What Determines Capital Structure?
Evidence from IT Firms in the UK

by Irina Trunova

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Department of Economics

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Supervisor: Professor Istvan Konya

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Abstract

This study tests the determinants of capital structure for the firms listed in the Software & Computer Services sector at the London Stock Exchange during the five year period from 2006 to 2010. Three models using pooled OLS, cross-section and time fixed effects regression equations are used to estimate the relationship between firm decisions about level of leverage and tangibility of assets, firm size and profitability. Tangibility and profitability are found to be positively correlated with the leverage ratio, while firm size revealed a negative effect. Findings are explained with the reference to the late 2000's financial crisis.

Table of contents

Chapter 1 – Introduction

Studies in the area of corporate governance are drawing more and more attention of both academic researchers and business people, such as analysts, investors, boards of directors and officers. Hundreds of academic papers are devoted to the issue of capital structure. Choices of appropriate ownership structure and exercise of control rights, capital structure and capital resource allocation are amongst the most important financial and strategic decisions which are essential for a company's viability and successful performance. Firm activities can be financed through different sources, and the capital structure is a combination of various kinds of bank loans, debt, preferred stock, warrants, and equity in financing the firm activities.

"Financial leverage (gearing) is the use of debt to increase the expected return on equity." (Brealey, Myers and Allen, 2006, p. 360). It can be measured by the ratio of debt to debt plus equity. A firm is considered to be highly-leveraged if its debt is significantly larger than equity. Although leverage is attractive for investors as well as for firms, it increases risks since the magnitude of both possible gains and losses widens.

The difference between current and fixed assets is that the latter are used by firms in the long term, rather than in the short run. In a firm's balance sheet fixed assets are divided into tangible assets, intangible assets, or investments. For instance, different kinds of property such as plants, equipment, machinery, buildings and land represent tangible assets, while patents and trademarks are intangible. The ratio of tangible (fixed) assets to total assets is called the tangibility of assets.

This thesis contributes to the existing debate on capital structure puzzle. I obtained recent UK firm-level financial data from the Company Profile Reports service provided by the London Stock Exchange (LSE). In particular, I considered the relationship between firm leverage and such factors as tangibility of assets, firm size, and profitability using a panel of

100 Software & Computer Services companies listed at the London Stock Exchange from 2007 to 2010 each year. Next I extended the period by one year back to 2006 and 73 companies' reports remained that have all necessary financial information. The UK was selected for this case study because the results can be a good approximation for other developed countries due to their similarity in financial and social institutions.

I study firm-specific determinants of capital structure such as tangibility of assets, firm size and profitability. The patterns in the leverage level, as well as the trends caused by recent crisis are discussed, i.e. that the overall economic recession resulted in a sharp drop in debt ratio across the firms.

Three types of regression equations are examined to estimate the influence of changes in firm size, tangibility of assets and profitability on capital structure. The objective of the modeling is to detect if there is any statistically and economically significant effect of the above-mentioned factors on the explained variable and estimate it. The Pooled OLS method and the panel data analysis using cross-section fixed effects and accounting for the time trend are employed for this study.

In accordance with the theories of capital structure, I hypothesized that the correlation of firm leverage with tangibility of assets is positive because firms with a larger amount of tangible assets should have a better access to external sources of financing. This hypothesis was proved.

Similar to Rajan and Zingales (1995), I expected that debt ratio should be positively correlated with firm size and negatively with profitability. Large companies usually look more secure in the eyes of investors compared to small firms that are vulnerable to market fluctuations. In turn, profitable companies tend to heavily rely on financing by issuing new shares and offering them to the public than on borrowing debt. However, the hit of the late-2000's global financial crisis led to the changing of relationship between leverage and such

factors of interest as firm size and profitability. The study results show that during the recession investors tended to be more conscious about providing financing to large corporations, preferring dealing with smaller firms in order to diversify their risks. Regarding the profitability, it became very complicated even for a profitable company to get financed by issuing the equity, so such a company had to switch to bank loans instead of offering new shares.

The paper proceeds as follows. Chapter 2 overviews the two theories of capital structure, the trade-off theory and the pecking-order theory. Chapter 3 is devoted to data description and functional form specification. Chapter 4 comprises the discussion of results. Finally, the Conclusion summarizes the main findings of study and data limitation issues.

Chapter 2 – Literature review

This chapter presents the overview of existing literature devoted to capital structure puzzle.[1] The seminal article by Modigliani and Miller (1958) lays the foundation for the discussion of relevance of capital structure for firm value.[2] The Modigliani-Miller irrelevancy theorem states that "market value of any firm is independent of its capital structure and is given by capitalizing its expected return at the rate appropriate to its class" (1958, p.268). In other words, the way "the pie" of cash flows generated by a firm is sliced into pieces does not affect its total value of cash flows, and the firm value is determined by its real assets, and not by the issued securities. Modigliani and Miller claim that if the firm changes the proportions of debt and equity in its financing, what changes is the risk and expected return on the securities, and not overall cost of capital. The contribution of Modigliani and Miller to financial economics was influential; they made a stark claim that led to further fruitful debate, and were awarded the Nobel prizes in Economics.[3] However, the propositions they made in their 1958 paper are unlikely to hold in the real world due to their assumption of perfect markets. If capital structure had been of no relevance or importance for shareholders' wealth, then the market agents would not have watched over the firms' strategies, and stock prices would not have reacted considerably after announcements about changes of proportions in the mix of financing sources. Therefore, this represents simple evidence against the Modigliani-Miller theorem which would only hold in perfect capital markets. Nevertheless, the prevalent number of studies tackling the issue of capital structure inevitably refers to this theorem in order to better illustrate why the mix of financing sources may matter.

[1] Unless otherwise mentioned, the information in this is primarly bases on Brealey, Myers, and Allen (2006) and Grinblatt and Titman (2002).
[2] The findings of Modigliani and Miller were partly anticipated by Williams (1938), and Durand (1952).
[3] Modigliani was awarded the Nobel Prize in Economics in 1985, and Miller in 1990, along with Harry Markowitz and William Sharpe.

There are some factors that most likely make the capital structure affect the weighted-average cost of capital and the firm value. Among them are corporate and personal taxes, the financial distress and bankruptcy costs, asymmetric information, the costs of drafting and enforcing debt contracts, and the effects of debt on incentives for management.

2.1 The trade-off theory

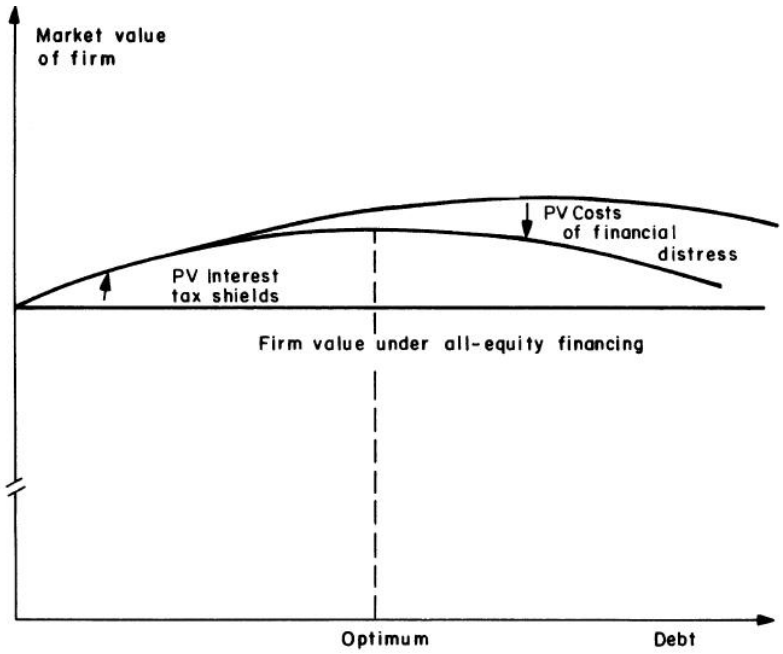
The competing theories developed by financial economists to scrutinize the impact of capital structure on firm value are the trade-off theory and the pecking-order theory. The trade-off theory analyzes the advantages and drawbacks of debt financing, compares the benefits of debt with costs in order to determine the target debt ratio.

On the one hand, in the U.S., U.K and France, corporate taxes favor debt financing since interest there is treated as a tax-deductible corporate expense, while non tax-deductible dividends correspond to the distribution of profits rather than expenses. Such a corporate tax shield explains why firms may be inclined to finance their operations through debt rather than equity. If personal taxes paid out as equity income are present in an economy, they also affect capital structure, because the minimization of both corporate and all personal taxes becomes a managerial goal. On the other hand, increasing leverage always causes higher risk for investors, higher probability and higher costs of financial distress, which appears when promises to creditors are broken or honored with difficulty, and in some cases such instability may lead to bankruptcy.

It is believed that there is some optimum for the firm debt ratio that is determined by the trade-off between the tax benefits and the costs of probable financial distress. The paper by Modigliani-Miller allows bankruptcy but makes an unrealistic assumption about the absence of bankruptcy costs. Nevertheless, in reality there are direct and indirect costs of financial distress. The bankruptcy costs represent the direct legal and administrative fees (transaction costs) associated with the mechanisms allowing creditors to take over in case a

company files for bankruptcy. The indirect costs take place even if the bankruptcy is avoided but the negative effect of financial distress may result in lost profits from the shrinking market demand for the goods or services, decline in investments, management turnover, loss of the firm's reputation, higher interest rates on bank loans, and so forth. Indirect costs are usually a lot more difficult to estimate compared to the direct costs. When a firm faces financial troubles, the interests of bondholders (creditors) and shareholders may be in conflict. Figure 1 developed by Myers (1984) depicts how present values of interest tax shields and costs of financial distress are taken into account by firms when they determine their target debt ratios.

Figure 1. The relationship between market value of firm and the firm's target debt ratio according to the static tradeoff theory of optimal capital structure



Note: PV stands for the present value.

According to the trade-off theory of capital structure, companies have different target debt ratios depending on the kind of assets they possess. Hereby it is expected that firms with safe, tangible assets can afford having high target debt ratios, while distressed companies with risky, intangible assets should have low debt ratios and rely mostly on equity financing. The main drawback of the trade-off theory is that in spite of its success in explaining many industry differences in capital structure, there are still puzzles left to answer.

Graham and Harvey (2001) conducted a moderately large-sample study of a broad cross-section of U.S. and Canadian firms, based on an explicit survey of chief financial officers as a joint effort with the Financial Executives Institute. Their survey had separate questions about debt, equity, debt maturity, convertible debt, foreign debt, target debt ratios, credit ratings, and actual debt ratios. They found that a tight debt ratio is sustained by most large firms, while only one-third of small companies are inclined to do so. Also, it was noted that among the most important factors for considering debt financing are financial flexibility and a good credit rating. According to the study, before issuing equity the CEOs reckon earnings per share dilution and recent stock price appreciation. Very little evidence was found that firms' officials are concerned about asset substitution, asymmetric information, transactions costs, free cash flows, or personal taxes. In order to explain why debt ratios vary across firms and through time even if firms have their target ratios, Graham and Harvey brought the argument of Fisher, Heinkel, and Zechner (1989), that due to fixed transaction costs of issuing or retiring debt, firms only rebalance if their debt ratios cross an upper or lower limit.

In an international comparison, Wald (1999) found that the most profitable firms usually borrow the least – this is in direct conflict with the trade-off theory of capital structure. The study by MacKie-Mason (1990) found that due to asymmetry for funds in the access to information about the firm and different ability to monitor firm behavior, companies have large and persistent differences in their preferences regarding internal and external sources of financing.

Fama and French (1998) examined the relationship between firm value and earnings, investment, and financing variables to estimate tax effects in the pricing of dividends and debt. Based on cross-sectional firm-level Compustat data about past, current, and future earnings, investment, research and development expenditures, they proxied for expected net

cash flows. While the marginal relation between firm value and dividends was estimated to be positive, the study did not detect evidence that interest tax shields contributed to firm value, since the debt slopes in regressions were found to be negative. In order to explain this finding, the authors comment on the argument of Miller (1977) that the absence of tax benefits is caused by the offset between corporate interest tax shields and the personal taxes paid by investors in the firm's debt. Fama and French (1998) claimed that it is more likely that firm leverage conveys some information about profitability, and regressions do not reveal tax effects because they do not control for this information in debt.

Brealey, Myers, and Allen (2006), in their textbook about corporate finance, draw attention to another argument disproving the trade-off theory of capital structure. They claim that current debt ratios in the U.S. are compatible and not higher than they were in the beginning of the twentieth century, when income tax rates were low or even zero.

2.2 The pecking-order theory of capital structure

The questions raised by the critics of the trade-off theory have lead to the creation of another model, which does not necessarily contradict the trade-off model, however tries to shed some light on its weaknesses in explaining some empirical facts. This model was called the pecking-order theory of capital structure which was developed by Myers and Majluf (1984). It claims that the firm decision about how to mix internal and external financing sources is affected by asymmetric information available to managers and investors. Since market agents have different information about firms' prospects, strategies, risks, and any internal problems, they prioritize the financing sources while deciding whether to issue new debt or equity. The importance of insider information is corroborated by an "information effect" which demonstrates that investors react to the companies' public announcements about their new financial choices, and it causes the change in stock prices. At first, managers are inclined to use internal funds, then issue new debt, and, as a last resort, issue new equity.

Myers (1984) notes that the term "pecking order" was previously not used by other researchers, even though the underlying ideas of the theory were realized before. For instance, Donaldson (1961) observed a sample of large companies and found that internal financing is considerably favored by managers in contrast to external one. Myers (1984) argues that the trade-off framework is not successful in explaining the capital structure puzzle and actual financial behavior of firms. He points out that there is a significant variation in debt ratios across similar firms which can be evidence that firms have very little intention to implement their target debt ratios. This theory explains why firms issue new debt frequently but new stock rarely by the rule "Issue safe securities before risky ones". Apart from that, the less developed the stock market in a particular country, the more difficult for a firm to get financing by issuing equity.

When researchers test the trade-off and pecking-order theory of capital structure, they find that both theories are of value for explanation of different real cases. The pecking-order theory is relevant for large firms with tangible assets, that rarely issue equity and prefer internal financing; but the theory is likely to fail for small young firms which heavily rely on issuing equity.

Rajan and Zingales (1995) examine the data from Global Vantage Database on non-financial companies in the G7 countries[4] excluding banks and insurance companies from the sample. Studying the data of years 1987-1991 and using pre-1987 data as a robustness check, they determine factors influencing the firm leverage and depict the overall international picture. The highly industrialized countries are chosen due to data availability and their homogeneity in level of economic development. The authors provide insight into differences of accounting rules across countries to make measures of leverage comparable. Firms of the same size are comparatively less leveraged in the UK and Germany, while in other countries

[4] Canada, France, Germany, Italy, Japan, United Kingdom, United States

of G7 debt ratios are about the same. Amongst the local peculiarities which are likely to cause institutional differences between countries are the tax code, bankruptcy laws, characteristics of bond market, and ownership features. Rajan and Zingales (1995) study the relationship between leverage and four following factors: the tangibility of assets, the market-to-book ratio viewed as a proxy for investment opportunities, profitability given by earnings before interest, taxes, depreciation and amortization (EBITDA), and the firm size as an inverse proxy for the probability of bankruptcy, computed as a logarithm of net sales. They report the results of two regressions estimated with a censored Tobit model; the first regression uses the book value of equity for measurement of leverage, and the second one considers the market leverage. The Tobit model is used for estimation the target debt ratio since the variable of interest can only take non-negative values clustered around one point and are dispersed over the [0,1] interval. It is found that firms which have a higher ratio of tangible assets are leveraged to a larger extent than others holding other factors fixed. The correlations of market-to-book and profitability with firm leverage are found to be negative. Firm size as an inverse probability of default does not reveal a high degree of correlation because in the developed G-7 countries costs of financial distress are very low.

Shyam-Sunder and Myers (1999) tested the static trade-off theory against the pecking-order model of capital structure using the data from Compustat's flow of funds statements for a sample of 157 firms from 1971 to 1989. It is found that the pecking-order theory works better for prediction and explanation of the variation in firms' debt ratios, at least for mature, large firms presented in the sample.

Frank and Goyal (2002) tested the pecking-order theory of capital structure using cross-sectional data about publicly traded American firms from 1971 to 1998. They showed that the theory fails to hold for small, growth companies which invest significantly in intangible assets because for them the issue of asymmetric information is of special concern.

Nevertheless, the trade-off theory is powerful in explaining the differences in capital structure across industries. Firms of relatively safe industries with tangible assets are more likely to have higher debt ratios, while less-leveraged firms are those of riskier industries with intangible assets to a considerable extent dependent on growth opportunities.

Subsection of Chapter 3, devoted to description of model specification, summarizes various theories dealing with such topical question in financial literature as what determinant is the best for measurement firm size.

Chapter 3 – Methodology

3.1 Data and variables

To estimate the effects of changes in tangibility of assets, firm size and profitability on the changes in leverage I used the UK firm-level data that come from the London Stock Exchange. There are several motives in favor of choosing the UK for this case study. The main reason why the UK was selected for the research is that some of the particularities of corporate financing structure can be applicable to depict the general pattern in other developed countries. Firstly, the UK results can be a good proxy for other developed countries because they have similar degree of economic development, legal and institutional environments, for instance, alike accessibility to the sources of external financing, the development of domestic stock exchange and financial markets, consumption patterns, etc. Secondly, there is the presence of similar or easily comparable accounting rules and practices in developed countries. Apart from that, availability of financial data incorporated into reports of companies listed at the LSE is another reason which made this study possible.

Company Profile is a free service of the London Stock Exchange providing detailed information about the listed firms' past financial performance and future prospects. The following facts are incorporated into single PDF reports:

- Company contact information;
- Trading information;
- Price data (up to yesterdays close);
- Last ten news headlines (up to yesterdays close);
- Last ten trades (up to yesterdays close);
- Historical share price performance chart;
- Last five day's and five year's volume history;

- Fundamental financial data.

Firm's financial data is represented by figures from such fundamental reporting documents as income statement and balance sheet as well as by ratios calculated according to the International Financial Reporting Standards. One of the most important documents used to evaluate a company's financial condition is a balance sheet that includes basic information about the structure of a company's assets, liabilities and shareholders equity. Income statement indicates the amount of profit or loss the company made during the period being reported. It shows how net sales (revenue) are transformed into the net income after all expenses have been paid off.

First, I examined the sample (1) consisting of panel data for 100 Software & Computer Services companies, listed at the London Stock Exchange, related to every year from 2007 to 2010, inclusively. The total number of observations is 400. The data set is a balanced panel, i.e. the same companies are observed every year. Then I extended the time horizon by one year back to 2006 and considered the smaller sample (2) consisting of 73 companies, because some of the firm reports lack data related to the initial year. The total number of observations is 365. Therefore, in order to check for robustness of results, all descriptive statistics and regression coefficients are reported for these two samples. The choice of Software & Computer Services as an activity sector was made in order to control for one non-financial sector to disregard industry heterogeneity. Moreover, the selection of firms in this sector is sufficient to provide credible results, and at the same time it is narrow enough to make feasible the extraction of financial data from firms' balance sheets and income statements one by one. Data limitation issue arises due to the lack of some financial records in companies' reports.

Description of the control and response variables is given in Table 1.

Table 1. Meaning of variables

Variables	Description of variables for a particular firm
leverage	debt ratio of total debt to total assets
tangibility of assets	ratio of fixed assets to total assets
log revenue	natural logarithm of firm revenue
ROCE	return on capital employed

There is a decreasing trend in leverage ratio amongst IT firms of the sample (1) in the UK in the studied period as reported in Table 2. The average leverage ratio decreased from 51.6% to 44.1% from 2006 to 2010. The maximum values in the sample also decreased from 390.9% to 140% from 2006 to 2009.

Table 2. Descriptive statistics for leverage in 2006-2010 (*leverage*)

Year	Mean	Median	Max	Min.	Std. Dev.
2006	0.516	0.417	3.909	0.007	0.567
2007	0.478	0.426	3.467	0.013	0.423
2008	0.469	0.431	1.587	0.030	0.258
2009	0.453	0.426	1.400	0.021	0.236
2010	0.441	0.417	1.733	0.013	0.254
All	0.472	0.426	3.909	0.007	0.370

Note: Firms included: 73.

In particular, an especially sharp drop happened between the years 2007 and 2008, corresponding to the recent global financial crisis, when firms were subject to tight liquidity constraints and they had to decrease leverage in order to meet the obstacles of economic recession and appear more reliable and financially stable from the point of view of investors and bankers. Firms also tended to shift from financing by loans to equity since payments on debt are fixed, and in the meanwhile corporate decisions about whether, when and how much to pay in dividends depend of the actual financial performance of the firm. The gap between

minimum and maximum values in the sample became substantially narrower. However, in 2010 more firms exhibit higher degree of leverage than in previous years, and such evidence could be the sign of overcoming the burden of crisis. The descriptive statistics for leverage in the sample (2) of 100 firms related to the years 2007-2010 are given in Table 3 in the Appendix. In average companies of this sample are slightly more leveraged than firms of the sample (1).

Similarly, dynamics of firms' returns on capital employed (ROCE) that proxy for their profitability traces the impact of financial crisis as well. The average rate of ROCE considerably dropped in 2007 to reach the bottom in 2008, with the values of -35.7% and -43.8% in the sample (1) and (2), respectively. These numbers reflect the overall recession of the markets worldwide. Then followed the rise in profitability of the IT sector in 2009, in 2010 its performance was not so successful, though. In contrast with changes in leverage ratio within the industry across the years, changes in ROCE tend to widen the fluctuation interval, in other words, firm heterogeneity and earnings gap are increasing during the financial crisis. The descriptive statistics for ROCE in the sample (1) of 100 firms related to the years 2006-2010 are given in Table 4.

Table 4. Descriptive statistics for return on capital employed in 2006-2010 (*ROCE*)

Year	Mean	Median	Max	Min.	Std. Dev.
2006	0.084	0.096	6.832	-8.391	1.626
2007	0.043	0.115	5.945	-5.145	1.619
2008	-0.357	0.130	2.849	-9.104	1.924
2009	0.152	0.113	9.397	-7.945	2.142
2010	0.010	0.141	3.198	-4.037	1.133
All	-0.014	0.115	9.397	-9.104	1.723

Note: Firms included: 73.

The descriptive statistics for ROCE in the sample (2) of 100 firms related to the years 2007-2010 are given in Table 5 in the Appendix.

Harris and Raviv (1991) state that leverage usually increases with fixed assets, non-debt tax shields, investment opportunities, and firm size and decreases with volatility, advertising expenditure, the probability of bankruptcy, and uniqueness of the product. In accordance with them, as well as Rajan and Zingales (1995), I hypothesize that the correlation of firm leverage with tangibility of assets is positive because firms with a considerable amount of tangible assets are more likely to have easy access to external funding. For firms with prevalence of intangible assets in their balance sheets it is usually more difficult to get financing from external sources.

I expect the positive correlation of leverage with the firm size due to the fact that large companies most probably seem to be more stable and secure in the eyes of investors and bankers and so such enterprises will meet less obstacles searching for funding compared to the possible barriers for the small companies.

I suspect that the changes in profitability are negatively correlated with the changes in a company's debt ratio. The main reason is that it is cheaper for a corporation to service the equity rather than service the debt since debt requires constant payments of interest, while equity does not. In this light, a profitable company will have two types of non-debt financing resources – keeping the retained profit and offering new shares. Since the company is profitable, the new shares will be more easily sold. However, I suspect that correlation between leverage and its determinants can alter due to the crisis presented in the studied period.

3.2 Functional form specification

For estimation the effects of changes in tangibility of assets, firm size and profitability on the changes in leverage three types of regression models are used.

First I regress the leverage on capital structure determinants by pooling independent cross-sections across time using OLS (ordinary least squares) procedure for estimation the following equation:

$$leverage_i = \beta_0 + \beta_1 Tangibility\ of\ assets_i + \beta_2 Log\ revenue_i + \beta_3 ROCE_i + \varepsilon_i \quad (1)$$

where i denotes company, β_0 is the intercept term, β_1, β_2 and β_3 are the coefficients on independent variables, and ε contains unobservables.

Then, I use the fixed effects regression model since panel data analysis provides more credibility and generality, than the simple pooled OLS model, with the assumption that the constant term differs in firm population. In the real world some of the time-constant attributes related to a particular firm can be correlated with the explanatory variables. For instance, they contain among other things liquidity constraints, degree of exposure to systematic and idiosyncratic risks, corporate taxation, firm reputation, etc. Since some of these factors might be unobserved but are very likely constant for a particular firm over a short period of time, it is possible to disregard their presence by using the fixed effects method and estimate the equation:

$$leverage_{it} = \beta_0 + \beta_1 Tangibility\ of\ assets_{it} + \beta_2 Log\ revenue_{it} + \beta_3 ROCE_{it} + a_i + u_{it} \quad (2)$$

where i and t denote company and time period, respectively, β_0 is the intercept term, and β_1, β_2 and β_3 are the coefficients on independent variables. The variable a_i presents a fixed effect and captures all unobserved, time-invariant firm-specific factors that affect company's financial decision about the level of leverage; it accounts for unobserved firm heterogeneity. The variable u_{it} is idiosyncratic (time-varying) error term including unobserved factors that change over time and affect leverage. According to Wooldridge (2003), cross-section

heteroskedasticity allows for a different residual variance for each cross section, and residuals between different cross-sections and different periods are assumed to be zero.

Further, to test whether the changes in leverage are affected by the time trend related to the financial crisis, year dummy variables are added to the equation:

$$leverage_{it} = \beta_0 + \beta_1 Tangibility\ of\ assets_{it} + \beta_2 Log\ revenue_{it} + \beta_3 ROCE_{it} + a_i + D_t + u_{it} \quad (3)$$

where D_t denotes year dummy variables. This model allows separating the impact of firm-specific determinants on capital structure and the global trend corresponding to the crisis.

There are unlikely to be measurement errors in the data since all figures are well-defined, quantitatively meaningful and obtained from the very reliable source such as the London Stock Exchange. If the variance of the error term is not constant across observations, then heteroskedasticity is exhibited in a model. And it is very likely to take place in the real world. The unobservables in the model contain factors which can be probably correlated with the magnitude of the change in firm size or profitability between the adjacent years in a particular country. Hence, the variance of unobserved factors is different among companies, depending on the different values of the explanatory variables, and heteroskedasticity is present in this model. To handle heteroskedasticity in the model, I report the regression results using the White standard errors.

3.2.1 Leverage

There are different approaches to define firm leverage for the purpose of studies in corporate finance. For instance, Scott (1972), Scott and Martin (1975), Swartz and Aronson (1967), and Bowen, Daley and Huber (1982) use the equity ratio, calculated as common equity divided by total assets, as the leverage variable. Remmers, Shonehill, Wright and Beekhuisen (1974) consider the debt ratio as the leverage variable and calculate it as both long-term and short-term debt divided by total assets.

For the purpose of consideration the leverage ratio as the firm decision how much to borrow from external sources, based on the available data extracted from companies' reports, I calculate leverage as the ratio of total debt to total assets:

$$\text{leverage} = \frac{\text{total debt}}{\text{total assets}} = \frac{\text{total liabilities} - \text{provisions}}{\text{total assets}} \quad (4)$$

The standard IAS 37 developed by International Accounting Standards Board (IASB) as a part of International Financial Reporting Standards (IFRS) defines provision as a liability of uncertain timing or amount. Sometimes in IFRS the term reserve is used instead of the term provision. According to Technical summary of IASC Foundation, "a provision should be recognised when, and only when:

- an entity has a present obligation (legal or constructive) as a result of a past event;
- it is probable that an outflow of resources embodying economic benefits will be required to settle the obligation; and
- a reliable estimate can be made of the amount of the obligation."[5]

3.2.2 Tangibility

Fixed assets are those that are used by companies in the long term, opposite to current assets which are usually utilized within one financial year. In accounting practice fixed assets are divided into the groups of tangible assets, intangible assets, or investments. It is thought that it is crucial for a firm's financial stability how much tangible assets a firm possess relative to such intangible assets as patents and trademarks.

Tangibility of assets is the ratio of a company's tangible assets to the total amount of assets it has:

$$\text{tangibility of assets} = \frac{\text{tangible assets}}{\text{total assets}} \quad (5)$$

[5] Technical summary of IASC Foundation on IAS 37 "Provisions, Contingent Liabilities and Contingent Assets". Available at http://www.iasb.org/NR/rdonlyres/81F90956-3009-4346-B727-11119816C992/0/ias37sum.pdf

Information about tangible assets is derived from the line *Property, Plant and Equipment* of a company's balance sheet that represents the amount of physical assets held by the company for one year or more.

3.2.3 Firm size

There is a long debate in financial literature how to measure firm size. Kumar, Rajan, and Zingales (1999) discuss and test a number of different theories studying the relationship between firm size and its determinants. The authors classify and name them as technological, organizational and institutional theories depending on the influencing institutional factors, amongst those are the particular specification of the production function, the process of control or influences of the economic environment. Technological theories take their roots from works of Adam Smith (1776) who claims that firm size is directly affected by the size of the market being served and in more developed markets there should be larger firms. Within neoclassical theory Lucas (1978) brings an assumption that managing talent is distributed unequally among people, and along with the inelastic substitution between capital and labor as inputs of production function it causes an inclination that marginal managers tend to become regular employees, increasing the number of employees by one manager.

Rosen (1982) and Kremer (1993) apply human capital approach in their studies considering determinants of firm size. Kremer (1993) differentiates the workers by the level of their skills based on the frequency of mistakes they make while implementing the task. In equilibrium wages and output are defined as the result of allocation of workers with different levels of skills. Kremer (1993) utilizes his theory to explain the stylized facts that there is a positive relationship between the wages of workers in different industries and that in poor countries small companies are very common, while in developed countries larger firms prevail.

Organizational theories deal with such aspects influencing firm size as contract costs, transaction costs and property rights. Institutional theories study everything that is left out of scope by technological and organizational theories. For instance, La Porta, Lopez-De-Silanes, Shleifer, and Vishny (1997) compared legal rules of 49 countries and found that in countries where legal system is less developed, the capital markets are smaller and narrower than in countries with countries with highly developed and efficient legal system. By the degree of development of the legal system they mean the character of legal rules and the quality of law enforcement.

The common differentiation of firms into small, medium, and large enterprises is made by state law for the purpose of accounting requirements in a number of countries and it is primarily based on the number of enrolled employees and various financial firm-specific characteristic. In the UK, the Companies Act (2006) introduces the requirements that qualify whether a company can relate to small or medium enterprises. In order for a firm to be considered small- or medium-sized, it must meet two of the three qualifying conditions that are summarized in Table 6. The balance sheet total is defined as the aggregate of assets shown in the company's balance sheet. The number of employees denotes the average number of workers employed by a firm within the year.

Table 6. Qualifying conditions for small and medium enterprises in the UK

Requirement	**Small enterprise**	**Medium enterprise**
Turnover	Not more than £5.6 million	Not more than £22.8 million
Balance sheet total	Not more than £2.8 million	Not more than £11.4 million
Number of employees	Not more than 50	Not more than 250

Note: Based on the Companies Act 2006.

It is common in financial literature to proxy firm size by net sales. Rajan and Zingales (1995) consider firm size as an inverse proxy for the probability of bankruptcy. As they

suggest, I use a natural logarithm of firm's revenue (net sales) as a proxy variable for firm size.

3.2.4 Firm performance

Similarly, it is questionable and subjective what firm characteristics or financial data it is more efficient to use for measuring the firm performance. Existing approaches primarily differ by the fact whether researchers look at financial prosperity or market performance of a particular company. The former refers to profitability that demonstrates a company's overall efficiency and performance; it can be expressed in margins or returns. Below are some examples of different measures:

- rate of return on assets (ROA) calculated as the net income divided by total assets;
- rate of return on equity (ROE) calculated as the net income divided by shareholder's equity;
- operating profit margin calculated as the operating profit divided by firm net sales;
- asset turnover rate calculated as the value of firm production (sales) divided by average total assets;
- etc.

The market performance of a particular firm can be analyzed by studying its dividend yield and price-to-earnings ratio which is the ratio of market value per share divided by earnings per share.

I proxy firm performance by return on capital employed (ROCE). ROCE is analogous to ROA but considers the financing sources, therefore demonstrates how much a particular firm gains from its assets or loses from liabilities. Firm-level data are obtained from the LSE Company Profile Reports service. For each firm revenue is taken from the income statement and fixed assets, total assets, total liabilities are derived from the balance sheet, ROCE is

found at the section presenting financial ratios on continuing operations calculated according to the IFRS.

Chapter 4 – Discussion of results

To study the relationship between firm decisions about leverage and such factors as tangibility of assets, firm size and profitability, the UK data from IT firms listed at LSE is collected and three regression methods are utilized for the analysis. Table 7 compares the results of estimation of two samples, (1) and (2), considering the four-year and five-year period respectively, using the pooled OLS equations and the White standard errors.

Table 7. Regressions coefficients predicting the proportionate change in the leverage using the Pooled OLS (results from 4 and 5 year panels)

Independent variables	1		2	
	Coefficient, SE	Probability	Coefficient, SE	Probability
C	0.481 (0.045)	0.0000***	0.464 (0.062)	0.0000***
$Tangibility_i$	0.101 (0.083)	0.2233	0.278 (0.195)	0.1545
$Log\ revenue_i$	-0.002 (0.010)	0.8151	-0.004 (0.015)	0.8026
$ROCE_i$	0.003 (0.010)	0.7540	0.031 (0.015)	0.0400**
R-squared	0.0019		0.0264	
Periods included:	4		5	
Observations included:	400		365	

Note: *, **, *** Significant at 10, 5 and 1 percent significance level respectively, using a two-tailed t-test.

Intercepts are found to be significant at 1% significance level and of almost the same magnitude. However, other variables are weak in predicting the value of leverage and insignificant against a two-sided alternative.

In order to overcome weaknesses of the pooled OLS, a panel data regression analysis was implemented. Since it accounts for firm specificity, such method allows obtaining more

credible results. Table 8 compares the results of estimation of two models using the fixed effects equations and the White standard errors.

Table 8. Regressions coefficients predicting the proportionate change in the leverage using the fixed effects (results from 4 and 5 year panels)

Independent variables	1		2	
	Coefficient, SE	Probability	Coefficient, SE	Probability
C	0.556 (0.024)	0.0000***	0.431 (0.027)	0.0000***
$Tangibility_{it}$	0.649 (0.096)	0.0000***	1.707 (0.743)	0.0223**
$Log\ revenue_{it}$	-0.040 (0.007)	0.0000***	-0.025 (0.015)	0.1075
$ROCE_{it}$	0.022 (0.021)	0.2917	0.035 (0.012)	0.0032***
R-squared	0.6079		0.6257	
Periods included:	4		5	
Cross-sections included:	100		73	

Note: *, **, *** Significant at 10, 5 and 1 percent significance level respectively, using a two-tailed t-test.

I will primarily focus my discussion of results of the sample (1) because they are statistically significant and more consistent with the findings of other studies. According to sample (1), controlling for the revenue and ROCE changes, the average increase in the leverage ratio between two firms is expected to be 0.0649 more for a firm whose ratio of assets tangibility is 10% higher. In other words, a 10% increase in the percentage of fixed assets compared to total assets of a particular company is estimated to result in a 6.49% increase in leverage ratio holding other factors fixed. ROCE is not a significant at 10% level predictor. However, $tangibility_{it}$, $log\ revenue_{it}$ and $ROCE_{it}$ are jointly significant at 1% significance level: the F-statistic (with 3 and 296 degrees of freedom) generated with the Wald test has a p-value = 0.0000.

The positive correlation of firm leverage with tangibility of assets indicates that a larger portion of tangible assets in the total composition of assets results in a higher degree of leverage for a certain firm. This is consistent with the trade-off theory of capital structure which states that when firms are choosing their target debt ratio, they compare the costs of potential financial distress and the benefits of tax shields provided by corporate taxes favoring debt financing. Firms with a considerable amount of safe tangible assets that could serve as collateral in case of bankruptcy are regarded to be financially stable in the eyes of investors and bankers.

I expected that *log revenue* viewed as a proxy for the firm size, and therefore as an inverse proxy for the probability of default should be positively correlated with the leverage. On the contrary, the results of the current study show that it is negatively correlated with the leverage. The increase of a given firm's revenue by 100% (i.e. doubling the volume of net sales) will decrease leverage ratio by 0.04 or 4 percentage points. Rajan and Zingales (1995) find this correlation to be positive for some of the G7 countries but quite low in its magnitude. They explain such a slight correlation by arguing that in economically developed countries such as the UK costs of financial distress are low. However, after the severe consequences that the last financial crisis has brought, this argument can no longer be considered as valid.

In my opinion, the negative correlation of leverage with firm size presented in the model reflects the characteristics of the trend attributed to the studied time period. Although when economy goes up, large corporations are the most attractive targets for investors due to their safety, in the recession it becomes very risky to provide financing to such companies. During the crisis, the vast majority of firms was hit and faced financial troubles, and the level of loss was indeed associated with the scale of firm operations. In order to diversify portfolio and reduce the amount of potential loss, providing loans and financing of small- and medium-sized enterprises was preferred by banks and financial institutions in the studied period.

Profitability proxied by ROCE is found to be unsuccessful in predicting the value of leverage ratio in the studied models. This insignificance can be explained by a high degree of heterogeneity exhibited in firm population that does not allow obtaining robust results.[6] Rajan and Zingales (1995) report the negative correlation between leverage and firm profitability. According to the theories of capital structure, more profitable firms rely on equity more than on borrowing from banks. However, when it comes to recession and the whole security market collapses, investors lose their confidence, and it becomes very difficult even for profitable companies to sell new shares.

Next, in order to separate firm-specific factors that influence the level of leverage from the time trend, the panel data analysis accounting for cross-section fixed effects and the year dummies was implemented. The results of estimation of two models using the cross-section fixed effects equations, year dummy variables and the White standard errors are reported in Table 8.

When year dummy variables are added to the model, the magnitude and level of significance remain almost the same for the variables of my main interest as they are in the model (2) that only accounts for cross-section fixed effects. The coefficients on all year dummies are negative except for *d2008* in the 4-year sample (1) that is insignificant. Such a steady relationship is a clear evidence of the downward trend caused by the overall economic recession.

The model (3) using the 4-year sample (1) is obviously the most successful out of three models in predicting the change in leverage as an effect of changes in a company's composition of assets, firm size and profitability.

[6] Apart from above-discussed two models, the regressions using four and five year average for the sample (1) and (2), respectively, were run but the results demonstrate no representative outcome that can be another evidence of strong heterogeneity across firms. Results can be provided upon request.

Table 9. Regressions coefficients predicting the proportionate change in the leverage using the cross-section and time fixed effects (results from 4 and 5 year panels)

Independent variables	1		2	
	Coefficient, SE	**Probability**	**Coefficient, SE**	**Probability**
C	0.556 (0.030)	0.0000***	0.424 (0.048)	0.0000***
$Tangibility_{it}$	0.656 (0.010)	0.0000***	1.714 (0.745)	0.0221**
$Log\ revenue_{it}$	-0.038 (0.007)	0.0000***	-0.013 (0.012)	0.3083
$ROCE_{it}$	0.022 (0.021)	0.2866	0.035 (0.012)	0.0024***
D2007	–	–	-0.028 (0.005)	0.0000***
D2008	0.003 (0.002)	0.8283	-0.022 (0.004)	0.0000***
D2009	-0.022 (0.014)	0.0000***	-0.065 (0.005)	0.0000***
D2010	-0.115 (0.006)	0.0153**	-0.061 (0.007)	0.0000***
R-squared	0.6088		0.6299	
Periods included:	4		5	
Cross-sections included:	100		73	

Note: *, **, *** Significant at 10, 5 and 1 percent significance level respectively, using a two-tailed t-test.

Chapter 5 – Conclusion

This thesis contributes to a long-history debate on capital structure puzzle by revealing new evidence regarding determinants of financial decisions of firms about the level of leverage. The relationship between leverage and tangibility of assets, firm size and profitability was considered. Firm-level data were collected for 100 companies belonging to the Software & Computer Services sector and listed at the London Stock Exchange. The studied period, years 2006-2010, is of particular interest due to the covered financial crisis. Within the mentioned period, due to the crisis, in average companies reconsidered their policies and preferences regarding the choices of financing sources and tended to decrease the amount of bank loans among them.

Three regression analysis methods were used. The use of panel data better captures the effects of changes in firm-specific factors on leverage. The regression model based on panel data analysis using the cross-section fixed effects and accounting for the time trend is the most successful in predicting the value of debt ratio. It reveals the downward trend in debt ratio across the firms and shows the particular decrease in every year of the studied sample.

In accordance with the trade-off theory, tangibility of assets is estimated to be positive. Having other factors fixed, the average increase in the leverage ratio between two firms is expected to be 0.0649 more for a firm whose ratio of assets tangibility is 10% higher. The relationships between leverage and firm size and profitability are found to differ from what is usually found in studies using larger samples and broader time horizon. The downward trend related to the global financial crisis resulted in the inverting these relationships. In recession small firms were more attractive for investors due to the limited amount of potential loss compared to large corporations, and paradoxically, the large corporations had troubles selling their shares due to collapse of the stock market and needed the bank loans the most. Also it became very difficult even for profitable companies to sell new shares.

The main limitation of this study is due to data limitation caused by feasibility to collect large amount of firm-level data. Although the findings of this study can be applied to the UK market in general, they come from observations of one activity sector. Moreover, since the sample is only presented by firms listed at the London Stock Exchange, the results can be biased towards large firms. Also, in order to check for robustness of results, it would be helpful to use various proxy variables for firm size and profitability, but additional financial information from firm reports would be needed.

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Appendix

Table 3. Descriptive statistics for leverage in 2007-2010 (*leverage*)

Year	Mean	Median	Max	Min.	Std. Dev.
2007	0.501	0.433	3.467	0.013	0.455
2008	0.481	0.429	1.728	0.030	0.286
2009	0.474	0.433	1.400	0.021	0.252
2010	0.466	0.417	2.524	0.013	0.330
All	0.481	0.431	3.467	0.013	0.338

Note: Firms included: 100.

Table 5. Descriptive statistics for return on capital employed in 2007-2010 (*ROCE*)

Year	Mean	Median	Max	Min.	Std. Dev.
2007	0.253	0.148	12.325	-5.245	1.980
2008	-0.438	0.136	3.122	-15.57	2.530
2009	0.243	0.136	9.397	-7.945	2.062
2010	-0.055	0.129	3.533	-4.698	1.266
All	0.001	0.135	12.325	-15.570	2.023

Note: Firms included: 100.