986), Managers prefer their firms to grow beyond the optimal size as the increase in the size increases their control. In addition, manager’s compensation is directly related to the growth of the firm sales. The managers usually receive remuneration instead of part of profits, and so managers prefer to get high benefits but that reducing the profits. Increasing debt commits the firm to pay out cash. Therefore, it reduces the amount of free cash flow available to the managers and the opportunities of such profligacy and empire building (Jensen, 1986). With increase in the debt in capital structure and keeping the manager’s investment constant usually increases the manager’s share of equity and lessens the loss arising out of the conflict between the mangers and shareholders (Datta & Agarwal, 2009). As there is always a problem of diverge interests of managers and shareholders there are potential forces which will help to reduce the problem of diverge interests such as making senior management as stock holders (Jensen, 1986); dependency on outside management; including the performance of managers while paying them (Byrd, Parrino, & Pritsch, 1998). These measures are not a perfect solution and even after these forces, managers overlook these forces and work toward achieving their interest.
2.4.2 Conflict between Shareholders and Debt Holders

This conflict arises due to the risk of default, as when the shareholders can gain at the cost of the debt holders. This case arises when the managers act in favour of the shareholders and the risk of default is significant to the firm. The manager got certain ways through which they can favour the shareholders. The manager can increase borrowing and payout cash to stockholders that will result in constant value for firm but decline in value of debt and manager may conceal the problem from the credit holder and hence preventing them to force bankruptcy, this lead the maturity of the debt to increase and make the debt more riskier (Myers S. C., 2001). The reason behind the conflict between the shareholders and debt holders is because of the difference in the risk appetite and the expected return. Debt holders are concerned about the current profit as it will ensure their return whereas equity shareholders might be willing to forgo the current profit for long-term capital appreciation. As a result, equity shareholders could invest even in risky projects with long gestation periods, which mark the interest of debt holders (Datta & Agarwal, 2009).

Therefore, the consequences of including the debt have two-sided effect. The agency cost arising due to conflict between the manager and shareholders reduces with the inclusion of debt in the capital structure and the cost from the conflict of shareholders and debt holder increases with the increase in debt. According to Jensen and Meckling (1976), the optimal capital structure could be achieved with the trade-off between these agency costs and they also said that the agency cost model predicted a negative association of leverage with growth opportunities.
Chapter 3: Empirical Studies & The Theoretical Determinants of Capital Structure

In the previous chapter, we have discussed the influential theories regarding the optimal capital structure. The earlier research done by the scholars usually placed more emphasis on countries like US and other developed economies regarding the firm based characteristics such as bankruptcy cost, taxation and asymmetric information. There are many variables that has been tested by various researchers and scholars to test empirical validity of capital structure. To get a fair idea the determinants are explained briefly in the section below.

3.1 Profitability

Profitability could be defined as earning power of the firm. We can say profitability as the ratio of earnings before interest, tax, and depreciation to total assets of the firm. The firm’s profitability is a matter of great importance to get an optimum capital structure. Under the Pecking Order Theory, Myers (1984) cited evidence from Donaldson (1961) that the firm raises capital in a preferred sequence. The firm’s first choice of preference is internal funding and only when internal funding is not sufficient then the firm opt for debt rather than issuing more equity. And for the Trade-Off Theory the firms gets advantage of including debt in the capital structure to avail the debt tax-shield but in order to claim the advantage of the tax shield, firm need to be in profit. Therefore, the past profitability of the firm is an important determinant for the current capital structure of the firm. The theories suggests that a very low profitable firm with a slow growth rate will use less level of leverage than the firms in the same industry will rely heavily on debt financing than the other firms in the same industry (Ozkan, 2001). The Pecking Order Theory creates a negative relationship between the leverage level and the profits of the firm. Therefore, according to the theory a negative relationship should hold between debt and profitability. Toy et al. (1974), Kester (1986), Titman and Wessels (1988), Bennett and Donnelly (1993), Rajan and Zingales (1995), Bevan and Danbolt (2002) and Ozkan (2001) all found an inverse relationship between level of gearing and profitability.

The result of the Trade-Off Theory provides contrary result to the Pecking Order Theory. The Trade-Off Theory of capital structure suggests that profitable firms would prefer to opt for more debt which would be needed to shield the larger profits generated from corporate taxes. This establishes a linear relation of gearing ratio and profitability. So higher the profitability of the firm, higher the level of debt in the capital structure of the firm.

3.2 Firm Size

Firm size is one of the most common determinants while explaining the company’s debt level. The firm size and leverage provides very astonishing results. There is literature present which states that
there is no conclusive relation between leverage and firm size. The research that there is no systematic relationship exist between leverage and the size of the firm is backed by Ferri and Jones (1979), Kim and Sorensen (1986) and Chung (1993). The study conducted by Ferri and Jones (1979) provided some relation between the leverage and firm size but the results was not able to explain the relation properly and the study by Chung (1993) found negligible relationship between the firm size and the use of debt in the capital structure. There have been various measured used by various researchers and scholars to calculate the firm size: logarithm of sales (Titman & Wessels, 1988) (Rajan & Zingales, 1995), logarithm of total assets (Chen J. J., 2003).

The Trade-Off Theory states a positive relationship between the size of the firm and the debt level in the capital structure. This implies that larger firm will be more dependent on the debt as compared to the small firms. Bankruptcy cost is deemed to be the most obvious reason behind the positive relation between debt and size of the firm as it is strongly related to the firm size. Bankruptcy cost usually has greater proportion in the firm’s value as that value decreases because of the economies of scales present in the bankruptcy cost (Warner, 1977). Later Titman and Wessels (1988) supported this statement by providing proof that the large firms are usually more diversified and are much safer as compared to smaller firm in respect of bankruptcy cost. Large firms may be able to exploit economies of scale in issuing securities (Chen & Strange, 2005). It is backed up by other Marsh (1982) that large firms have a bargaining power over their capital supplier, they issue debt instead of equity, and hence the larger firms have higher level of debt in their capital structure borrowed at rates that are more feasible. There been evidences that large firms have certain advantages when compared with the smaller firm. The large firms tends to have less agency costs, stable cash flows, easy access to credit market and they engage in high debt financing practices to increase the advantage of debt tax shield (Deesomsak, Paudyal, & Pescetto, 2004)

However, the other important theory of capital structure i.e. Pecking Order Theory suggest negative relation between firm size and the leverage of the firm. It was stated by Gupta (1969) that the cost of acquiring equity financing is quite high for smaller firms and the management is more reluctant in opting for new equity capital because of the psychological reasons such as losing control. This led the small firms to rely on debt for most of the financing issues. Thus it is expected that smaller firms may have more debt in their capital structure as compared to the larger firms as acquiring equity for finance is an expensive option, the smaller firms may prefer short-term debt instead of long-term debt as fixed cost associated with the short-term debt is less. Rajan and Zingales (1995) also mentioned negative relation between leverage and debt level. Bates (1971) stated that small firms prefer internal financing rather than raising money via equity or debt because both the sources are more expensive for small firms and the statement was supported by Voulgaris, Asteriou & Agiomirgianakis (2004).
3.3 Growth Opportunities

The empirical evidences available for the relationship between the growth opportunities and firm’s leverage level provide a mixed result. Titman and Wessels (1988) found negative relationship between the leverage and the growth opportunities available to the firm and Rajan and Zingales (1995) also found the same result for the gearing ratio and growth opportunities for the G7 countries and similar results were found by Gul (1999) while studying the growth opportunities and capital structure of the Japanese firms. However, Kester (1986) found no evidence that can support the negative relation. There were contradicting results found by Chen (2003), the results showed a positive relation of firms leverage and growth opportunities while studying the data of Chinese firms which was consistent with other developed economies except for US. Growth opportunities has been defined by Titman and Wessels (1988) as “growth opportunities are capital assets that add value to a firm but cannot be collateralized and do not generate current taxable income”.

The agency cost is deemed to be one of the important determinants of leverage (Jensen & Meckling, 1976). “The cost associated with this agency relationship is likely to be higher for firms in growing industries, which have more flexibility in their choice of future investments. Expected future growth should thus be negatively related to long-term debt levels.” (Titman & Wessels, 1988). The problem could show opposite results if the firm switch the use of long-term debt to short-term debt (Myers S. C., 1977).

The Trade-Off Theory provides with a different results while taking growth opportunities and gearing ratio in mind. According to the Trade-Off Theory, the firms prefer to utilise less debt as it increases the expected cost of bankruptcy for the firm. Firms with higher ratio of tangible assets are more comfortable in borrowing rather than the firm holding more of intangible assets because intangible assets cannot be used as collateralization for the growth opportunities. According to Myers (1984), specialised intangible assets or growth opportunities are the first few things that lose their value in the time of financial distress.

On the other hand the Pecking Order Theory gives us a positive relation between the gearing ratio and growth opportunities as the firm with growth opportunities will require huge amount of funds and internal financing won’t able to provide sufficient funding for the firm. In addition, according to the Pecking Order Theory when external financing is required firm will opt for debt first and then only will shift to equity (Frank & Goyal, 2003).

There have been various measurements used by various researchers while measuring the firm’s growth opportunities. Some of the widely used measurements are: market-to-book ratio of total assets (Myers S. C., 1977), (Ozkan, 2001); annual growth rate of firm’s assets (Titman & Wessels, 1988),
Kester (1986) used an exceptional measure which is the average of net debt divided by market value of equity.

### 3.4 Asset Tangibility

Tangibility has been defined as the ratio of fixed assets to the total assets by Rajan and Zingales (1995) and Titman and Wessels (1988). The Pecking Order Theory and the Trade-Off Theory both states that the asset composition of the firm has role in shaping up the capital structure of the firm. The Trade-Off Theory states a positive relation between tangibility of assets and leverage of a firm because of the simple reason that the fixed assets can be utilised as collateral for debt financing. The use of tangible assets as collateral to reduce the risk of lender from suffering the agency cost of debt and the tangible assets hold more value at the time of liquidation and thus the greater the value of fixed assets helps the company to gain access to debt easily (Rajan & Zingales, 1995). Scott (1977) suggested that firms that are not able to provide collateral for the debt financing usually forced to issue equity or pay higher interest rates. Therefore, companies with higher level of tangible assets get the debt easily. Thus, a positive relationship between tangibility of assets and leverage is anticipated which is confirmed by various scholars Titman and Wessels (1988) and Rajan and Zingales (1995), Marsh (1982).

Jensen and Meckling (1976) and Myers (1977) argued that the firms with high amount of debt in their capital structure tends to under invest or invest optimally and hence transferring the wealth from debt holders to equity holders. And the lenders usually ask for collateral to make their position safe as providing with secure debt can lighten this problem.

Under the Pecking Order Theory it is stated that firm with high level of tangible assets have less asymmetrical information, and hence prefer equity financing (Harris & Raviv, 1991). Researchers like Harris and Raviv (1991) and Frank and Goyal (2003) stated that firm with low level of tangible assets prefer to acquire as much debt as possible and become highly levered and if adverse selection is about assets in place, tangibility would increase adverse selection and results in higher debt (Frank & Goyal, 2003).

Results of most of the studies conducting about testing relationship between tangibility of assets and leverage of firm showed positive relation between both of them. There are different measures of tangibility taken by different researchers, the ratio of fixed to total assets by Rajan and Zingales (1995), Chung (1993) and the ratio of total net amount of fixed assets (cost of fixed assets minus accumulated depreciation) by total assets by Shah and Khan (2007).
3.5 Non-Debt Tax Shields

The proxy of non-debt tax shields can be measured by total annual depreciation charges and investment tax credits on the sum of annual earnings (Bradley, Jarrell, & Kim, 1984), ratio of annual depreciation to total assets (Titman & Wessels, 1988), (Chen J. J., 2003).

With the non-debt tax shield the main theories of capital structure agrees in the same notion. Both, the Pecking Order Theory and the Trade-Off Theory implies that it is inversely related to the leverage of the firm. This indicates that firm with higher advantage of non-debt tax shield will prefer to use less debt in their capital structure (DeAngelo & Masulis, 1980), (Myers S. C., 1984), (Myers & Majluf, 1984). Ozkan (2001) and Modigliani and Miller (1963) argued that with other tax shields available to the firm such as depreciation and investment tax credit deductions, the value of debt-tax shields reduces and the firm is not very keen in raising debt for the advantage of debt-tax shield. The Trade-Off Theory suggests that one of the main motivations behind including debt in the capital structure is saving corporate tax. According to DeAngelo and Masulis (1980) suggested that the marginal value of tax-debt shield reduces with every unit of debt added, and with the presence of non-debt tax shield, the debt turns out to be more expensive. Overall, the higher the level of non-debt tax shield reduces the potential tax benefit attached with the introduction of debt in the capital structure. There only very few studies which shows the contradicting relation between the leverage and non-debt tax shield. Most of the empirical evidences show a negative relation between non-debt shield and leverage but Bradley, Jarrell & Kim (1984) researched showed a positive relation between these two.

3.6 Volatility

Earning volatility is a proxy for the probability of financial distress and it is generally expected to be negatively related with leverage (Huang & Song, 2006). The volatility of earnings is defined as the absolute difference between the annual percentage change in earnings before interest and taxes and the average of this change over the sample period (Deesomsak, Paudyal, & Pescetto, 2004). Various other author explained volatility differently. “Several measures of volatility are used in empirical studies, such as the standard deviation of the return on sales (Booth, Aivazian, Kunt, & Vojislav, 2001), standard deviation of the first difference in operating cash flow scaled by total assets e.g., (Bradley, Jarrell, & Kim, 1984), (Chaplinsky & Niehaus, 1993), (Wald, 1999) or standard deviation of the percentage change in operating income e.g., (Titman & Wessels, 1988).” (Huang & Song, 2006).

Higher volatility of earnings increases the probability of financial distress, since firms may not be able to fulfil their debt servicing commitments. Thus, firm’s debt capacity decreases with increases in earnings volatility leading to an expected inverse relation with leverage (Deesomsak, Paudyal, & Pescetto, 2004). However, Modigliani–Miller theorems state that variance of firm’s asset increases then the systematic risk of equity starts to decline. Hence, the risk is positively related to leverage. According to the Trade-Off Theory, large earning volatility leads to an increase probability of
financial distress and hence making it difficult for the firms to acquire more financing via means of debt.

3.7 Industries Classification

The firm within a particular industry group have different impact on the leverage capacity of the firm. Each industry has its unique and distinguished characteristics which have its impact on shaping up the capital structure. Usually the firm that comes under the same industry within the same country usually displays similar characteristics like the utility industry comes under highly levered industry and high technological industry comes under low-levered industry.

The impact of a particular industry was studied by Bradley et al. (1984) conducted a research to investigate the cross-sectional behaviour for 851 firms across 25 industries to examine the 20 year average of firm’s leverage ratio. The evidence from the study suggested that industry factor has a strong influence on the leverage ratio of the sample firms. Harris and Raviv (1991) supported the same evidence in their research. The list of the companies used in the research is given in Appendix 1 with the respective industry classification.

The studies conducted by various scholars like Bradley et al. (1984) and Kester (1986) mainly divided industries producing drugs, instruments, electronics and food into low levered industries and industries producing paper, textiles, steel, airlines as highly levered industries.
So the above-mentioned variables are used for this research and a summary of various studies related to the above variables is presented below:

<table>
<thead>
<tr>
<th>Determinants</th>
<th>Expected Theoretical Relation</th>
<th>Supporting Theory</th>
<th>Empirical Evidences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profitability</td>
<td>Negative</td>
<td>Pecking Order Theory</td>
<td>Shyam-Sunder and Myers (1999); Griner and Gordon (1995); Kester (1986).</td>
</tr>
<tr>
<td>Size</td>
<td>Negative</td>
<td>Pecking Order Theory</td>
<td>Kester (1986); Titman and Wessels (1988).</td>
</tr>
<tr>
<td>Volatility</td>
<td>Negative</td>
<td>Trade-Off Theory</td>
<td>Bradley et al. (1984); Huang &amp; Song (2006).</td>
</tr>
</tbody>
</table>

Table 3.1: Impact of various determinants on gearing ratio of firm presented with empirical evidences and related theories (Chen J. J., 2003).
Chapter 4: Research Methodology and Data Description

In the previous chapters, we have discussed the literature available on capital structure and various previous empirical evidences, the theoretical determinants of the capital structure. Now this chapter will introduce the methodology and the data collection used for our empirical study to investigate the determinants and factors that affect the capital structure decision making of a firm.

4.1 Data Collection

The data for the researcher is collected from DATASTREAM which offers information about the balance sheets and income statements for all the listed firms. The detailed list of all the companies listed under FTSE 350 on London Stock Exchange index is mentioned and data for the 10 years that is from 2002 to 2011 is collected for this research.

The research does not include all the companies listed in FTSE 350 Index on London Stock Exchange. Not all the firms are suitable for this research and to provide a better and more reliable result the data required sampling. Therefore, the suitable sampling is done for the data based on the following criteria. Firstly, the firms that are selected for the sample should not belong to the category of financial institutions such as banks, insurance companies, real investments companies and stock agents as their financial structure is quite different from non-financial companies (Chen J. J., 2003). In addition, the firms whose data was not fully available on the database is also excluded to make balanced panel dataset.

An ideal study would include all the data available on the companies listed on FTSE 350 on London Stock Exchange for a long period of time but because of the constraints of time and data availability, 178 companies has been selected from different industries for a period of 10 years from 2002 to 2011.

4.2 Description of Variables

After going through so many empirical and theoretical reviews, there are various definitions available for the gearing ratio and the determinants of capital structure. For this study, we will analyse two different dependent variables, which are long-term leverage and short-term leverage. All the independent variables regarding this research has been taken from the literature mentioned above and after considering work of various scholars on the determinants of capital structure, the independent variables used in this research are profitability, firm size, growth opportunities, asset tangibility, non-debt tax shields and firm’s volatility.

4.2.1 Dependent Variables

The research question mainly focuses on the determinants and factors affecting the firms borrowing pattern, for this the debt-equity ratio or the gearing ratio is the preferred dependent variables. There
been various measures to calculate the gearing ratio by various researchers in the past. While finding out the impact of various determinants on the gearing ratio we first have to distinguish between the market value and book value. There is been research done by various researchers to show the contrast between the market value and book value results. Even after so many years of research there is been debate about which values should be used as a proxy of leverage, whether we should use market values or the book values. Bowman (1980) argued that using book values in place for market value will have effect on the research although the effect will be small.

There is been various views on using book value and market value while observing capital structure. Frank and Goyal (2008) stated that book value of debt is backward looking and only measures what has already taken place in the firms and market value of debt is a forward-looking approach. Myers (1984) said that book value is just a measure that reflects the assets of the firms whereas market value reflects assets of the firm along with intangibles, growth opportunities present to the firm. There is been various researchers and scholars (e.g. Rosenberg and McKibben (1973)) who prefers market value of debt over the book value of debt wherever it is possible for them to include in their empirical studies.

On the other hand, there are scholars who justify the use of book value of debt as a proxy for leverage. Bowman (1980), Marsh (1982), Titman and Wessels (1988) suggested and showed that the cross-sectional correlation between the market value and book value is very large and the misspecification arises due to the use of book value in place of market value will be quite small. Therefore, it can be concluded that there should not be any major bias if book value of debt is used instead of market value of debt. According the research conducted it was found that the 83% of the respondents use book values to measure debt to equity ratio rather than the theoretically-supported market values which is used by 12% and the result also showed that 5% use both of the values (Beattie, Goodacre, & Thomson, 2006). And due data constraints and keeping in mind the various arguments presented by various scholars, this paper will measure debt in terms of book values instead of market values.

For the definition of leverage there are a lot of views present by various scholars. Rajan and Zingales (1995) gave one of the broadest definitions for leverage. According to them leverage is the ratio of total liabilities to total assets. However, it is known that when the firm raises capital, it considers various kind of debt option available to the firm. Hence, the different kind of debt available should be differentiated based on its maturity as long-term debt and short-term debt. There are many empirical evidences that suggest that the long-term and short-term debt has different effect on the financial decisions of the firm. Even the cost related to acquiring long-term debt and short-term debt is different. Therefore, it is important to know the different type of debt available to a firm based on maturity. Therefore, for this study we have used both short-term debt and long-term debt to be the dependent variables in the model.
**Long-Term Leverage:** Long-term leverage is defined as the ratio of long term debt to total assets of the firm. Long-term debt includes all the debt instruments that are payable in a period more than a year.

**Short-Term Leverage:** Short-term leverage is defined as the ratio of short-term debt to total assets of the firm. Short-term debt include all the debt instruments that are payable within a period of one year.

The following table presents the formula used to calculate the long-term and short-term leverage:

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long-Term Leverage (LTLEV)</td>
<td>( LTLEV = \frac{\text{Total Long-Term Debt}}{\text{Total Assets}} )</td>
</tr>
<tr>
<td>Short-Term Leverage (STLEV)</td>
<td>( STLEV = \frac{\text{Total Short-Term Debt}}{\text{Total Assets}} )</td>
</tr>
</tbody>
</table>

Table 4.1: Measurement used for the dependent variable

### 4.2.2 Independent Variable

After comparing the empirical research conducted by various researchers, we have taken certain measures used to calculate the independent variables used for this research. We have used profitability, firm size, growth opportunities, asset tangibility m non-debt tax shield and volatility to test the prediction of trade-off, pecking order and agency theory.

**Profitability:** Profitability is calculated by pre-tax profits (EBITD) to total assets. The same measure is used by many researchers (e.g. Bevan and Danbolt (2004); Ozkan (2001)) in their research conducted.

\[
\text{PRO} = \frac{\text{Profit Before Tax and Depreciation}}{\text{Total Assets}}
\]

**Firm Size:** Firm size is represented by the logarithm of total assets, the log smoothen the variation in the figure over the period of time (Shah & Khan, 2007).

\[
\text{SIZ} = \ln(\text{Net Sales})
\]

**Growth Opportunities:** Growth opportunity is measured by the percentage change in the total assets of firms during the period selected. The same measure is used by the study conducted by Rajan and Zingales (1995).

\[
\text{GRO} = \frac{\text{Total Assets}_t - \text{Total Assets}_{t-1}}{\text{Total Assets}_{t-1}}
\]
**Asset Tangibility:** This is calculated by the ratio of fixed assets to total assets (Titman & Wessels, 1988), (Rajan & Zingales, 1995).

\[
TAN = \frac{\text{Fixed Assets}}{\text{Total Assets}}
\]

**Non-Debt Tax Shield:** This is measured as a ratio of annual depreciation divided by total assets (Chen J. J., 2003), (Bradley, Jarrell, & Kim, 1984).

\[
NDTS = \frac{\text{Depreciation}}{\text{Total Assets}}
\]

**Earnings Volatility:** Earnings volatility is defined as the absolute value of the first difference of the growth rate of operating income (Chen J. J., 2003).

\[
VOL = \left| \frac{\text{EBIT}_t - \text{EBIT}_{t-1}}{\text{EBIT}_{t-1}} - \frac{\text{EBIT}_{t-1} - \text{EBIT}_{t-2}}{\text{EBIT}_{t-2}} \right|
\]

**Industry Classification:** Industries are classified using the dummy variables. The firm within a specific group industry (9 industries, Appendix 2) is given as one and other being zero to know the impact on gearing ratio.

### 4.3 Research Model

For this study, we have used quantitative methods over the qualitative methods. In the following part, we are using the static model to investigate the impact of various independent variables chosen on the short-term leverage and long-term leverage of the firm. We have used ANOVA and panel analysis models with the help of the statistical software named STATA 11.

#### 4.3.1 ANOVA for Industry Classification

We have used dummy variables in our model named industry classification. We have used One Way ANOVA to examine the effect how the industry classification has effect on the firms short-term and long-term leverage.

The main purpose of conducting the ANOVA test is know whether the difference between sample is because of random errors or whether there was a systematic treatment difference which led the score of one group different than the other group. In our research, we are conducting the analysis of variance to check the impact of industrial classification on the leverage through comparing the variance among the different groups which is due to independent variable with the variability within each of the groups which is due to chance. In the recent years, many scholars have included dummy variables for industry and using regression for the industry dummies against the leverage. Ozkan (2001) said that firm belongs to certain industry enjoys the conditions like entry barriers, and factor
market conditions. We will test the industry effect by regressing industry dummy variable against the long-term and short-term leverage. The model for the same is given below:

\[ STLEV = \alpha + \sum \beta_i IND_i + e_i \]

\[ LTLEV = \alpha + \sum \beta_i IND_i + e_i \]

Here \( STLEV \) is short-term leverage and \( LTLEV \) is long-term leverage, \( \alpha \) is the constant number which indicates the interception for the regression line. \( IND_i \) is the industry specific dummy used to represent the industry classification. And \( \beta_i \) is the coefficient what our regression model will derive, representing the variation to leverage of different industries.

### 4.3.2 Panel Analysis for Trade-Off Theory, Pecking Order Theory and Agency Cost

In the previous studies, we have seen use of OLS regression on cross-sectional data and in the recent papers, the scholars took the advantage of improved technology and used panel data regression, which involves both cross-sectional and time-series observations.

Panel data is pooling observations of cross-sectional over a period of time. To be more precise the panel data is more effective than either cross-sectional data or time-series data alone as it has the features of both the data sets to analyse the capital structure of the firms. We are using panel regression to show the relationship between the long-term and short-term leverage against the various determinants (size, profitability, non-debt tax shield, asset tangibility, earning volatility, growth opportunities).

There are various researchers which have used panel data for their research such as Ozkan (2001), Bevan and Danbolt (2004), Chen (2003) because the panel data has various advantages over the cross-sectional and time-series research methods. The panel data has a large amount of data points, which increases the degree of freedom, and hence it reduces the co-linearity between the explanatory variables which overall improves the overall results (Hsiao, 2003).

In order to explain the determinant of UK firms’ leverage ratio, a standard regression approach which is followed in most of the existing empirical literature is applied in our study has shown below:

\[ STLEV_{it} = \beta_0 + \beta_1 PRO + \beta_2 SIZ + \beta_3 GRO + \beta_4 TAN + \beta_5 NDTS + \beta_6 VOL + \varepsilon_{it} \]

\[ LTLEV_{it} = \beta_0 + \beta_1 PRO + \beta_2 SIZ + \beta_3 GRO + \beta_4 TAN + \beta_5 NDTS + \beta_6 VOL + \varepsilon_{it} \]
Where

\( i \) represents the individual firm, in our case 1, 2, 3…… 237, 238, 239.

\( t \) represents the time period, in our case 2002-2011.

\( \varepsilon \) represents the error term.

\( \beta_i \) represents the coefficient of the independent variables.

The dependent and independent variables are the determinants of firm’s capital structure which are explained in the above chapter.

The null and alternative hypotheses for this model are:

\[
H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6
\]

That is, none of the explanatory variables could explain UK firms’ capital structure decisions.

\[
H_1: \beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6 \neq 0
\]

That is, at least one of the independent variables accounts for UK firms’ borrowing policies.
Chapter 5: Empirical Results and Analysis

In this chapter we will provide the statistical results and analyse the outputs of the test conducted (ANOVA, Panel Data Model and Pooled OLS) to know about which determinants effects the capital structure decision and how these determinants affects the capital structure. The findings of the above tests are interpreted, evaluated and compared to the theoretical predictions and previous empirical studies.

5.1 Multicollinearity

Before running the regression analysis, we need to check that our data is free from multicollinearity. Collinearity exists when two variables have a significant relationship irrespective of the sign. Multicollinearity exists when there are more than two variables involved. For the check of multicollinearity, we have used correlation matrix and VIF (Variance Inflating Factor). There are various problems involved with multicollinearity (a) P value can be high, even though the variable is important; (b) confidence intervals on the regression coefficients will be very wide which will lead to accept the “zero null hypothesis” more readily, etc. (Farrar & Glauber, 1967). The correlation matrix is shown on the next below:

<table>
<thead>
<tr>
<th></th>
<th>STLEV</th>
<th>LTLEV</th>
<th>TAN</th>
<th>VOL</th>
<th>GRO</th>
<th>NDTs</th>
<th>PRO</th>
<th>SIZ</th>
</tr>
</thead>
<tbody>
<tr>
<td>STLEV</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LTLEV</td>
<td>-0.0855</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TAN</td>
<td>-0.0019</td>
<td>0.0320</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VOL</td>
<td>-0.0032</td>
<td>-0.0020</td>
<td>-0.0312</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GRO</td>
<td>0.0190</td>
<td>-0.0412</td>
<td>-0.0575</td>
<td>0.0296</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NDTs</td>
<td>0.0196</td>
<td>0.2037</td>
<td>0.4975</td>
<td>0.0060</td>
<td>-0.1505</td>
<td>1.0000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PRO</td>
<td>0.0214</td>
<td>0.0041</td>
<td>0.1292</td>
<td>-0.0695</td>
<td>0.0654</td>
<td>0.2284</td>
<td>1.0000</td>
<td></td>
</tr>
<tr>
<td>SIZ</td>
<td>0.0507</td>
<td>-0.0193</td>
<td>0.0535</td>
<td>-0.0734</td>
<td>-0.0901</td>
<td>-0.0687</td>
<td>-0.0581</td>
<td>1.0000</td>
</tr>
</tbody>
</table>

Table 5.1: Correlation matrix of dependent and independent variables

Multicollinearity exist when there is a strong correlation of .70 or higher between two variables. We can say that a correlation of .1 to .29 can be categorized in low correlation, .30 to .49 to be medium and .5 to 1 as high correlation. The signs do not have any impact on the correlation, it only indicates about the direction of the relationship. In our results, we can say that all the results lies between low to medium range of correlation. The Table 5.1 shows a negative relation of short-term leverage and a positive relation with long-term leverage with the tangibility. The results are mixed and not all results are constant with the empirical evidences. Both of the dependent variables have a negative relation with volatility although which is consistent with the empirical evidences. There is a different result for
growth regarding the short-term leverage and long-term leverage, and the Trade-Off Theory states a negative result. The result of profitability and non-debt tax shield both have a positive relation with short-term and long-term leverage. And again the size of the firm also shows a mixed result. It exhibits a low positive correlation with short-term leverage and a low negative with long-term leverage. In general, the correlation matrix does not prove to be consistent. However, it indicates low chance of multicollinearity due to the low correlation values for most of the variables. Now we use the alternative method that is VIF, which states that if the result, is less than 10 then it is not collinear.

<table>
<thead>
<tr>
<th>Variable</th>
<th>VIF</th>
<th>1/VIF</th>
</tr>
</thead>
<tbody>
<tr>
<td>NDTN</td>
<td>1.45</td>
<td>0.688458</td>
</tr>
<tr>
<td>TAN</td>
<td>1.42</td>
<td>0.702075</td>
</tr>
<tr>
<td>SIZ</td>
<td>1.04</td>
<td>0.964936</td>
</tr>
<tr>
<td>PRO</td>
<td>1.02</td>
<td>0.976660</td>
</tr>
<tr>
<td>VOL</td>
<td>1.02</td>
<td>0.984327</td>
</tr>
<tr>
<td>GRO</td>
<td>1.01</td>
<td>0.987822</td>
</tr>
</tbody>
</table>

| Mean VIF | 1.16 |

Table 5.2: Variance Inflating Factor

And from the Table 5.2 we can see that non of our value is above 10 hence proving that the data doesn’t have multicollinearity among its variables.

5.2 Statistical Description

The statistical description is done according to the table presented in Appendix 3. The results of that table shows a variance in the observations, the variance occurs in the number of observations due to the unavailability of data for certain dependent and independent variables. The mean of short-term leverage is 5.1% whereas for the long-term leverage is 21.60%. The results are quite similar to the empirical studies done earlier regarding the capital structure of UK based firms. The variance in the leverage ratios of this study regarding the other studies can because of the different formulas used to calculate the leverage ratios by different scholars. The mean of asset tangibility is 31.05%. This shows the proportion of fixed assets to total assets of the companies. The growth opportunities have a mean of 19.45% with a minimum of -1% and max of 54%. The non-debt tax shields vary from a very low 0.004% to 25.16% with a mean of 3.43%. Profitability has an average of 14.35%, which is a consistent feature of firms with large size and high maturity. The size of the firm is calculated using the Ln(Net Sales) so the result is realised with $e^{13.86}$ which gives us the average net sales as 1.05 million pounds.

5.3 Regression Analysis

The panel data regression was run to analyse the relationship between the firm’s leverage and the various determinants of capital structure which are firm size, profitability, growth opportunities, asset
tangibility, non-debt tax shield and earning volatility. The above model used long-term leverage and short-term leverage as the dependent variables.

5.3.1 Pooled OLS Results

We use the pooled OLS test to get the results for the regression and deduce the relationship between various independent variables and the dependent variables. For the purpose of deducing relationship between two different dependent variables we have used the pooled OLS twice. The results for short-term leverage and long-term leverage are presented in Table 5.3.

<table>
<thead>
<tr>
<th></th>
<th>(1) STLEV</th>
<th>(1) LTLEV</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAN</td>
<td>-0.00585</td>
<td>0.184***</td>
</tr>
<tr>
<td></td>
<td>(-0.89)</td>
<td>(10.05)</td>
</tr>
<tr>
<td>VOL</td>
<td>0.0000227</td>
<td>0.0000724</td>
</tr>
<tr>
<td></td>
<td>(0.18)</td>
<td>(0.21)</td>
</tr>
<tr>
<td>GRO</td>
<td>0.00543</td>
<td>-0.00604</td>
</tr>
<tr>
<td></td>
<td>(1.12)</td>
<td>(-0.44)</td>
</tr>
<tr>
<td>NDTST</td>
<td>0.0647</td>
<td>0.451*</td>
</tr>
<tr>
<td></td>
<td>(0.96)</td>
<td>(2.41)</td>
</tr>
<tr>
<td>PRO</td>
<td>0.0176</td>
<td>-0.0609</td>
</tr>
<tr>
<td></td>
<td>(1.22)</td>
<td>(-1.52)</td>
</tr>
<tr>
<td>SIZ</td>
<td>0.00159</td>
<td>-0.00289</td>
</tr>
<tr>
<td></td>
<td>(1.74)</td>
<td>(-1.12)</td>
</tr>
<tr>
<td>_cons</td>
<td>0.0197</td>
<td>0.194***</td>
</tr>
<tr>
<td></td>
<td>(1.45)</td>
<td>(5.07)</td>
</tr>
<tr>
<td>N</td>
<td>1618</td>
<td>1617</td>
</tr>
</tbody>
</table>

Table 5.3 Pooled OLS for Short-Term Leverage and Long-Term Leverage (refer Appendix 4 and 5)

We can infer from the above table tangibility has mixed results regarding the short-term and long-term leverage. Tangibility shows a negative relation with the short-term leverage whereas a positive relation with the long-term leverage. The results for volatility are not consistent with the empirical evidences available. Earning Volatility forms a positive relation with both the short and long-term leverage. The results of non-debt tax shield show a positive relation. And growth, size and profitability make a mixed relation with short and long-term leverage. This can be concluded as the Trade-Off Theory and Pecking Order Theory also gives different results for these three independent variables. We are getting the $R^2$ value of 0.004 for the short-term leverage regression and the value of
.099 for long-term leverage regression. In theories, the $R^2$ for the micro panel data is usually quite small and ranges from 0.10 to 0.25. There are certain problems with the results of the pooled OLS results as pooled OLS is not free from certain disadvantages, pooled OLS known for not using the full richness of the panel data sample and it ignores the firm’s heterogeneity. Because of the certain limitations, we will use the Breusch-Pagan Lagrangian Test to check for the heterogeneity in the sample.

5.3.2 Breusch-Pagan Lagrangian Test for Pooled Model & Random Model
Breusch-Pagan Lagrangian Test is used to detect the presence of heterogeneity in the sample data. As the difference between the coefficients of the pooled OLS and random effects tests there, we need Breusch-Pagan Lagrangian Test to tell about which test results are better in the two. We will see from the Table 5.4 that the P-value of the Breusch-Pagan Lagrangian Test for short-term leverage and long-term leverage comes out to be less than 0.05, which means we reject the null hypothesis and we conclude that random effects model is better and significant than the pooled OLS regression method. The null and alternative hypothesis for the following is mentioned below:

$H_0$: Pooled OLS Model is appropriate

$H_1$: Random effects Model is appropriate

<table>
<thead>
<tr>
<th>P-values</th>
<th>Short-Term Leverage</th>
<th>Long-Term Leverage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.000</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Table 5.4: Summary for Breusch-Pagan Test (refer Appendix 6 and 7)

We can see the coefficients of the independent variables affecting the long-term and short-term leverage. From the Table 5.5 we can see that the results of the pooled OLS and random effects model have different results and the results also vary for the direction trend of the independent variable on the short-term and long-term leverage. We can see that the result for the tangibility regarding both the long-term and short-term leverage gives us almost the same coefficient with the same direction, but except for those the results of the random effects model varies in the magnitude as well as the direction. We can see that with the random effects model the coefficient values of the independent variables turns to have a negative relation with the short-term leverage. The non-debt tax shield shows a different result, it shows a negative relation with the long-term leverage instead of the short-term leverage.
5.3.3 Hausman Test

Hausman test is used to test the effect of fixed effects model against the random effects model. The random effects model pre-assumes that there is no correlation the group specific random effects and the regressors. But on the other hand this assumption is not so true and the fixed effects model does not make any assumption in regard of the correlation between the individual effects and the regressors. The Hausman test checks whether the assumption of the correlation is statistically present or not in the sample data. The null hypotheses for this test is that the group specific random effects and the regressors are not correlated and thus if the Hausman test shows a parameter value of more than 0.05 than it would mean that fixed effects model is inefficient and random effects model is better. The results of the Hausman test are given below in the table 5.6:

<table>
<thead>
<tr>
<th></th>
<th>Short-Term Leverage</th>
<th>Long-Term Leverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>P-values</td>
<td>0.0024</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

Table 5.6: Summary for Hausman Test (refer Appendix 10 and 11)
We can see from the results that the null hypothesis is rejected in our case and hence the fixed effects model is better than the random effects model as all the P-values for both of the dependent variable is less than 0.05. Our results for choosing the fixed effects model over the random effects model was also supported by the model presented by Bevan and Danbolt (2004), there model also favoured the fixed effects model over the random effects model due to the presence of correlation.

5.3.4 Fixed Effects Model

From the Hausman test, we deduce that the fixed effects model is the best model for getting the optimum regression results. The fixed effects model takes effect of correlation and heterogeneity, hence the results of this model tends to provide better results as compared pooled OLS model and the random effects model.

We get two regression equations, one where the short-term leverage is the dependent variable and the other with long-term leverage as the dependent variable. The regression equation for short-term leverage as the dependent variable is as follows:

\[
STLEV_i = 0.185 - (0.0344)PRO_i - (0.00963)SIZ_i + 0.00636GRO_i - (0.0195)TAN_i \\
+ 0.258NDTS_i + 0.0000699VOL_i + \varepsilon_i
\]

And the regression equation with long-term leverage as the dependent variable:

\[
LTLEV_i = 0.354 - (0.129)PRO_i - (0.00837)SIZ_i + 0.02216GRO_i + 0.0303TAN_i \\
- (0.354)NDTS_i + 0.0000310VOL_i + \varepsilon_i
\]

The table 5.7 gives us the coefficient values of the independent variable with respect to the dependent variable by using a fixed effects model. For the model, we have used 1618 observations for the short-term leverage analysis and 1617 observations for the long-term leverage analysis. The result of the \(R^2\) for the short-term leverage model is 0.0147 and for the long-term leverage model is 0.0185. The value of \(R^2\) is quite low from the usually accepted values but on the contrary, the F-Test values suggest that the model is the best fit as the P-Value of the F-Test is 0.0000. The reason behind low value of \(R^2\) can happen because of various unavoidable reasons. One of the most important reasons behind the low explanatory power that indicates the relationship between the variables is because of the difference in the technique to measure the selected variables or because of unobservable elements. In respect to this study, we have used the book values instead of the market values for measuring the variables. Certain more elements are not included in our study that may lead to a lower value of \(R^2\) such as macroeconomics factors, uniqueness and liquidity. One of the other reasons for a low value of \(R^2\) is the exclusion of various companies due lack availability of data on the DataStream database.
Now we need to evaluate each of the independent variable with respect to the two dependent variables chosen for this research. The independent variables need to be evaluated and analysed based on two criteria. First, we have to check whether the independent variable contributed toward change in the independent variable and secondly, the magnitude of the independent variable towards the dependent variable. The results of the six independent variables are now explained and the relation of these six variables with short-term leverage and long-term leverage derived though the fixed effect model is discussed in detail below.

**Profitability (PRO)**

Probability is one of the important variables which affect the leverage of the firm. Various studies have shown that profitability is one of the important determinants with respect to the capital structure decisions of the firm. In our result, we get the P-Value as 0.037, which makes the profitability significant at 95% confidence interval for the short-term leverage. The results are consistent with most of the empirical studies earlier done while solving up the Capital Structure Puzzle. Titman and Wessels (1988) argues that profitability is one of the most important factors while choosing the financing options by the management. The result of the P-Value for the long-term leverage is 0.000 which is also gives us the same results. Bennett and Donnelly (1993) also conducted the research.

<table>
<thead>
<tr>
<th></th>
<th>((1)) STLEV</th>
<th>((1)) LTLEV</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAN</td>
<td>-0.0195</td>
<td>0.0303</td>
</tr>
<tr>
<td></td>
<td>(-0.88)</td>
<td>(0.72)</td>
</tr>
<tr>
<td>VOL</td>
<td>0.0000699</td>
<td>0.0000310</td>
</tr>
<tr>
<td></td>
<td>(0.58)</td>
<td>(0.14)</td>
</tr>
<tr>
<td>GRO</td>
<td>0.00636</td>
<td>0.0221*</td>
</tr>
<tr>
<td></td>
<td>(1.32)</td>
<td>(2.44)</td>
</tr>
<tr>
<td>NDTB</td>
<td>0.258</td>
<td>-0.345</td>
</tr>
<tr>
<td></td>
<td>(1.68)</td>
<td>(-1.20)</td>
</tr>
<tr>
<td>PRO</td>
<td>-0.0344*</td>
<td>-0.129***</td>
</tr>
<tr>
<td></td>
<td>(-2.08)</td>
<td>(-4.22)</td>
</tr>
<tr>
<td>SIZ</td>
<td>-0.00963**</td>
<td>-0.00837</td>
</tr>
<tr>
<td></td>
<td>(-2.97)</td>
<td>(-1.37)</td>
</tr>
<tr>
<td>_cons</td>
<td>0.185***</td>
<td>0.354***</td>
</tr>
<tr>
<td></td>
<td>(3.81)</td>
<td>(3.88)</td>
</tr>
<tr>
<td>N</td>
<td>1618</td>
<td>1617</td>
</tr>
</tbody>
</table>

Table 5.7: Summary statistics for the fixed effects model (refer to Appendix 12 and 13)
using the cross sectional determinants of capital structure among the non-financial firms and their results also showed that profitability acts an important factor while determining the capital structure choice by the management.

Our results for the coefficient showed a negative correlation between profitability and short-term leverage as well as with the long-term leverage. The result for the short-term leverage comes out to be (-0.0344) which implies that a single unit increase in the profitability will decrease the short-term leverage of UK firms by 0.0344 units. The results for the long-term showed that one unit increase in the profitability would reduce the long-term leverage level by 0.1287 units. The results are consistent with the Pecking order Theory which states that when that there is an order by which the firm will prefer to gather funds and in that list internal funding is the first preference of choice, hence if the firms have enough profits to support internal financing then firm wont prefer outside options for finance. The results are supported by various scholars and researchers such as Rajan and Zingales (1995), Fama and French (1999), Bevan and Danbolt (2002) and Ozkan (2001), all the researchers got an inverse relation of profitability with the gearing ratio of the firm. But our results contradict the results of the Agency Theory as well for the Trade-Off Theory.

So overall our statistical results are very much satisfactory as they are consistent with most of the empirical studies conducted prior in the same field of research.

**Firm Size (SIZ)**

Coefficient of firm size is (-0.0096) on short-term leverage of the firm with P-Value as 0.003. This gives a significant negative relation between firm size and the short-term leverage. The results are consistent with the Pecking Order Theory but on the other hand our results contradicts the results of the Agency Cost and Trade-Off Theory which states the bigger the size of the firm the more safer it is from the bankruptcy cost and hence these firms include more of debt into their capital structure. On the other hand we do not find significant result for the long-term leverage and the firm size as the P-Value comes out to be 0.171 with the coefficient as (-0.0084).

Overall, we got mixed results for the firm size. The effect of the firm size has a significant negative effect on short-term leverage, which is consistent with most of the capital structure theories. There been similar results produced in the studies of Rajan and Zingales (1995), Gupta (1969), Bates (1971) and Voulgaris, Asteriou & Agiomirgianakis (2004). All these scholars suggested that smaller firms prefer to finance internally rather than choosing the debt financing. On the other hand the results for the long-term leverage gave us insignificant results which are consistent with the researches of Ferri and Jones (1979), Kim and Sorensen (1986) and Chung (1993). The research conducted by all the
researchers does not prove any direct and significant impact of the firm size on the leverage level of the firm. Overall the results regarding the firm size and the leverage cannot be fully accepted or declined as the results shows significance while using it against the short-term leverage and insignificant while regressing against the long-term leverage.

**Asset Tangibility (TAN)**

The result estimates do not reveal any significant relationship between asset tangibility and debt level. The P-Values for both long-term leverage and short-term leverage comes out to be quite high, 0.377 and 0.471 respectively for short-term leverage and long-term leverage. This means that the asset tangibility does not have enough explanatory power on the capital structure decisions of the UK based companies selected in this test. The high P-Value means that our results are not statistically significant but the results could be theoretically significant. The coefficient for short-term leverage comes out to be (-0.0195) which is not consistent with most of the previous empirical evidences present regarding the asset tangibility and debt ratio except for a few conducted scholars such as Bevan & Danbolt (2002). The reason behind a negative relation between short-term leverage and asset tangibility may be due to the reason that selling an asset in short period of time is not an easy task for the debt holders. But on the other hand the result for the long-term leverage gives a positive relation between these two. The coefficient for the long-term leverage is 0.0302 which is consistent with both the Pecking Order Theory as well as the Trading-Off Theory. Both of these theories suggested that the firm with tangible assets could use them to collateralise for the debt and issuing debt that is secured by tangible assets reduces the agency cost. The results long-term leverage and short-term leverage is consistent with the work of scholars like Rajan and Zingales (1995), Chen (2003) and Bevan & Danbolt (2002) which all find that the asset tangibility is positively related with the long-term leverage and negatively related with the short-term leverage.

**Non-Debt Tax Shield (NDTS)**

The non-debt tax shield gives us mixed result while checking the P-Values. P-Value with short-term leverage gives is 0.093 which is significant at 90% confidence interval. The result for the coefficient comes out to be 0.2580 that means that the non-debt tax shield is positively related with the short-term debt level of the firm. Increase in one unit of the non-debt tax shield will increase the short-term debt in the firm by 0.2580 units. This result is inconsistent with most of the capital structure theories. There are certain reasons that may lead to these results to be inconsistent. One of them could be the nature of the debt, as in this case, the debt for a short period, the tax advantage associated with the debt is not so
large in the magnitude and hence the firm look over the other advantages of choosing debt rather than the tax advantage.

On the contrary the results for the long-term leverage comes out to be statistically insignificant because the P-Value for the regression comes out to be 0.230 and with coefficient value as (-0.3445). These results are consistent with almost all the theories of capital structure. Ozkan (2001), Modigliani and Miller (1963) and various other scholars argued that that with each unit increase in non-debt tax shield the utility for the debt-tax shield reduces and hence these non-debt tax shields are inversely related to each other and hence the firms prefer to equity financing over debt financing. The result can be supported by various empirical studies such as Wald (1999) and Myers S. C. (1984).

The main reason behind the huge contrast between our study and the various other empirical studies could be the use of the ratio of depreciation for the firm to total assets of the firm as the proxy for the non-debt tax shield. There can be other proxies for the same or the same proxy can be used as a proxy for some other variable.

**Growth Opportunities (GRO)**

For growth opportunities, we got mixed results for the P-Value for short-term leverage and long-term leverage. The result of P-Value for fixed effect model with short-term leverage as the dependent variables comes out to be 0.186. This makes the results statistically insignificant. On the other hand, the P-Value for the fixed effect model with long-term leverage as the dependent variable comes out to be 0.015 which makes it significant at 95% confidence interval. The result of long-term leverage is consistent with most of the theories.

The value of coefficient for short-term leverage and long-term leverage is 0.0064 and 0.0221 respectively. Both the values create a positive relation between the growth opportunities and leverage level of the firm, although the result for the short term leverage is statistically insignificant. Both the results are consistent with the Pecking Order Theory as the theory suggests that with high growth opportunities, a firm requires higher amount of capital for its functions and usually it gets difficult to use internal sources for financing, hence the firm opts for debt financing which is the second best option for financing after internal financing. Our results for the coefficient are consistent with the work of various scholars such as Titman and Wessels (1988) and Frank and Goyal (2003). But our results are not consistent with other major theory of capital structure which is the Trade-Off Theory which argues that the growth opportunities and leverage ratio holds a negative relation because the firm with growth opportunities tends to borrow less as growth opportunities is kind of intangible assets and cannot be collateralised for acquiring debt (Chen J. J., 2003).
The reason for the insignificance P-Value for the short-term leverage may be because of various reasons. Again, one of the most important factors is the measurement of the proxy. We used the growth in total assets as the proxy but there are other proxies like the growth in total sales.

**Earning Volatility (VOL)**

Earning volatility is negatively related to the firms leverage as earning volatility is usually used as the cost of financial distress and thus it is negatively related to leverage of the firm. Our estimate does not reveal any significant relationship between the earning volatility and the debt ratio of the firm. Even the coefficient values for the short-term leverage and long-term leverage gives us a positive relation which is inconsistent with the empirical studies and other theories in respect of capital structure. The coefficient value for short-term leverage is 0.00006 and for long-term leverage is 0.00003. The low value shows that there is negligible effect of volatility on the leverage of the firm, both short-term leverage and long-term leverage. The reason behind the insignificant results can be the proxy taken for the independent variable as there are various other substitutes mentioned in various theories. The unavailability of data for all the companies listed in FTSE 350 can be another reason for the insignificant results. Hence, there is no statistically significant relation of the earning volatility with either of the leverage in our study.

**5.3.5 Analysis of Variance (ANOVA)**

ANOVA is a technique, which is used to compare the variance within as well as with different groups. The difference exists because of the independent variables. The main purpose of ANOVA is to know about whether differences exist between the samples are due to random error or whether there was some systematic treatment effect that caused the scores in one group different from the other group. For the study, we have used the following tables:
We can see from the above table the values for sum of squares, degrees of freedom, mean squares for both the between groups and within groups for both of our dependent variables. The significant of F value of 4.72 and 32.88 tells us that at least one the treatment effect is different from zero, i.e. all the means are not equal. The other main value of interest for us is the result of the P-Value. For us both the P-Values should range 0.0000 to 0.05 and in our case, both the P-Values are 0.000. This defines that there is significant difference in the mean scores on the dependent variables. Therefore, with the results we can state that there is there is a difference in mean within industries in both short-term leverage and long-term leverage.
Chapter 6: Conclusion and Discussions

The study was based on finding answer to the most discussed and controversial theory of finance. The research aimed to explain the major determinants which have an impact on the leverage ratio of the UK based companies. In order to provide the empirical evidence we have constructed panel data for 178 companies listed on FTSE 350 on London Stock Exchange for a period of 10 years ranging from 2002 to 2011.

One of the main objectives of the study is to provide empirical evidences for the decisions which impacts the capital structure decisions of UK based companies. We have used various methods for the results. Most of the researchers used OLS method for the results which tends to provide biased results, so for this we have used fixed effect and random effect model. There were huge amount of theoretical evidences available in this field. By studying the various theories of capital structure that helped us to define the independent and dependent variables for our research.

The capital structure theories were based on Pecking Order Model and Trade-Off Model. These models gives information regarding the debt structure of the firms although being driven by different forces for the prediction of the capital structure. Initially the OLS model was used to define the relation between the dependent and independent variables, the result from the OLS gave us all the independent variables as insignificant hence we used the Breusch-Pagan Lagrangian Test and Hausman Test. The result of Breusch-Pagan Lagrangian Test rejected the null hypothesis and hence we accept the alternative hypothesis and therefore we will prefer random effect model over the OLS model to get our results for the determinants of the capital structure of the UK based firms. Then we used the Hausman Test to determine the more significant test among the fixed effect and the random effect model and the results proved to be in favour of the fixed effect model.

The results for the fixed effect model for both the long-term leverage and for the short-term leverage provided a very small value for the $R^2$. The reason behind the low explanatory power could be attributed because of the use of only book values ignoring the market values. The model showed various significant and insignificant values regarding the various independent variables for both long-term and short-term leverage. The result of the fixed effect model for the short-term leverage provided with mixed results with some independent variable proving to be statistically significant and the rest not statistically significant. The non-debt tax shield, profitability and the firm size proved to statistically significant among the six independent variables. We can see the variables such as growth, profitability and firm size showing the impact on the short-term leverage in accordance of the Pecking Order Theory, whereas volatility, non-debt tax shield and asset tangibility are not consistent with most of the theories available. On the other hand, the fixed effect model for the long-term leverage showed
growth, profitability and firm size as the statistical significant variables. The variables like asset tangibility and non-debt tax shield proved to be theoretically significant. In the long-term leverage analysis there is a mix of Trade-Off and Pecking Order traits we can see in various independent variables. Tangibility and non-debt tax shield are consistent with the Trade-Off Theory and growth opportunities, profitability and firm size is consistent with the Pecking Order Theory. The only insignificant variable for both the regression comes out to be Earning Volatility. The empirical results for the ANOVA test for investigating the impact of industry gives us a significant and conclusive result. The ANOVA test showed that there is a significant difference in the mean of the short-term and long-term leverages within and between the industries in the sample study.

<table>
<thead>
<tr>
<th>Determinant</th>
<th>Prediction</th>
<th>Results short-term</th>
<th>Results long-term</th>
</tr>
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<tr>
<td>Profitability</td>
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<td>-*</td>
</tr>
<tr>
<td>Tangibility</td>
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<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Growth</td>
<td>+/-</td>
<td>+</td>
<td>+*</td>
</tr>
<tr>
<td>Non-Debt</td>
<td>-</td>
<td>+*</td>
<td>-</td>
</tr>
<tr>
<td>Tax Shield</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Volatility</td>
<td>-</td>
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<td>+</td>
</tr>
<tr>
<td>Firm Size</td>
<td>+/-</td>
<td>-*</td>
<td>-*</td>
</tr>
</tbody>
</table>

*implies statistically significant.

Table 5.9: Results of Fixed Effect Model with theoretical prediction and empirical research

The table 5.9 explains the empirical research results and the results of the theories. The reason behind the statistically insignificant results regarding various variables and inconsistent results with the theories is due to various constrains and restriction in the research. The unavailability of data for various companies listed under the FTSE 350 and the unavailability of data for the whole ten year gave the research some statistically insignificant results. The problem for incomplete data arises because of several reasons like new born firms, dead firms and different industry. We have also used book value over the market value that may have led to a low value of R². And the values used are taken from the annual reports of the companies and these reports usually have the problem of biasness due to the accounting and public relation issues. The other important factor for the low R² and statistically insignificant results is omission of other important variables such as liquidity, tax-shields, dividend rate, equity concentration and many more. And also the proxies used for the independent and dependent variables can be calculated using several measures and this might led to a low value of R². We have just included the microeconomics variables and excluded the macroeconomics variables such as interest rate changes and inflation levels. For further studies, the research can use larger dataset that will overall enhance the results of this model. Future study can also increase the panel data set observation by adding more alternative indicators for independent variables. The research can utilise different proxies for a same indicator that will enhance the credibility of that indicator,
especially for earning volatility as the our results regarding tat independent variables shows an insignificant relationship with the short-term as well as long-term leverage.

To sum up we can say that the capital structure puzzle is not an easy theory and its determinants still act in mysterious fashion with different datasets. With the new development in the statistical tools and software, the previous studies can be challenged with better results. Our empirical evidence does not support any particular theory for the optimal capital structure blend. Although it helped us to narrow down the determinants and their direction by which they will affect the short-term and long-term leverage of the UK based companies. However, we still don’t have any conclusive and very strong result which can solve the problem of the perfect blend of the debt and equity financing. As said by Myers (1984), "How do firms choose their capital structures?" The answer is, "We don't know".
Bibliography


http://www.mountainplains.org/articles/2001/pedagogy/PECKING%20ORDER%20THEORY.htm


### Appendix

1. List of companies arrange in accordance of the industries.

<table>
<thead>
<tr>
<th>Basic Materials</th>
<th>Consumer Goods</th>
</tr>
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<td>BARRATT DEVELOPMENTS</td>
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</tr>
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<table>
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</thead>
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<tr>
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### Telecommunications
- BT GROUP PLC
- CABLE & WIRELESS
- INMARSAT PLC
- KCOM GROUP PLC
- VODAFONE GROUP PLC

### Utilities
- CENTRICA PLC
- DRAK GROUP PLC
- NATIONAL GRID PLC
- PENNON GROUP PLC
- SEVERN TRENT PLC
- SSE PLC
- UNITED UTILITIES PLC

### Consumer Services
- AEGIS GROUP PLC
- BSkyB GROUP PLC
- N BROWN GROUP PLC
- CARNIVAL PLC
- CARPETRIGHT PLC
- COMPASS GROUP PLC
- CARPETRIGHT PLC
- DIXONS RETAIL PLC
- DOMINO'S PIZZA GR
- EASYJET PLC
- EUROMONEY INSTL INV
- FIRSTGROUP PLC
- GO-AHEAD GROUP PLC
- GREENE KING PLC
- HALFORDS GROUP PLC
- INCHCAPE PLC
- INFORMA PLC
- INTERCONTINENTAL
- ITV PLC
- JD SPORTS FASHION
- KINGFISHER PLC
- LADBROKES PLC
- MARKS & SPENCER
- MARSTON'S PLC
- MILLENIUM
- MITCHELLS & BUTLERS
- WM. MORRISON SUPERMT
- NATIONAL EXPRESS GRP
- NEXT PLC
- PEARSON PLC
- RANK GROUP PLC (THE)
- RESTAURANT GROUP PLC

### Industrials
- AGGREKO PLC
- ASHTEAD GROUP PLC
- WS ATKINS PLC
- BABCOCK INTL GROUP
- BAE SYSTEMS
- BALFOUR BEATTY PLC
- BBA AVIATION
- BERENDSEN PLC
- BOCYTEC
- BUNZL PLC
- CAPITA PLC
- CARILLION PLC
- CHEMRING GROUP PLC
- COBHAM PLC
- COOKSON GROUP PLC
- DE LA RUE PLC
- DOMINO PRINTING
- ELECTROCOMPONENTS
- EXPERIAN PLC
- FENNER PLC
- FILTRONA PLC
- G4S PLC
- GALLIFORD TRY PLC
- HAYS PLC
- HOMESERVE PLC
- HOWDEN JOINERY
- IMI PLC
- INTERERVE PLC
- INTERTK GROUP
- KIER GROUP PLC
- MEGGITT PLC
- JOHN MENZIES PLC
- MITIE GROUP PLC
2. Industry classification used in the research.

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4. Pooled OLS for Short-term Leverage

. regress STLEV TAN VOL GRO NDTS PRO SIZ

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<td>1617</td>
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| STLEV  | Coef.  | Std. Err. | t     | P>|t| | [95% Conf. Interval] |
|--------|--------|-----------|-------|------|----------------------|
| TAN    | -0.0058468 | .0065661 | -0.89 | 0.373 | -0.0187259 -.0070323 |
| VOL    | .0000227   | .000125  | 0.18  | 0.856 | -.00002225 .0000268 |
| GRO    | .0054276   | .0048633 | 1.12  | 0.265 | -.0041116 .0149667 |
| NDTs   | .0647465   | .0675425 | 0.96  | 0.338 | -.067734 .197227 |
| PRO    | .0176044   | .0144725 | 1.22  | 0.224 | -.0107825 .0459914 |
| SIZ    | .001587    | .0009141 | 1.74  | 0.083 | -.000206 .003338 |
| _cons  | .0196876   | .0135551 | 1.45  | 0.147 | -.0068998 .046275 |

5. Pooled OLS for Long-term Leverage

. regress LTLEV TAN VOL GRO NDTS PRO SIZ

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| LTLEV  | Coef.  | Std. Err. | t     | P>|t| | [95% Conf. Interval] |
|--------|--------|-----------|-------|------|----------------------|
| TAN    | .183902  | .0183034 | 10.05 | 0.000 | .1480011 .219803 |
| VOL    | .0000724 | .0003501 | 0.21  | 0.836 | -.0006143 .000759 |
| GRO    | -.0060419| .0136027 | -0.44 | 0.657 | -.0327228 .026069 |
| NDTs   | .4514532 | .1873934 | 2.41  | 0.016 | .0838925 .8190138 |
| PRO    | -.0609184| .0399957 | -1.52 | 0.128 | -.1393675 .0175308 |
| SIZ    | -.0028939| .0025812 | -1.12 | 0.262 | -.0079568 .002169 |
| _cons  | .1943924 | .0383164 | 5.07  | 0.000 | .1192372 .2695476 |

6. Breusch-Pagan Lagrangian Test Results for Short-Term Leverage

Breusch and Pagan Lagrangian multiplier test for random effects

STLEV[name1,t] = Xb + u[name1] + e[name1,t]

Estimated results:

<table>
<thead>
<tr>
<th></th>
<th>Var</th>
<th>sd = sqrt(Var)</th>
</tr>
</thead>
<tbody>
<tr>
<td>STLEV</td>
<td>.0029598</td>
<td>.0544038</td>
</tr>
<tr>
<td>e</td>
<td>.0021785</td>
<td>.0466744</td>
</tr>
<tr>
<td>u</td>
<td>.008752</td>
<td>.0295836</td>
</tr>
</tbody>
</table>

Test: Var(u) = 0

\[ \chi^2(1) = 329.44 \]

Prob > \chi^2 = 0.0000
7. Breusch-Pagan Lagrangian Test Results for Long-Term Leverage

Breusch and Pagan Lagrangian multiplier test for random effects

\[ \text{LTLEV}[\text{name1}, t] = Xb + u[\text{name1}] + e[\text{name1}, t] \]

Estimated results:

<table>
<thead>
<tr>
<th></th>
<th>Var</th>
<th>sd = sqrt(Var)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LTLEV</td>
<td>.0254997</td>
<td>.1596863</td>
</tr>
<tr>
<td>e</td>
<td>.0077571</td>
<td>.0880746</td>
</tr>
<tr>
<td>u</td>
<td>.0155339</td>
<td>.124635</td>
</tr>
</tbody>
</table>

Test: \( \text{Var}(u) = 0 \)

\( \text{ch}2(1) = 2621.67 \)

\( \text{Prob} > \text{ch}2 = 0.0000 \)

8. Random Effect Results for Short-term Leverage

. \texttt{xtr} \texttt{STLEV TAN VOL GRO NDT} \texttt{SIZ PRO SIZ, re}

Random-effects GLS regression

<table>
<thead>
<tr>
<th></th>
<th>Number of obs = 1618</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group variable: name1</td>
<td>Number of groups = 178</td>
</tr>
</tbody>
</table>

R-sq: within = 0.0097  
between = 0.0014  
overall = 0.0000

Obs per group: min = 1  
avg = 9.1  
max = 10

Random effects \( u_i \) ~ Gaussian

Wald \( \text{ch}2(6) = 7.04 \)

\( \text{corr}(u_i, X) = 0 \) (assumed)

\( \text{Prob} > \text{ch}2 = 0.3172 \)

<table>
<thead>
<tr>
<th>STLEV</th>
<th>Coef.</th>
<th>Std. Err.</th>
<th>z</th>
<th>P&gt;z</th>
<th>[95% Conf. Interval]</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAN</td>
<td>-.0075848</td>
<td>.0108417</td>
<td>-0.70</td>
<td>0.484</td>
<td>-.0288341 to .0136645</td>
</tr>
<tr>
<td>VOL</td>
<td>.0000622</td>
<td>.0001174</td>
<td>0.53</td>
<td>0.596</td>
<td>-.0001679 to .0002923</td>
</tr>
<tr>
<td>GRO</td>
<td>.0056572</td>
<td>.0045981</td>
<td>1.23</td>
<td>0.218</td>
<td>-.0034175 to .0145520</td>
</tr>
<tr>
<td>NDT</td>
<td>.203798</td>
<td>.0999088</td>
<td>2.04</td>
<td>0.041</td>
<td>.0793045 to .3282915</td>
</tr>
<tr>
<td>PRO</td>
<td>-.0194949</td>
<td>.0152547</td>
<td>-1.28</td>
<td>0.201</td>
<td>-.0493936 to .0104037</td>
</tr>
<tr>
<td>SIZ</td>
<td>-.0007112</td>
<td>.0015171</td>
<td>-0.47</td>
<td>0.639</td>
<td>-.0036846 to .0022623</td>
</tr>
</tbody>
</table>

| _cons   | .0533456 | .0223395 | 2.39  | 0.017 | .009561 to .0971303 |

\( \text{sigma_u} = .02958364 \)

\( \text{sigma_e} = .0466744 \)

\( \text{rho} = .28660129 \) (fraction of variance due to \( u_i \))
9. Random Effect Results for Long-term Leverage

Random-effects GLS regression  
Group variable: name1

<table>
<thead>
<tr>
<th>R-sq:</th>
<th>within = 0.0137</th>
<th>Obs per group: min = 1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>between = 0.0970</td>
<td>avg = 9.1</td>
</tr>
<tr>
<td></td>
<td>overall = 0.0696</td>
<td>max = 10</td>
</tr>
</tbody>
</table>

Random effects u_i ~ Gaussian 

corr(u_i, X) = 0 (assumed)

| LTLEV | Coef.  | Std. Err. | z    | P>|z| | 95% Conf. Interval |
|-------|--------|-----------|------|------|-------------------|
| TAN   | .1181834 | .0313575  | 3.77 | 0.0000 | [.0567238, .1796429] |
| VOL   | .0000607 | .0002273  | 0.27 | 0.7890 | [-.0003848, .0005063] |
| GRO   | .0224566 | .0089823  | 2.50 | 0.0122 | [.0048517, .0400616] |
| NDTS  | -.1955734 | .247264   | -0.79 | 0.4296 | [-.6802019, .2890552] |
| PRO   | -.116955 | .0300316  | -3.89 | 0.0000 | [-.0175819, -.0580942] |
| SIZ   | -.0027147 | .0044517  | -0.61 | 0.5422 | [-.01144, .0060105] |
| _cons | .2364297 | .06602    | 3.58 | 0.0000 | [.1070329, .3658265] |

\[
sigma_u = 0.12463502 \\
\sigma_e = 0.08807459 \\
rho = 0.66694747 \text{ (fraction of variance due to } u_i)\]

10. Hausman test Results for Short-Term Leverage

```
. hausman fe re

<table>
<thead>
<tr>
<th></th>
<th>Coefficients</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(b)</td>
<td>(B)</td>
<td>(b-B)</td>
<td>sqrt(diag(V_b-V_B))</td>
<td></td>
</tr>
<tr>
<td></td>
<td>fe</td>
<td>re</td>
<td>Difference</td>
<td>S.E.</td>
<td></td>
</tr>
<tr>
<td>TAN</td>
<td>-.0195099</td>
<td>-.0075848</td>
<td>-.0119251</td>
<td>.0192383</td>
<td></td>
</tr>
<tr>
<td>VOL</td>
<td>.0000699</td>
<td>.0000622</td>
<td>0.70e-06</td>
<td>.0000254</td>
<td></td>
</tr>
<tr>
<td>GRO</td>
<td>.0063646</td>
<td>.0056572</td>
<td>.0007074</td>
<td>.0014307</td>
<td></td>
</tr>
<tr>
<td>NDTS</td>
<td>.2580685</td>
<td>.203798</td>
<td>.05427</td>
<td>.1163752</td>
<td></td>
</tr>
<tr>
<td>PRO</td>
<td>-.0344174</td>
<td>-.0194949</td>
<td>-.0149225</td>
<td>.0063355</td>
<td></td>
</tr>
<tr>
<td>SIZ</td>
<td>-.0096347</td>
<td>-.0007112</td>
<td>-.0089235</td>
<td>.0028698</td>
<td></td>
</tr>
</tbody>
</table>
```

\[b = \text{consistent under Ho and Ha; obtained from xtreg}\]
\[B = \text{inconsistent under Ha, efficient under Ho; obtained from xtreg}\]

Test: Ho: difference in coefficients not systematic

\[
\text{ch}i^2(6) = (b-B)'[(V_b-V_B)^{-1}](b-B) = 20.33
\]

\[\text{Prob}>\text{ch}i^2 = 0.0024\]
11. Hausman test Results for Long-Term Leverage

<table>
<thead>
<tr>
<th></th>
<th>Coefficients (b)</th>
<th>Coefficients (B)</th>
<th>(b-B) Difference</th>
<th>sqrt(diag(V_b-V_B)) S.E.</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAN</td>
<td>.030269</td>
<td>.118183</td>
<td>-.0879143</td>
<td>.0279041</td>
</tr>
<tr>
<td>VOL</td>
<td>.000031</td>
<td>.0000607</td>
<td>-.0000298</td>
<td></td>
</tr>
<tr>
<td>GRO</td>
<td>.0221342</td>
<td>.0224566</td>
<td>-.0003224</td>
<td>.0011846</td>
</tr>
<tr>
<td>NDTs</td>
<td>-.3445766</td>
<td>-.1955734</td>
<td>-.1490032</td>
<td>.1450274</td>
</tr>
<tr>
<td>PRO</td>
<td>-.1286924</td>
<td>-.116955</td>
<td>-.0117373</td>
<td>.0054002</td>
</tr>
<tr>
<td>SIZ</td>
<td>-.0083717</td>
<td>-.0027147</td>
<td>-.005657</td>
<td>.0041864</td>
</tr>
</tbody>
</table>

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

\[
\text{chi2}(6) = (b-B)'[(V_b-V_B)^{-1}](b-B)
\]

Prob>chi2 = 0.0000

(V_b-V_B is not positive definite)

12. Results of Fixed Effect Model for Short-Term Leverage

. xtreg STLEV TAN VOL GRO NDTs PRO SIZ, fe

Fixed-effects (within) regression
Number of obs = 1618
Group variable: name1
Number of groups = 178

R-sq: within = 0.0147 Obs per group: min = 1
between = 0.0055 avg = 9.1
overall = 0.0008 max = 10

F(6,1434) = 3.57
Prob > F = 0.0016

corr(u_i, Xb) = -0.4883

| STLEV | Coef.  | Std. Err. | t      | P>|t| | [95% Conf. Interval] |
|-------|--------|-----------|--------|------|---------------------|
| TAN   | -.0195099 | .0220829 | -0.88  | 0.377 | -.0628281 , .0238083 |
| VOL   | .0000699 | .0001201 | 0.58   | 0.561 | -.0001657 , .0003055 |
| GRO   | .0063464 | .0048089 | 1.32   | 0.186 | -.0030686 , .0015798 |
| NDTs  | .258068  | .1533785  | 1.68   | 0.093 | -.0428022 , .5589382 |
| PRO   | -.0344174 | .016518  | -2.08  | 0.037 | -.0668195 , -.0020154 |
| SIZ   | -.0096347 | .0032461  | -2.97  | 0.003 | -.0160023 , -.0032671 |
| _cons | .1847003 | .0485003  | 3.81   | 0.000 | .0895611 , .2798394 |

sigma_u | .03826237
sigma_e | .0466744
rho     | .4019233 (fraction of variance due to u_i)

F test that all u_i=0: F(177, 1434) = 4.26 Prob > F = 0.0000
### 13. Results of Fixed Effect Model for Long-Term Leverage

**Fixed-effects (within) regression**

<table>
<thead>
<tr>
<th>Group variable: name1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of obs</td>
</tr>
<tr>
<td>Number of groups</td>
</tr>
</tbody>
</table>

**R-sq: within = 0.0185**

- Obs per group: min = 1
- avg = 9.1
- max = 10

**corr(u_i, Xb) = -0.1296**

| Term          | Coef.  | Std. Err. | t     | P>|t|   | [95% Conf. Interval] |
|---------------|--------|-----------|-------|------|---------------------|
| TAN           | 0.030269 | 0.0419753 | 0.72  | 0.471| -0.0520707 to 0.1126088 |
| VOL           | 0.000031 | 0.0002273 | 0.14  | 0.892| -0.0004149 to 0.0004769 |
| GRO           | 0.0221342 | 0.0090601 | 2.44  | 0.015| 0.0043618 to 0.0399067 |
| NDTS          | -0.3445766 | 0.2866573 | -1.20 | 0.230| -0.9068896 to 0.2177364 |
| PRO           | -0.1286924 | 0.0305133 | -4.22 | 0.000| -0.1885478 to -0.0688369 |
| SIZ           | -0.0083717 | 0.0061111 | -1.37 | 0.171| -0.0203591 to 0.0036157 |
| __cons        | 0.353505  | 0.0910693 | 3.88  | 0.000| 0.1748615 to 0.5321486 |

**F test that all u_i=0:**

\[ F(177, 1433) = 18.95 \]

**Prob > F = 0.0000**