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Determinants of Capital Structure: An Empirical Test of Pecking Order Theory on UK Data

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Abstract

We investigate the main predictions of pecking order theory that has been central to the corporate capital structure debate since its postulation by Myers (1984) and Myers and Majluf (1984). Using a sample of 189 large UK companies, we find that pecking order theory provides only a partial explanation to financing decisions. Contrary to the prediction, 50% of the firms with internal funds deficit pay down debt and 65% of the firms with surplus issue new debt. The pecking order behaviour is particularly strong among moderately levered and medium sized firms. Tests of two different deficit compositions show that current portion of long term debt is included in the DEF variable beyond its role, thus DEF should exclude it. We also find that profitability is negatively related with borrowing while tangibility is positively related. Inclusion of pecking order deficit in the capital structure model improves explained variation, however does not wipe out the effects of other variables. Our analysis does not offer a clear explanation about the impacts of growth opportunities and firm size on financing decisions.

Contents

Introduction

Pecking order theory is one of the most influential capital structure theories along with trade-off theory and market timing theory. Posited by Myers and Majluf (1984) and revised by Myers (1984), pecking order theory predicts that firms follow a financial hierarchy in an asymmetric information world. The theory is built on the fact that managers have more information about their firm than investors which in turn may lead to mispriced securities. Therefore, firms that are able to fund their needs using internal resources would do so rather than resorting to external borrowing. When firms need to finance their investment opportunities, they initially use internally generated funds such as retained earnings. Then they issue the safest security and lastly issue equity as a last resort. The theory predicts a dollar-for-dollar approach, the borrowed amount would be equal to the amount required to fund those projects. This reasoning also works in reverse when firms have a surplus and want to return cash to investors. If holding funds or distributing dividends is costly, managers pay down debt or repurchase shares. Less optimistic managers will pay down debt instead of repurchasing shares at a high price. Optimistic managers opt for repurchasing shares, forcing up share prices. After facing with high stock prices the number of optimistic managers lessens. If the asymmetric information is the only imperfection, the repurchase price would be so high that all managers end up paying down debt (Sunder and Myers, 1999).

In the simple version of pecking order, firms want to maximise shareholder wealth by avoiding costly external financing alternatives. There is no target debt ratio as in the trade-off theory, the threat of financial distress and tax advantages are assumed second order (Sunder and Myers, 1999). Firms only issue debt when internal resources are insufficient to finance new projects. As Fama and French (2002) note, pecking order theory neglects firms' payout policy. Theory does not explicitly say when and why firms pay dividends or determines a limit to the use of internal funds (retained earnings). However, since it is expensive to raise outside funds, less profitable firms are expected pay less dividends and retain more of their earnings. Although there is no optimal debt ratio, the point until which firms will continue borrowing is left to the managers' disposal. Ceteris paribus, more profitable firms use less external funds in the simple pecking order model. In the complex version, however, controlling for profitability, high growth firms might desire to preserve their low-risk debt capacity and resort to issuing equity. Once they decide to bear the cost of share issuance, they can issue more of it to accommodate future investments.

Most of the capital structure studies focus on US firms and other developed countries. In recent years, developing markets and multinational market studies have begun to emerge. Rajan and Zingales (1995), Booth, Aivazian, Demirguc-Kunt and Maksimovic (2001), Gonenc and Seifert (2008) and Gonzalez and Gonzalez (2008) are a few of the international capital structure studies. However, the studies on the UK companies are still rare despite the UK being a developed market. Adedeji (2002), Ozkan (2001) and Westgaard et al (2008) are the main empirical studies on UK firms' capital structure. Beattie et al (2006) also exemplifies a survey research on UK firms.

Many studies in the US and other markets present a theory as dominant strategy of financing, yet the evidence for the UK is somewhat inconclusive and mixed. Various individual factors can be identified as influential; however neither of the two theories is capable of independently explaining firm financing decisions in practice (Beattie et al, 2006). Utilizing the Sunder and Myers (1999) pecking order model, Adedeji (2002) investigates 608 UK firms between 1994 and 2000 and finds little support for the pecking order hypothesis. Average pecking order coefficients are very low, 0.22 for raw deficit variable and 0.305 for adjusted deficit variable. What he calls adjusted deficit coefficient is obtained when we do not include any surplus and raw deficit coefficients are obtained when both deficit and financial slack data are entered into regression. DEF variable in his model performs noticeably better when surplus is excluded, while explained variation remains almost the same; R^2 values do not increase considerably, only from 0.1396 to 0.15. He concludes that the relation between pecking order coefficient and internal financing deficit is lower than what the theory suggests. In his sub-sample tests he finds that pecking order hypothesis explains new debt issues better at high debt ratios in contrast to Sunder and Myers (1999) assumption that firms with moderate or low debt ratios should abide more closely by the financial hierarchy. Expected growth and size are also found to have significant impact on the new issues of debt, consistent with the literature. Some proxies in his model are not clearly explained. For example, volatility proxy in his trade-off model is defined as volatility of earnings, however the type of earnings is not specifically stated. Earnings can be defined in many ways, most researchers use EBIT or EBITDA values as earning proxies (see Table 1), this point could be made clear.

Westgaard et al (2008) analyse UK real estate companies using traditional variables and a 308 firm-large sample. They find profitability, tangibility and size are positively related with leverage, however the significant positive coefficient on profitability contradicts pecking order predictions and major findings in the literature. Therefore their results are more consistent with trade-off theory, yet lend some support to the pecking order hypothesis.

Beattie and Goudacre et al (2006) survey listed UK firms. Around half of the firms say they seek a target debt level, while 60% of the firms say that they follow a financial hierarchy. Notably, part of the surveyed firms follows both approaches whilst some do not adopt either strategy. An important finding of their study is those surveyed do not view either theory mutually exclusive or exhaustive. Moreover, managers do not believe that seasoned share issues do not send a negative signal to the market, contrary to pecking order predictions. Authors claim that this heterogeneity casts doubt on the usefulness of the large scale archival empirical researches since they cannot reflect such diversity.

In this research we test the basic pecking order predictions by using Sunder and Myers (1999) equation. Then we test disaggregated pecking order equation and conventional capital structure models. We run the tests on annual data to observe year-to year change in firm behaviour. The structure of the rest of the paper is organised as follows: Chapter 1 presents a brief literature review, Chapter 2 explains frequently used dependent and independent variables in capital structure studies, Chapter 3 defines models, Chapter 4 dwells on data, Chapter 5 discusses empirical results and section 6 draws the conclusion and discusses limitations.

Chapter 1. Literature Review

There is a vast literature about capital structure. We only mention a few leading articles on several developed and emerging markets. One such study is carried out by Helwege and Liang (1996), where they use a logit model and several traditional variables to test pecking order predictions on a sample of American IPO firms. They fail to find any relation between firms' financial deficit and use of external funds. Firms with cash surpluses avoid external financing; however firms that access capital markets do not follow the pecking order when raising funds. See Table 1 to view variables used in reviewed studies.

Sunder and Myers (1999) introduce contemporary pecking order model. Traditional models use leverage ratio, which is mostly long term debt scaled by total assets, as dependent variable and various accounting ratios as independent variables. Instead they introduce the annual change in debt as the dependent variable. Annual positive changes in debt represent new borrowing and reduction in debt means the firm pays down debt. The coefficient on the DEF variable in the model is called pecking order coefficient. In a perfect fit, this coefficient is expected to be 1, which means all deficits are financed by issuance of debt. It is argued that traditional models do not provide this dollar for dollar explanation; the coefficients on independent variables represent a positive or negative relationship with firms' current leverage ratio, since dependent variable is leverage, not the change in leverage ratio.

They use 157 large and mature American companies and find strong support for pecking order. However, they are concerned that their sample could be biased towards large companies and in particular the pecking order implications could be poorly specified due to their simple model. Still they argue that using large companies is unlikely to affect the results since all companies, no matter what size they are, are expected to exhibit the same behaviour except those with the highest and the lowest debt ratios. Contrary to their argument, subsequent cross-sectional studies of Helwege and Liang (1996) and Frank and Goyal (2003) show that firm size in fact does matter. They observe that deficit variable performs significantly better in samples dominated by large companies. Supportive of this evidence, deficit variable is unable to explain much of the external finance in samples consisting mostly of small firms. In addition, large companies are more inclined to issue debt because they have good access to debt markets, thereby tilting the sample towards a favourable explanation of pecking order (Adedeji, 2002). Several scholars emphasize the importance of a more versatile model (i.e. Adedeji, 2002) and Frank and Goyal (2003) put the idea into practice. As explained below, their results are not as upbeat as Sunder and Myers'.

Fama and French (2002) examine target leverage and short term response of leverage to the variation in earnings in annual samples. They investigate a 33 year period with an average of 2844 US firms each year. Their results suggest that more profitable firms borrow less, confirming pecking order predictions. Firms with more investment opportunities are also less levered which is consistent with the complex version of the pecking order theory. On the other hand, this finding belies the simple model which predicts a positive relationship between leverage and growth opportunities. An interesting contribution of their paper is using firm size also as a proxy of volatility. Assuming large firms are more diversified and have less volatile earnings, they define natural logarithm of assets as volatility proxy and document a negative relationship between leverage and volatility.

One of the prominent pecking order studies is conducted by Frank and Goyal (2002). They utilise an extended Sunder and Myers equation while excluding a variable that is determined to be irrelevant, specifically current portion of long term debt. They find that large firms are more inclined to issue debt, however net equity issues more closely track financial deficit than net debt issues. In addition, the pecking order behaviour exhibited by larger firms is not robust when conventional factors are included. In a nested model with DEF variable inserted into traditional variables, it is expected that the pecking order coefficient will wipe out the effect of traditional variables. This is not the case, yet the variables have expected signs. The coefficients are positive on log sales and tangibility, negative on profitability.

The last paper we review in the US market is carried out by Ritter and Huang (2008). The research is quite exhaustive, it scrutinises a 38 year period using more than 12,000 firms that are continuously listed. The long analysis period enables the authors examine time patterns in pecking order behaviour. They document that right before Myers' (1984) article was published, the market had shown strong pecking order behaviour, the average net equity issuance between 1974-78 was below 2% (scaled by book assets). However, this pattern that pecking order theory is built on has begun to break down shortly after Myers' publication of his article. The pecking order coefficients are around 0.8 and 0.9 in 1970s and they hit a record low in the last decade, declining to only 0.3 in 2000. Some of their findings are consistent with the pecking order; firms with more cash and higher profitability are less likely to access capital markets. Age is also an important factor, older firms rely less on external financing. When they issue, more profitable, older and larger firms mainly issue debt. In addition, highly levered firms issue more equity than debt. This outcome is supportive of trade-off theory, however also lends little support to the pecking order prediction that the theory should best hold in firms with low and moderate debt ratios. While these results are partly consistent with pecking order theory, as they state, the main motivation in issuing debt is equity risk premium. Overall, publicly traded US firms fund a larger proportion of their financing deficit with external equity when the cost of equity capital is low and finance their deficit with debt when equity market risk premium is high. This result indicates that firms time the market, rather than adopting a financial hierarchy.

Booth, Aivazian, Demirguc-Kunt and Maksimovic (2001) are among the first to carry out an international capital structure study. They examine 10 developing countries and document that financing decisions are affected by the same factors as in developed countries. No matter how debt ratios are defined, profitability is negatively correlated in 9 of 10 countries in their sample, which is largely consistent with the pecking order. They find that total debt ratios increase with size, decrease with profitability and tangibility. When long term debt is used as dependent variable, the sign of tangibility coefficient turn positive, size coefficient turn negative and profitability remains the same. While partly consistent with pecking order predictions, results support a traditional argument where long term investment is financed with long term borrowing and short term investment with short term liabilities.

A more recent international study is conducted by Gonenc and Seifert (2008). They look into capital structures in 23 emerging markets including Brazil, China and Turkey and argue that emerging markets could be an ideal place to find support for the pecking order hypothesis since the information outside investors receives is more likely to be distorted or managed. They regress both a contemporary and a conventional model on the data covering a 20 year period from 1985 to 2004 and find no support for the pecking order. The strict pecking order that borrowed amount should be equal to the deficit is strongly rejected. Equity is often issued, even by firms that are not expected to issue equity such as small, high growth and dividend paying firms. The highest sub-sample pecking order coefficient is 0.711 which is considerably below its hypothesized value and the entire sample average pecking order coefficient is below 0.55. Large firms, less levered firms and low growth firms have relatively larger coefficients than other sub-groups. In the traditional model test, growth and profitability proxies have negative, size proxy has positive signs consistent with pecking order. Only tangibility contradicts theory predictions with a negative sign. Inclusion of DEF variable in the model does not wipe out the effects of other variables or increase explained variation (R^2).

Gonzalez and Gonzalez (2008) examine the effects of property rights and creditor protection using 12,049 international firms and conclude that pecking order and trade-off theories apply differently across countries. They find that the trade-off theory is more valid in countries with stronger property rights. Conversely, weaker protection of property rights raises the agency costs of external financing and leads to the preferential use of internal funds in the first place as predicted by pecking order. In addition, greater bank concentration substitutes for asset tangibility and creditor protection and reduces agency costs between debt holders and shareholders.

In their study on Spanish market Vidal and Ugedo (2005) posit that pecking order model is generally intended for listed companies and leaves the rest of firms out of explanation. To that end they use both listed and unlisted firms in their study. It is also argued that Myers and Majluf model applies to markets like American stock market where shares are offered mainly through firm commitment contracts, not via right issues. In a firm commitment contract shares are offered to the public simultaneously, thus a wealth transfer from new shareholders to the existing shareholders takes place. In right issues existing shareholders enjoy priority in the purchase of new shares thereby minimising the possibility of wealth transfer. Therefore, the pecking order prediction that equity issue is the last resort may not hold in markets such as Spain where right issues are prevalent method of issuance. Their results show that pecking order theory holds for most sub-samples analysed, in particular for the small and medium sized enterprises, high growth companies and highly levered firms.

Demirhan (2009) carries out one of the country-specific emerging market studies. She investigates a sample of Turkish service firms using traditional variables and documents that tangibility, firm size and profitability are important factors influencing capital structure. The sign of profitability variable is negative and size is positively related with leverage, both are consistent with pecking order. Only tangibility contradicts pecking order; fixed assets proxy has a negative sign, however it should not be surprising since the sample analysed consists of service firms, which have mostly intangible assets.

Umutlu (2008) tests market timing and pecking order predictions in Turkey using a panel of IPO firms and finds that pecking order theory is more applicable. Market to book ratios which insinuate good investment opportunities under the pecking order theory are positively related with leverage and profitability negatively correlated as expected. However, there is also evidence of market timing, specifically in hot IPO markets when market conditions are more favourable for equity issues, the increase in market-to-book ratio is associated with a decrease in leverage.

Another research conducted by Akyuz et al (2006) focuses on micro, small and medium sized enterprises (SME) in Turkey. They survey 851 SMEs in forest products industry where SME is defined as enterprises employing less than 250 employees and document that SMEs prefer internal financial sources to costly capital from external markets. The average total debt ratio is 25% which implies that 75% of the capital is provided by owners. This is partly because financial opportunities and capital markets are developed for large corporations. It also emerges from the results that large and mature companies tend to retain less of their earnings while new and small firms retain around 60% of their earnings consistent with pecking order theory.

China has emerged as a new interest of capital structure research in recent years. First study we know is Chen (2004) where he concludes that neither pecking order nor trade-off theory offers a convincing explanation for the financing choices of Chinese firms. Instead, Chinese firms seem to follow a new pecking order: retained earnings, equity issuance and long term borrowing. This is largely due to differences in institutional settings between Western and Chinese markets. The constraints in the financial sector also influence leverage decisions of Chinese firms.

Another study on Chinese market is carried out by Huang and Song (2005) where they scrutinize 1200 Chinese listed firms for a 10 year period. Summary results suggest firms prefer equity to debt once they go public. Signs of coefficients are consistent with pecking order; size and tangibility are positive and profitability is negatively related with leverage, however debt ratios are quite low. Consequently, Huang and Song conclude that their results are more consistent with trade-off theory.

Lastly, Jinlan and Yu (2008) analyse 407 Chinese firms listed on the Shanghai Stock Exchange and find no evidence in favour of pecking order. In pecking order regression, DEF coefficient of the entire sample is as low as 0.152, this figure is nearly 0 when only small companies are considered and the coefficient increases to 0.896 when large companies are tested. This finding that large firms more closely follow pecking order is in contrast with pecking order predictions. Firms with moderate debt ratios also do not follow pecking order in absolute contradiction with Myers-Sunder's prediction, the DEF coefficient of moderately levered firm sub-sample is only 0.134.

Chapter 2. Determinants of Capital Structure

Harris and Raviv (1991) say factors influencing capital structure decisions are uncountable. Many factors and models can be criticised from a number of aspects; Booth et al (2001) question the feasibility of empirically distinguishing capital structure models, while Chirinko and Singha (2000) claim that Sunder&Myers pecking order model can test neither trade-off nor pecking order theory. However, it is acknowledged that empirical studies are never complete; there is always a way to further improve the methodology and suggestions. Thus it is still necessary to determine some proxies that are applicable to the market and the environment studied. In this section I present a brief justification of the most used variables in pecking order studies.

a. Dependent Variable

In capital structure studies, dependent variable is usually a debt ratio that is defined in many ways; long term debt/assets, long term debt/book equity, total liabilities/assets and so on. Arguably, pecking order predictions are more about long term needs of firms and it is long term debt that is more sensitive to adverse selection problems and moral hazard (Gonzalez and Gonzalez, 2008). Therefore, researchers preferably use long term leverage as dependent variable and similar leverage ratios are used to check robustness of results. In a study using non-current debt/assets as dependent variable for instance, total debt/assets ratio could be used to test robustness. It is also common to use leverage ratios scaled by equity, in such a case independent variables must also be scaled by the same value; that is equity. We use long term debt/assets and long term liabilities/assets as dependent variables.

b. Independent Variables

b.1 **Tangibility (Asset Structure)**

It is acknowledged that tangible assets act as collateral when firms resort to external borrowing. This is particularly the case when firms want to use other ways of borrowing than issuing debt. Thus, tangible assets behave like a catalyst and facilitate borrowing. They also affect information asymmetry between managers and outside investors. As Harris and Raviv (1991) point out, firms with fewer tangible assets are more likely to suffer from information asymmetry. Empirical literature largely confirms this prediction; Marsh (1982), Booth et al (2001), Frank and Goyal (2003) and Westgaard et al (2008) document a positive relationship between fixed assets and leverage. There are also studies that suggest a negative relationship such as Gonenc and Seifert (2008). We expect to see a positive coefficient in this study.

b.2 **Profitability**

Pecking order theory is largely built on the assumption that more profitable firms have more internal funds to finance their needs. Firms with abundant cash will consider tax advantages of borrowing as secondary importance since use of debt brings about different responsibilities for the firm. Trade-off theory claims firms will maximise their value when they balance those responsibilities and tax shield and reach optimal debt ratio. Thus every firm should have a target ratio which is defined as the equilibrium point between positive tax effects of borrowing and negative effects of those responsibilities. In pecking order hypothesis, however, there is no target debt ratio. Firms resort to external financing only when they consume retained earnings and need more funds to run the business. Thus profitability is expected to be negatively correlated with leverage in pecking order tests. Empirical literature exhibits mixed evidence; Westgaard et al (2008) find a positive relationship, on the contrary Booth et al (2001) and Huang and Song (2005) document a negative sign.

b.3 **Size**

The predictions about size are quite straightforward. Large firms are usually more diversified and have easier access to external capital. The fact that they disclose more information to the outsiders (Rajan and Zingales, 1995) eases the asymmetric information problems and paves the way for external financing. However, when market conditions are more favourable, large firms may be inclined to issue equity instead. Ritter and Huang (2008) provide evidence that firms really time the market and the timing behaviour has become stronger in the last decade. Leary and Roberts (2005) suggest a 2-step hierarchy, a choice between external and internal financing. If we think of a two-step pecking order instead of 3-step, it is possible to say that large firms are more likely to be beneficiaries of the second stage. This prediction is mainly confirmed by empirical studies; Adedeji (2002), Frank and Goyal (2003) and Jinlan and Yu (2008) show that size is positively related with leverage. Booth et al (2001) find mixed evidence, total debt ratios increase and long term debt ratios decrease with size. The usual proxies used in the literature are, employee number (Akyuz et al, 2006), natural logarithm of sales and log assets.

b.4 **Volatility**

Volatility is a measure of firm risk; it shows how safe firm resources are and firm's ability to pay back its debt. This ability manifests itself in firms' earnings defined in a number of ways. It is usual to use standard deviation of earnings scaled by assets as a measure of volatility in models where variables are scaled by assets, see Huang and Song (2005) for example. It is also assumed that large firms will have more diversified investments and less volatile earnings, thus some scholars use size as volatility measures, i.e. Fama and French (2002). Care needs to be taken to avoid multicollinearity in this case. The usual prediction is that more volatile firms' ability to borrow might be restricted.

b.5 **Growth Opportunities**

Simple version of pecking order theory predicts that firms with more growth opportunities should borrow more to finance new investments. Myers (1984) relaxes this prediction and suggests that high growth firms might issue equity instead of exhausting debt options. High growth firms with outstanding debt might also prefer to issue equity since borrowing more would result in a wealth transfer from existing shareholders to the debt holders (Myers, 1977). Frequently used proxies are market to book equity, R&D expenses/assets and annual growth rate of assets. Empirical literature presents mixed evidence; the precise effect is uncertain due to different ways of measuring growth opportunities. Rajan and Zingales (1995), Fama and French (2002), Huang and Song (2005) and Gonenc and Seifert (2008) document a negative relationship with leverage which is consistent with the complex version of pecking order. Frank and Goyal (2003) and Umutlu (2008) find positive coefficients, both using market-to-book ratio as proxy for expected growth.

b.6 **DEF (Deficit)**

Deficit is the independent variable in Sunder and Myers (1999) pecking order model. It is an aggregated variable, obtained by totalling various annual earnings and expenses. Then this value is regressed against the annual change in debt or the amount of debt issued. By convention, both sides of the equation are scaled by assets or sales. If pecking order theory holds, the DEF coefficient should be close to 1. Researchers also test a nested model to see how DEF variable performs with conventional variables. If financing deficit is the key driver of leverage, DEF coefficient should wipe out the effects of other variables (Frank and Goyal, 2003). Sunder and Myers (1999) test target adjustment variable and DEF in the same model and find that target adjustment variable loses a significant proportion of its magnitude.

Chapter 3. Models and Proxies

As Booth et al (2001) point out; empirically distinguishing trade-off and pecking order hypotheses is difficult when traditional models are used, since the variables used to test one model could proxy for another in different models. The so called contemporary model is also not without problem. Chirinko and Singha (2000) argue that Sunder and Myers (1999) equation does not disprove trade-off theory when firms pursue a policy of fixed debt and equity financing. In this case a pecking order coefficient of 1 would only identify this ratio, instead of indicating a dollar-for-dollar approach. Arguably, the effect of those firms adopting a fixed debt and equity policy could be ignored if a sufficiently large sample is used. Moreover, Sunder&Myers equation is still the most used model to test pecking order behaviour in the literature, see Ritter and Huang (2008) and Vidal and Ugedo (2005) for example. Following them we use Sunder&Myers model in this paper. The model is simple; an independent variable, deficit, is regressed against the change in debt. Let us define the variables:

DIV_t: Dividend payments

X_t : Capital expenditures

ΔW_t: Annual change in working capital (working capital is measured as current assets - current liabilities)

C_t : Operating cash flow after interest and taxes

R_t : Short term debt and current portion of long term debt, short term debt had to be included since our database does not provide current portion of long term debt separately.

D_t : Long term debt outstanding.

$DEF_t : DIV_t + X_t + \Delta W_t + R_t - C_t$

The hypothesis to be tested is:

$$\Delta D_{it} : \alpha + \beta_{DEF} DEF_{it} + \varepsilon \text{ ,} \qquad (1)$$

ΔD_{it} is the amount of debt borrowed here (or retired if DEF is negative). It is calculated as the annual change in long term debt (D_t - D_{t-1}). We expect $\alpha = 0$ and β_{DEF}=1 in our model. β_{DEF} is the pecking order coefficient. If it is significantly different from 1, the hypothesis is rejected. Both dependent and independent variable is scaled by total assets.

Frank and Goyal (2003) and Helwege&Liang (1996) argue that current portion of long term debt is irrelevant and Sunder&Myers included it in the deficit beyond its role. To see whether this inclusion is justified, we also compose DEF excluding R_t and run the same regression. We name this variable as $DEF_{2.}$ Results are reported in a separate panel.

The DEF is an aggregated variable here. It is also of interest to see individual behaviour of its components. Thus we run a decomposed regression following Frank and Goyal (2003):

$$\Delta D_{it} : \alpha + \beta_{DIV}DIV_{it} + \beta_x X_{it} + \beta_w \Delta W_{it} - \beta_c C_{it} \quad (2)$$

To maintain consistency with pecking order, we expect all coefficients equal 1.

Conventional capital structure model:

$$LEV_i = \alpha + \beta_T T_i + \beta_{GR}GR_i + \beta_{LS}LS_i + \beta_P P_i + \beta_{DEF}DEF_i + \varepsilon \quad (3)$$

We use 2 dependent variables; long term debt/assets and long term liabilities/assets. Long term liabilities/assets is included since, arguably, it is liabilities, not only interest accruing debt that investors take into consideration. This inclusion will enable us test another aspect of the capital structure. T denotes tangibility measured as fixed assets/total assets, GR is the growth rate of assets measured as (total $assets_t$-total $assets_{t-1}$)/total $assets_{t-1}$, which is our proxy for growth opportunities, LS represents log sales, P denotes profitability measured as EBIT/total assets. A separate nested model with DEF variable is also tested to see its performance. When DEF is included in the model, it is expected that DEF will be significantly correlated with leverage and its inclusion will lower the effect of other variables in the model. Formally, the model to be tested is:

$$LEV_i = \alpha + \beta_T T_i + \beta_{GR}GR_i + \beta_{LS}LS_i + \beta_P P_i + \beta_{DEF}DEF_i + \varepsilon. \quad (4)$$

Chapter 4. Data

Our sample consists of 189 firms that trade at London Stock Exchange. We take FTSE 350 Index firms as our population, eliminate trusts (including REITs), counselling firms, investment companies, banks and other financial firms. Firms with less than 5 years of data are also dropped from the sample. After elimination process we end up with 207 companies. The last 18 companies had to be excluded to save time. We also require our sample companies to have continuous data flow through 2005 and 2009, however this does not cause significant biases since we use the most recent accounting years' data. As widely known, recent years' data are more easily accessible. As a result, only 2 firms are dropped due to discontinuity of financial statements.

We obtain the required data as follows: First the list of FTSE 350 companies is downloaded from LSE website; our list is valid as of 16th July 2010. Then we investigate firms' individual industries and drop necessary firms accordingly. In the next step, balance sheet, income statement and cash flow statements are downloaded from Thomson One Banker using Thomson Financials tool. Lastly, we transfer the necessary data from financial statements of firms to our Excel file using copy and paste function. Since used database allows access to only last 5 years' balance sheet and cash flow statements, our analysis period is limited with 4 accounting year (lagged data is required for calculation of dependent variable in equation (1), change in working capital and growth proxy). The SPSS statistical software is used for correlation and regression tests.

Chapter 5. Empirical Analysis and Results

Table 2 provides summary statistics of the variables. We use a larger sample than Sunder and Myers (1999) and following them we require our sample companies to have continuous data flow through the years analysed. In addition, the characteristics of our sample bear resemblance to their sample, as seen from the last row in Table 2, average total assets is quite large, nearly £6 bn which is 6 times greater than that used by Adedeji (2002). Previous studies suggest that large companies are more likely to follow pecking order, thus we expect to see higher DEF coefficients. Table 3 displays the number of firms with internal funds deficit of surplus each year, where deficit is defined in two ways. Although we also include short term debt in the DEF variable, the number of firms with financial slack is unusually high; of 756 observations, 433 firms have deficit and 323 surpluses. The number of firms with surplus exceeds deficits when short term debt and long term debt repayments are excluded from the DEF. This observation exhibits a striking difference from what Adedeji (2002) observes; those figures in his study are 413 and 195 for deficit and surplus respectively. As we will see later, this disequilibrium affects our results.

a. **Pecking Order Model**

Table 4 reports the results of the entire sample test. We run the regression each year and use two different deficits to account for the claim made by Helwege and Liang (1996) and Frank and Goyal (2003). They argue that current portion of long term debt is irrelevant to the financing deficit and find higher pecking order coefficients when it is excluded. Our results are in supportive nature of this argument. The explained variation is quite low, 0.175 at its best when deficit includes R, this figure increases to 0.277 when deficit does not contain R. The pecking order coefficients are much lower than their predicted values; with the highest coefficients being 0.285 and 0.370 it is clear that our sample firms do not follow pecking order in the analysed years. It is also common among sample firms to pay down debt in years with insufficient internal funds and to borrow in years with abundant cash. Of 460 surplus observations, 232 (50 %) pay down debt, 179 (40 %) issue new debt and 49 do neither of them. The number of deficit firms are 295; 193 (65 %) of them issue debt as predicted by pecking order, 79 (27 %) pay debt and the debt remains the same for the rest of observations.

The DEF is an aggregated variable, thus it is questionable whether this aggregation is justified. Following Frank and Goyal we break down the deficit and run the regression against the same dependent variable. Table 5 reports results of the disaggregated pecking order test. The variables have expected signs; the coefficients on net working capital are significantly positive in all years, negative on operating cash flow and positive on capital expenditures and dividend payments. The surprising finding is the significant negative sign of the R, which is supposed to be positively related with the deficit according to pecking order. Exclusion of R, for the most part, does not cause a reduction in the explained variation, the sign and magnitude of the coefficients also remain the same, further supporting the argument that inclusion of current portion of long term debt in the model is beyond its role. Overall, the results do not provide outright justification for the aggregation; coefficients are noticeably lower than 1. However, given the fact that the highest pecking order coefficient is 0.370, it could be concluded that our results lend support to the aggregation. Reported signs are in consistent with the findings of Frank and Goyal (2002) who document negative signs on current portion of long term debt and operating cash flow, and positive signs on the rest.

Table 6 exhibits the results of sub-sample deficit and surplus tests. Adedeji (2002) reports that DEF variable performs much better when surplus firms are removed from the sample. Our results suggest the opposite; the models are not significant when sample consists only of those with internal funds deficit and pecking order coefficients are low. On the other hand, the coefficients on the surplus DEF are significantly higher than average entire sample DEF coefficient, which means firms with internal fund surplus more closely follow the pecking order. This result is unexpected since the ratio of sample firms with deficit that choose to issue debt (65 %) is higher than that of firms with surplus that prefer to pay down debt (50 %).

Tests on subsamples classified by size and leverage lend some support to the pecking order. As seen from Table 7 and 8, medium sized and moderately levered firms have higher DEF coefficients. The explained variation and significance of models are also greater in these sub-samples. It is expected that moderately levered firms will more closely follow the pecking order, conversely highly levered firms may avoid debt financing to circumvent high cost of financial distress and low levered firms might be inclined to use more debt to fill the gap and take advantage of borrowing in support of trade-off theory. Our results are consistent with Myers' prediction, however contradict a large part of the literature that find more support for the pecking order theory among largest firms.

b**. Conventional Model**

We run two different regressions to observe the impact of five independent variables on capital structure decisions. First model purely consists of conventional variables and pecking order deficit is included in the second model to see whether pecking order is the leading determinant. If DEF is the main driver of capital structure, inclusion of DEF should lead to a significant decrease in the magnitude of conventional variables' coefficients. As shown in Table 9, the sign of tangibility is significantly positive and profitability negative as expected. The effects of growth and size are ambiguous; we find both positive and negative coefficients. In addition, their magnitude is quite small and insignificant. Use of long term liabilities as dependent variable causes a noticeable increase in the explained variability and coefficients. This finding is supportive of the idea that interest accruing debt is not the only factor managers and debt holders take into account. The results of the nested model are not considerably different from the conventional model. We do not report growth and size variables in Table 10 since their coefficients remain virtually the same. Tangibility and profitability have again positive and negative signs; however inclusion of DEF does not cause a significant reduction in their magnitude nor is the impact of DEF sufficiently high to acknowledge that deficit is a driving determinant of financing decisions. Frank and Goyal (2003) note that when nested model is used, a decline in explained variation is expected, however we document the opposite. The R^2s of nested model are greater than conventional model. Still we cannot state that deficit is a key driver as the DEF indicators are, for the most part, insignificant.

Chapter 6. Conclusion and Limitations

In this research we investigate the main predictions of pecking order theory using a sample of 189 largest firms in the UK. Our entire sample results suggest that pecking order behaviour explains only a small part of the capital structure decisions. In addition, we do not document a dollar-for-dollar approach, 65% of firms with surplus issue debt while around 50% of deficit firms pay down debt. The explanation power is particularly strong in medium sized and moderately levered firm subsamples, consistent with pecking order theory. While our whole sample results are consistent with Adedeji (2002), sub-sample analyses run counter to his findings. He documents that exclusion of firms with negative deficit causes an increase in pecking order coefficients; in contrast we find that pecking order behaviour is stronger among firms with surplus. In addition, we show moderately levered and medium sized firms follow pecking order more closely than other firms, again in contradiction with his findings. Our findings of capital structure are mostly consistent with the literature. We document a negative relationship between profitability and leverage as predicted by pecking order theory. This single finding shows that trade-off theory does not apply to our sample firms since a positive correlation is suggested by it. The debt-facilitating effect of tangible assets is again confirmed by our results; displayed by significant coefficients. However, we fail to document any significant relationship between growth opportunities, size and borrowing. This outcome may stem from the characteristics or size of our sample, thus it is of interest to further look into financing choices of UK firms using a more diversified sample.

We need to acknowledge that the simplicity of our models might have led to some important omissions, for instance, we do not observe equity issues in this paper and had to include short term debt as part of independent variable in pecking order model (1), although short term debt does not originally have a place in that equation. For this reason, and in part due to irrelevance of ‘R’ as shown in Tables 4 and 5, we carry out the rest of tests without R variable hoping that this exclusion would reduce the extent of misleading.

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Appendix: Tables

Table 1: Capital Structure Proxies Used in Empirical Studies

Independent Variables	Definition	References
Tangibility	Fixed assets/Total assets	Rajan&Zingales (1995), Helwege&Liang (1996), Booth et al (2001), Adedeji (2002), Frank&Goyal (2003), Huang&Song (2005), Gonenc&Seifert (2008), Demirhan (2009), Umutlu (2008), Westgaard et al (2008).
Profitability	EBIT/Total Assets (ROA)	Booth et al (2001), Fama&French (2002), Chen (2004), Huang&Song (2005), Jinlan&Yu (2008), Westgaard et al (2008).
	EBITDA/Total Assets	Rajan&Zingales (1995), Gonzalez&Gonzalez (2008), Gonenc&Seifert (2008), Demirhan (2009), Umutlu (2008).
Size	ln(Assets)	Fama&French (2002), Gonenc&Seifert (2008), Demirhan (2009), Umutlu (2008), Westgaard et al (2008).
	ln(Sales)	Rajan&Zingales (1995), Booth et al (2001), Adedeji (2002), Frank&Goyal (2003), Huang&Song (2005), Gonzalez&Gonzalez (2008), Jinlan&Yu (2008), Demirhan (2009).
	ln(Equity)	Marsh (1982), Demirhan (2009).
Volatility	Standard deviation of EBIT	Booth et al (2001), Adedeji (2002), Huang&Song (2005), Westgaard et al (2008).
	Standard deviation of EBITDA	Helwege&Liang (1996).
	ln(Assets)	Fama&French (2002).
Growth Opportunities	Market to Book Ratio	Rajan&Zingales (1995), Booth et al (2001), Adedeji (2002), Frank&Goyal (2003), Huang&Song (2005), Gonzalez&Gonzalez (2008), Gonenc&Seifert (2008), Umutlu (2008).
	R&D Costs	Helwege&Liang (1996), Fama&French (2002), Demirhan (2009).
	Change in EBITDA	Westgaard et al (2008).
	Change in Total Assets	Fama&French (2002), Jinlan&Yu (2008).

Table 2: Summary Sample Statistics					
LEV1 is long term debt/total assets, LEV2 is long term liabilities/total assets, DEF1: DIVt + Xt + ΔWt+ Rt - Ct and DEF2: DIVt + Xt + ΔWt - Ct. TANG is fixed assets to total assets ratio, GROWTH is the annual change in total assets, PROFIT is defined as ROA, SIZE is the natural logarithm of annual sales. Assets are in million sterling.					
	Mean	**Median**	**St Dev**	**Min**	**Max**
LEV1	.202	.181	.170	0	.940
LEV2	.291	.273	.196	-.179	1.001
DEF1	.022	.014	.136	-.63	.740
DEF2	-.018	-.02	.136	-.63	.730
TANG	.295	.255	.229	.002	.953
GROWTH	.186	.092	.437	-.845	5.082
PROFIT	.109	.098	.106	-.80	.648
SIZE	7.132	7.089	1.554	.543	12.797
ASSETS	5897.95	1299.75	21169.43	33.63	237734.4

Table 3: Number of sample companies with internal funds deficit or surplus per year						
DEF1 is composed as: DIVt + Xt + ΔWt+ Rt - Ct. DIV represents annual cash dividends, X capital expenditures, ΔW annual change in net working capital, R short term debt and current portion of long term debt, and C operating cash flow. DEF2 is created by excluding R.						
	DEF1= DIVt + Xt + ΔWt+ Rt - Ct			DEF2= DIVt + Xt + ΔWt - Ct		
Years	Surplus	Deficit	Total	Surplus	Deficit	Total
2006	74	115	189	110	79	189
2007	77	112	189	114	74	188
2008	66	123	189	108	81	189
2009	106	83	189	128	61	189
Total	323	433	756	460	295	755

Table 4: Pecking Order Regression: Entire Sample								
DEF_1 is Sunder&Myers pecking order deficit, composed as : DIVt + Xt + ΔWt+ Rt - Ct. DEF_2 is composed by excluding short term debt and current portion of long term debt. Dependent variable is the change in long term debt. Both dependent and independent variables are scaled by total assets. Standard errors are in parentheses. *, ** and *** represent significance at 1%, 5% and 10% levels respectively. Unstandardised coefficients are reported. Models and variables that are significant at 5 percent are written in bold. N=189								
	DEF1= DIVt + Xt + ΔWt+ Rt - Ct				DEF2= DIVt + Xt + ΔWt - Ct			
	2006	2007	2008	2009	2006	2007	2008	2009
Constant	.004	.031*	.035*	-.023*	.005	.037*	.044*	-.011**
	(-.009)	(.007)	(.007)	(.006)	(-.01)	(.007)	(.007)	(.006)
DEF	.009	**.126***	**.192***	**.285***	.012	**.164***	**.251***	**.370***
	(-.029)	**(.05)**	**(.056)**	**(.045)**	(-.03)	**(.049)**	**(.052)**	**(.043)**
Adj. R^2	-.005	.027	.054	.175	-.004	.051	.105	.277
F	.092	**6.23***	**11.78***	**40.90***	.175	**11.20***	**23.067***	**73.002***

Table 5: Disaggregated Pecking Order Regression								
DEF1 is composed as : DIVt + Xt + ΔWt+ Rt - Ct. DEF2 is composed by excluding short term debt and current portion of long term debt. Dependent variable is the change in long term debt. Both dependent and independent variables are scaled by total assets. Standard errors are in parentheses. *, ** and *** represent significance at 1%, 5% and 10% respectively. Unstandardised coefficients are reported. CAPEX variables in 2009 are dropped due to collinearity. Models and variables that are significant at 5 percent are written in bold. N=189								
Variables	DEF1				DEF2			
	2006	2007	2008	2009	2006	2007	2008	2009
Constant	.002	.037*	.056*	-.034*	.005	.033*	.052*	-.048*
	.018	(.015)	(.013)	(.012)	.016	(.013)	(.012)	(.012)
R	.076	-.080	-.123	**-.402***	—	—	—	—
	(.191)	(.117)	(.111)	**(.114)**				
X	.316***	.210	**.322****	—	.310***	.209	**.303****	—
	(.187)	.145	**(.144)**		(.186)	.145	**(.143)**	
DIV	.014	-.009	.161	**1.590***	.013	-.004	.164***	**1.490***
	(.029)	(.113)	(.102)	**(.348)**	(.028)	(.113)	(.102)	**(.357)**
ΔW	**.376***	**.202***	**.200***	**.567***	**.369***	**.220***	**.240***	**.556***
	(.08)	**(.071)**	**(.075)**	**(.140)**	**(.079)**	**(.065)**	**(.066)**	**(.144)**
C	**-.198****	-.099	**-.322***	**-.253***	**-.196****	-.094	**-.329***	**-.222****
	(.103)	(.085)	**(.091)**	**(.098)**	**(.103)**	(.085)	**(.091)**	**(.10)**
Adj. R^2	.132	.055	.100	.147	.136	.058	.099	.094
F	**6.74***	**3.208***	**5.186***	**9.067***	**8.43***	**3.90***	**6.17***	**7.5***

Table 6: Pecking Order Regression DEF Only

DEF excludes short term debt and current portion of long term debt: DEF= DIVt + Xt + ΔWt – Ct. Standard errors are in parentheses. *, ** and *** represent significance at 1%, 5% and 10% level respectively. Unstandardised coefficients are reported.

	ONLY DEFICIT				ONLY SURPLUS			
	2006	2007	2008	2009	2006	2007	2008	2009
Constant	.057*	.033**	.063*	.020	.019	.023***	.049*	.010
	(.017)	(.015)	(.016)	(.013)	(.014)	(.012)	(.001)	(.009)
DEF	-.065***	**.253***	.091	.008	**.493***	.041	**.349***	**.580***
	(.035)	**(.10)**	(.119)	(.100)	**(.103)**	(.088)	**(.081)**	**(.068)**
Adj. R^2	.032	.070	-.005	-.017	.170	-.007	.141	.360
F	3.571***	**6.515***	.587	.006	**22.79***	.214	**18.6***	**72.312***

Table 7: Pecking Order Regression on Small-Medium-Large Firms

Firms with sales lower than £500 m are defined as small, between £500 m and £3 bn as medium, and sales higher than £3 bn are defined as large firms. DEF variable excludes short term debt and current portion of long term debt. Standard errors are in parentheses. *, ** and *** represent significance at 1%, 5% and 10% respectively. Unstandardised coefficients are reported. Models and variables that are significant at 5 percent are written in bold. N=189

	SMALL				MEDIUM				LARGE			
	2006	2007	2008	2009	2006	2007	2008	2009	2006	2007	2008	2009
Constant	.047**	.039*	.013	-.014	-.018	.027*	.050*	-.007	-.001	.050*	.057*	-.006
	(.02)	(.015)	(.021)	.015	(.015)	(.01)	(.008)	(.008)	(.011)	(.013)	(.01)	(.009)
DEF	.138	**.222***	.148	**.270***	-.01	.083	**.336***	**.469***	.046	.187	.103	**.359***
	(.097)	**(.084)**	(.162)	**(.086)**	(.035)	(.077)	**(.055)**	**(.061)**	(.123)	(.108)	(.133)	**(.102)**
Adj. R^2	.021	.112	-.01	.170	-.01	.001	.277	.379	-.02	.040	-.008	.199
F	2.026	**6.90***	.832	**10.028***	.091	1.132	**37.785***	**59.522***	.140	2.99***	.603	**12.44***

Table 8: Pecking Order Regression on Low-Moderate-High Leverage Firms

Leverage is defined as long term debt/total assets ratio. Low leverage category contains firms with leverage ratio of lower than 10%, moderate leverage category contains leverage ratios between 10% and 30%. Firms with leverage ratio of higher than 30% are in the high leverage firm category. DEF variable excludes short term debt and current portion of long term debt. Standard errors are in parentheses. *, ** and *** represent significance at 1%, 5% and 10% respectively. Unstandardised coefficients are reported. Models and variables that are significant at 5 percent are written in bold. N=189

	LOW				MODERATE				HIGH			
	2006	2007	2008	2009	2006	2007	2008	2009	2006	2007	2008	2009
Constant	-.023**	-.02***	-.028**	-.014***	-.003	.041*	.053*	-.012	.088*	.080*	.090*	-.008
	(.01)	(.010)	(.012)	(.008)	(.011)	(.009)	(.007)	(.010)	(.028)	(.017)	(.01)	(.012)
DEF	**.117****	-.019	-.091	**.299***	**.566***	**.200***	**.256***	**.421***	-.055	.171	**.676***	**.391***
	(.053)	(.059)	(.083)	**(.056)**	**(.107)**	**(.075)**	**(.054)**	**(.073)**	(.046)	(.115)	**(.106)**	**(.106)**
Adj. R^2	.055	-.015	.004	.312	.265	.074	.221	.300	.009	.024	.407	.201
F	**4.914****	.100	1.199	**28.63***	**28.03***	**7.047***	**22.239***	**33.206***	1.418	2.213	**40.865***	**13.553***

Table 9: Leverage Regression with Conventional Variables

$LEV_i = \alpha + \beta_T T_i + \beta_{GR} GR_i + \beta_{LS} LS_i + \beta_P P_i + \varepsilon$ .TANG= Fixed assets/Total assets, GROWTH= The annual growth rate of total assets, PROFIT= Operating profit/Total assets, SIZE= ln(Sales). Dependent variables are long term debt/assets and long term liabilities/assets. Standard errors are in parentheses. *, ** and *** represent significance at 1%, 5% and 10% respectively. Unstandardised coefficients are reported. Models and variables that are significant at 5 percent are written in bold. N=189

	LEV1= Long term debt/Assets				LEV2= Long term liabilities/Assets			
	2006	2007	2008	2009	2006	2007	2008	2009
Constant	.207*	.175*	.174*	.096***	.228*	.155*	.169*	.094
	(.061)	(.059)	(.059)	(.06)	(.067)	(.06)	(.068)	.068
TANG	**.236***	**.281***	**.243***	**.203***	**.328***	**.359***	**.306***	**.254***
	(.057)	**(.053)**	**(.051)**	**(.05)**	**(.063)**	**(.058)**	**(.059)**	**(.057)**
GROWTH	-.014	.013	-.016	-.079	.000	.025	-.014	**-.16****
	(.030)	(.034)	(.020)	(.061)	(.000)	(.037)	(.024)	**(.07)**
PROFIT	-.183***	**-.210****	**-.414***	-.128	-.238***	-.104	**-.414***	-.121
	(.126)	**(.11)**	**(.098)**	(.151)	(.138)	(.120)	**(.113)**	(.173)
SIZE	-.008	-.004	.002	.008	-.001	.004	.013	.020
	(.008)	(.007)	(.008)	(.008)	(.009)	(.008)	(.009)	(.009)
Adj. R^2	.070	.127	.148	.085	.117	.161	.161	.138
F	**4.52***	**7.82***	**9.15***	**5.37***	**7.21***	**10.05***	**9.95***	**8.53***

Table 10: Nested Leverage Regression with Conventional Variables								
$LEV_i = \alpha + \beta_T T_i + \beta_{GR} GR_i + \beta_{LS} LS_i + \beta_P P_i + \beta_{DEF} DEF_i + \varepsilon$. TANG= Fixed assets/Total assets, PROFIT= Operating profit/Total assets, DEF= DIVt + Xt + ΔWt - Ct. Dependent variables are long term debt/assets and long term liabilities/assets. Standard errors are in parentheses. *, ** and *** represent significance at 99%, 95% and 90% respectively. Unstandardised coefficients are reported. Growth and Size coefficients are not reported since they remain virtually the same as in Table 9. Models and variables that are significant at 5% are written in bold. N=189								
	LEV1= Long term debt/Assets				LEV2= Long term liabilities/Assets			
	2006	2007	2008	2009	2006	2007	2008	2009
Constant	.174*	.165*	.172*	.103***	.193*	.144**	.165*	.100
	(.057)	(.059)	(.059)	(.06)	(.063)	(.064)	(.068)	.068
TANG	**.215***	**.274***	**.242***	**.187***	**.305***	**.350***	**.304***	**.239***
	(.053)	**(.052)**	**(.052)**	**(.051)**	**(.059)**	**(.057)**	**(.06)**	**(.059)**
PROFIT	-.209***	-.187***	**-.411***	-.102	**-.265****	-.078	**-.407***	-.096
	(.117)	(.11)	**(.098)**	(.152)	**(.129)**	(.120)	**(.114)**	(.174)
DEF	**.203***	.149***	.028	.142	**.216***	**.183****	.062	.136
	(.037)	(.085)	(.092)	(.100)	**(.04)**	**(.09)**	(.107)	(.116)
Adj. R^2	.200	.136	.144	.090	.232	.174	.157	.140
F	**10.37***	**6.93***	**7.302***	**4.71***	**12.37***	**8.93***	**8***	**7.11***