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Structure theories: Panel data evidence from the United Kingdom

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The purpose of this study is to identify the factors affecting the capital structure of UK quoted companies during 2000-2012, based on the main theories of capital structure. We try to find out which of these theories (trade-off theory, agency cost theory, pecking-order theory) are best suited for empirical explanation of the capital structure of the UK firms. Therefore, the case for consideration in this study is to analyze the variables for each of the theories and examine which one best explains the index of long-term debt leverage. We use the method of panel data with random effect. This paper's differentiation turned out that in UK the investment companies have no impact on their borrowing levels, thus lending mainly serves their current liabilities. Our findings are more consistent with the trade-off theory.

Key words: Capital structure, pecking-order theory, trade-off theory, UK firms.

INTRODUCTION

To maximize profits, general (and economic) managers must make two basic choices: the choices of investment and capital structure. Myers (2001) argued that there is no single theory that explains the lending leverage of companies, and there is no reason to expect one. Nevertheless, many academics have attempted to correlate variables with the capital structure, with the prevailing theories being the trade-off theory, the theory of representation costs, the pecking-order theory and the market-timing theory. The early studies, however, had no apparent effect. For example, the trade-off theory argues that there is a positive correlation between profits and debt leverage. In contrast to their expectations, Rajan and Zingales (1995) found a negative correlation between profits and leverage. Sinan (2010) found that the market value index per the book value is negatively correlated with the lending leverage, while Lemmon and Zender (2010) identified a positive correlation between the market value index per the book value and the lending leverage. These conflicting results reinforce Myers's view that there is no single theory that can explain companies' choice of capital structure and that the factors may change depending on the period and the country investigated.

Generally, the applicability of the capital structure theories ranks highly on the research agenda, and the research has been extended by a growing number of country-specific studies. In this context, Hutchinson and Hunter (1995) suggested that UK firms that have an inclination for utilizing held benefits for venture purposes

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and that take the perspective that business and venture methodologies are reliant, there might be more prominent prospects for bringing in extra obligation financing in recessionary periods. Michaelas et al. (1999) argued that the outcomes demonstrate that time- and industry-specific impacts affect the development structure of the obligations raised by SMEs. Generally, normal fleeting obligation proportions in SMEs give the impression of expansion at times of financial retreat and abatement as the monetary conditions in the commercial centre progress.

As described by Hall et al. (2000), the consequences of the investigations demonstrate that, while some of the distinctions in the capital structure can be clarified by varieties in the determinants, others cannot. This suggests that other financial and perhaps social or political elements are at play. The outcomes for previous Soviet coalition SMEs demonstrate that they have lower levels of obligations, both short term and long term, than those in non-Soviet-alliance nations. In the finding of Bevan and Danbolt (2002), the different transient components are adversely associated with substantial quality, while the long-term components illustrate a positive connection, in this manner providing confirmation of development coordination. Furthermore, they observed that size corresponds significantly contrarily to fleeting bank lending and is positively related to all long-term obligation structures and transient paper obligations. Weill (2002) found that the outcome bolsters the presumption of alternate loaning conduct of banks experiencing significant change in nations. This might be clarified by the prolongation of old credit or by a lower ability of banks in these nations. At that point banks may like to draw out credit rather than not recharging it, whether the non-restoration would prompt a misfortune or whether there are conniving relations amongst banks' and lenders' managers. As described by Panno (2003), the outcomes propose that firms in financially well-developed markets (such as the UK) may have long-term target influence proportions and accordingly they tend to acclimate to those objectives; nevertheless, in less effective markets (Italy for instance), different variables appear to be more critical than the quest for ideal influence proportions. It is additionally proposed that inward money is likened to outer accounts, in agreement with the pecking-order theory.

Hall et al. (2004) argued that relapses were run utilizing fleeting and long-term obligations as depended variables and gainfulness, development, resource structure, size and age as free variables. A key element of this paper is the utilization of limited and unlimited relapses to distinguish the nation impact from the firm-specific impact. The outcomes demonstrate that varieties are prone to be due to nation contrasts and firm-specific ones.

Bancel and Mittoo (2004) suggested that companies' financing arrangements are affected by both their institutional surroundings and their universal operations. Firms decide their ideal capital structures by trading off the expenses and advantages of financing. The study likewise demonstrates that firms can receive methodologies to relieve the negative impacts of the nature of the lawful environment in their nation of origin. As a case in point, firms in common-law nations essentially show greater attentiveness to keeping up target debt-to-value proportions and coordinating development than their associates in precedent-based law nations.

Hall et al. (2006) demonstrated that long-term obligations are connected decidedly to the resource structure and firm size and contrarily to age; fleeting obligations are connected adversely to benefit, resource structure, size and age and emphatically to development. A huge variety crosswise over enterprises was found in a large portion of the illustrative variables. Brav (2009)'s findings indicate that there is a negative correlation between leverage and growth in UK firms. This is because large companies in mature UK industries choose their financing with equity against foreign capital due to their high level of capital adequacy. Sinan (2010) demonstrated that there is a positive correlation between leverage and profitability. This is because, when financial leverage is used, changes in earnings before interest and taxes bring greater changes in profit before disposal per share. High leverage simply means that small changes in sales incur disproportionately larger changes in the operating profit and vice versa.

More recently, Kedzior (2012) demonstrated that the capital structure is influenced not just by the conventional determinants identified with a business element (for example industry, benefit, size and development potential) but additionally by macroeconomic/institutional components, including monetary development, swelling rates, corporate salary assessments, the advancement of the keeping money part and capital markets and the national legitimate frameworks.

The study by Dang (2013) demonstrated that the trade-off theory clarifies these companies' capital structure choices better than the pecking-order theory in the models, settling the two speculations. Finally, it was also demonstrated that UK, German and French firms do not nearly follow the pecking-order theory's expectation. On aggregate, the outcomes reliably demonstrate that trade-off contemplations are of primary significance to UK, German and French firms, which embrace the alteration towards the target influence in a dynamic and fast way.

In the finding of Mokhova and Zinecker (2013), the relationship examination between the capital structure and the sovereign FICO scores demonstrates the distinctions in appraisal valuation by rating firms, which can be clarified by various financial variables and their weights in the connected default likelihood models. The quality of the connection between the capital structure and the FICO assessments additionally relies on the

measures of the capital structure and the nation's specifics. Koksal and Orman (2015) argued that the trade-off theory gives a superior portrayal of the capital structures of every single firm to the pecking-order theory. In addition, the trade-off theory appears to be especially appropriate for comprehending the financing decisions of extensive private firms in the non-producing sector and when the financial environment is generally steady. The study's conclusion is that the trade-off theory is a superior system to the pecking-order theory. The finding of Sun et al. (2015) indicates that the institutional proprietorship has a homogeneously constructive outcome for the firm influence proportions, despite the fact that a high level of institutional proprietorship diminishes the likelihood of issuing bonds over value.
The authors discovered that UK firms picked value over securities amid the monetary emergency, giving solid confirmation to the market-timing theory.

The purpose of this study is to identify the factors affecting the capital structure of UK quoted companies in the light of the main capital structure theories. We try to determine which of these theories (trade-off theory, agency cost theory and pecking-order theory) is the most suitable for explaining empirically the capital structure of UK firms.

Therefore, the tasks to be carried out in this study are the analysis of the variables for each of the theories and the identification of the one that best explains the index of long-term debt leverage. In this paper the applicability of capital structure theories to the UK economy is examined by a panel data empirical model that uses their key variables. Using panel models of random or fixed effects, it is possible to control the implications of companies' non-observable individual effects on the estimated parameters.

The period of analysis spans from 2000 to 2012, incorporating different market phases and various stock market crashes and booms.

The years before the financial crisis were characterized by an excessive accumulation of exposures of UK firms in relation to their own funds (leverage).

During the financial crisis, the losses and the lack of funding forced UK firms to reduce their leverage significantly over a short period of time.

This increased the downward pressure on prices, components and assets, causing further losses for UK firms, which in turn led to further declines in their own funds. The end result of this negative sequence was a reduction in the availability of credit to the real economy and a deeper and longer-lasting financial crisis.

To the best of our knowledge, this paper is the first to examine the applicability of capital structure theories to UK firms with an extensive data set in this period. Our study differs from the literature in many ways, as reported in Table 1.

We propose to make a number of contributions to the literature. Firstly, we examine which variables affect the leverage of the London Stock Exchange (LSE) firms for the first time with the largest number of data.

Secondly, the research is expanded to cover almost all business categories, small, medium and large.

The result is the increment of the sample to 1081 companies and 8909 observations, which is the largest sample size in the research literature concerning the economy of the United Kingdom (UK). Thirdly, the period of analysis is the longest so far in the research literature; in addition, the previous studies are scattered.

The present study focuses on an aggregated ensemble of explanatory factors of the capital structure theories in UK firms. Finally, the period of analysis spans from 2000 to 2012, incorporating different market phases and various stock market crashes and booms.

The empirical results indicate that the inflow of debt financing from business is not converted into *investments*, as most papers have claimed. One of the predictions is that the funds lent seem to be directed to covering short-term liabilities.

We find a positive correlation between the percentage of fixed assets and leverage and a positive correlation between the *profitability* of the leverage and the firm's size. Our results imply that firms source finance in a manner consistent with Myers's (1984) pecking-order theory. Furthermore, we find a positive correlation between tangible assets and leverage but a negative correlation between liquidity and leverage, which is also consistent with Myers's (1984) pecking-order theory.

The capital requirements for covering risks are essential to ensure sufficient own funds to cover unexpected losses. However, the crisis has shown that these requirements alone are not sufficient to prevent UK firms from taking excessive and unsustainable leverage risk. This means that UK firms do not increase or reduce their debt with their investment opportunities, as shown in Kester (1986)'s study.

This result also does not give us the ability to classify the capital structure theories. Additionally, we observe that, when we do not take the market-to-book (market value ratio accounting) variable effect into account in our model, a negative correlation appears between leverage and firm size.

This means that UK firms do not increase their external debt with their investment opportunities but also do not direct internal financing and additional borrowing, but that exposes them to large systemic risk.

It is also demonstrated that deficits are financed with debt, and similar results were found by Shyam-Sunder and Myers (1999) for US companies.

The remainder of this paper proceeds as follows. Section 2 presents the literature review.

Section 3 describes the data set and some preliminary statistics. Section 4 presents the methodological approach and the formulation of hypotheses. Section 5 provides the empirical results, and concluding remarks are given in the final section.

Table 1. Studies of the firm-specific factors determining the capital structure in firms operating in the UK.

Authors	Puplication Year	Firm's sample	Special sample	Geographical scope	Period	Dependent variable *
Rajan et al.	1995	4557	NA	CA, DE, FR, IT, JP, **UK**, US	1987-1991	(+)
Hutchinson and Hunter	1995	53	NA	UK	1988-1992	(+)
Michaelas et al.	1998	3500	NA	UK	1986-1995	(-)
Hall et al.	2000	NA	NA	UK	1995	(-)
Weill	2002	1820	Manufacturing firms	CZ, FR, PL, UK	1996-1997	(-)
Bevan and Danbolt	2002	822	NA	UK	1991	(-)
Panno	2003	87	NA	IT, UK	1992-1996	(-)
Michaelas	2004	3500	Unquoted and SMEs	DE, ES, IE, NL, PT, UK	2004	(-)
Bancel and Mittoo	2004	153	English law firms	AT, BE, CH, DE, DK, ES, FI, FR, GR, IR, IT, NL, NO, PT, SE, UK	2002	(-)
Frąckowiak et al.	2006	1955	NA	DE, FR, PL, UK	1992-2002	(-)
Hall et al.	2006	359	Unquoted and SMEs	UK	1995-1998	(-)
Antoniou et al.	2008	4854	NA	DE, FR, JP, UK, US,	1987-2000	(+)
Brav	2009	54798	NA	UK	1993-2002	(+)
Akdal	2010	202	Firms of FTSE 250	UK	2002-2009	(-)
Kedzior	2012	1063	NA	BE, BG, CZ, DE, EE, ES, FI, FR, GR, IR, IT, NL, LT, LV, PL, PR, SE, RO, SK, UK	2005	(-)
Mokhova and Zinecker	2013	369	Manufacturing firms	AT, BE, BG, CY, CZ, DE, EE, ES, FI, FR, GR, HR, HU, IR, IS, IT, MO, MT, NL, LT, LV, LU, PL, PR, SE, RO, SK, UK, TR	2006-2011	(-)
Dang	2013	2102	NA	DE, FR, UK	1980-2007	(+)
Kóksal and Orman	2015	9000	Manufacturing firms	UK, TR	1996-2009	(+)
Sun et al.	2015	383	NA	UK	1998-2012	(-)

LITERATURE REVIEW

Capital structure theories

Modigliani and Miller (MM) (1958) suggested a hypothesis that developed into the present capital structure theory. This hypothesis is not just thought to be the earliest, most completely explained hypothesis concerning the corporate capital structure but is also perceived as a traditional hypothesis in capital structure research. Modigliani and Miller (1963) enhanced their hypothesis by including charges to alternate presumptions. Miller (1977) proposed the so-called Miller model, which considers both corporate salary assessment and individual wage expenses to appraise the impact of the capital structure on the corporate quality. This section analyses the research on the trade-off theory, the pecking-order theory and the agency cost theory.

Trade-off theory

The trade-off theory underlines the accomplishment of an ideal capital structure while expanding the company's quality, taking into account the parity of the obligation charge shield and the expense of money-related trouble. The firm tracks the trade-off theory to set a normal obligation-to-worth proportion and step by step moves nearer to the objective, which is the parity of the obligation charge shield and bankruptcy costs (Myers, 1984; Frank and Goyal, 2008). This incited contentions that incorporated the objective being conceivably obtained from attributed proof, the assessment impact, the bankruptcy expenses and the exchange costs (Frank and Goyal, 2008). Henceforth, Myers's definition ought to be partitioned into two sections: the static trade-off and the dynamic trade-off (Frank and Goyal, 2008). After considering the corporate pay charge,

it creates the upside of obligation and offers an assessment shield impact on benefits subsequent to considering corporate assessment (Iqbal et al., 2012).

Static trade-off theory

After the MM hypothesis and the Miller model had been presented, numerous researchers endeavoured to make the Miller model predictable with the equilibrium hypothesis of the ideal capital structure, including De Angelo and Masulis (1980). Bradley and Jarrell (1984), on the premise of such examinations, assembled a solitary-period model of the ideal capital structure, incorporating such research strategies and points of view. A related examination by Shyam-Sunder and Myers (1999) provided an intention to the experience of the static trade-off theory. The static trade-off theory conjectures the genuine influence, takes the objective or ideal influence (ideal obligation level) and predicts the cross-sectional connection between the normal influence and the resources' hazard, productivity, charge status and resource type. Frank and Goyal (2008) thought exceptionally about this commitment, calling attention to the fact that Bradley and Jarrell (1984) gave standard expressions on the static trade-off theory. Besides, the static trade-off model provides an answer to the question of influence without examining the mean inversion, which suggests that it does not cover any origination of target modification (Frank and Goyal, 2008).

Review of empirical literature

The capital structure of a company is essentially determined by its cash flows. The funds that it is based on result from equity and alternative sources of funding (long-term loans and common and preferred shares of the firm's capital). The aim of the firm is to obtain the best combination of sources of financing that it can ensure to ameliorate both the price of the common share and the value of the firm. The theme of academic studies is the principle speculations on the capital structure, taking into account the major work by Bradley and Jarrell (1984) (trade-off theory), Myers and Majluf (1984) (pecking-order theory) and Jensen and Meckling (1976) (theory of representation costs).

Theory of the trade-off

The capital structure theory stems from Modigliani and Miller (1958), who argued that the value of the business remains stable and is not affected by the choices of capital structure and that the capital structure is irrelevant to both the value of the enterprise and the cost of capital, as companies focus on maximizing value. Given certain assumptions, Modigliani and Miller (1958) argued that any attempt to reduce the ratio of equity to total capital structure of the business, replacing the debt with equity capital, will equally increase the price of capital in maintaining the stability of the overall capital cost and vice versa. However, it is now generally recognized that the assumptions made by the MM theorem are too restrictive, and other theories have emerged in the discussion of capital structure.

The pecking-order theory, the trade-off theory, the market-timing theory and the theory of representation costs (agency costs) present several variables as possible factors of the capital structure, such as *fixed assets*, *profitability*, *size*, *market-to-book ratio value* and *liquidity*. Marsh (1982) found that leverage and tangible assets are positively related. Myers and Majluf (1984) and Titman and Wessels (1988) argued that profitable companies tend to be funded by their profits and for this reason such companies tend to have lower leverage. Using a total sample of the G7 countries (Canada, France, Germany, Italy, Japan, the UK, and the US) for the years 1987–1991, Rajan and Zingales (1995) focused on four elements: the percentage of real estate, the investment opportunities, the *size* of each enterprise and its *profitability*. In most countries the magnitude and tangible assets showed a positive correlation with the percentage of debt. The size of companies has been found in many studies to be positively correlated with leverage (Rajan and Zingales, 1995). However, Kim and Sorensen (1986) and Mehran (1992) supported the opposite. Although the result of the size of leverage seems to be somewhat weaker than those of other determinants, they presented two types of explanations. Despite the significant differences presented in the institutional framework of each country, the gearing ratios for the G7 countries are largely similar to those resulting from surveys conducted in the USA.

Chirinko et al. (2000) argued that the tests conducted by Shyam-Sunder and Myers (1999) have little ability to distinguish capital structure theories. They asserted that the model used by Shyam-Sunder and Myers (1999) neglects the possibility of hidden costs of debt or hidden benefits of equity that could alter the choice of the capital structure. This ambiguity was explained by Myers (2001), who suggested that any capital structure theory might work better in some cases than in others, as theories cannot be applied generally to the various sets of capital structure determinants used in the studies. Focusing on US companies during the period 1973–1994, Graham and Harvey (2001) found that the benefit of capitalized interest tax is about 10 per cent of the value of the business but that the level of debt could rise to the point at which, although the marginal benefit decreases, the overall benefit of the tax shield could increase by up to 15 per cent of the enterprise value. The existence of unused tax shields, and therefore the indirect conservatism for increasing debt levels, reflects only weak support for the

trade-off theory, because this theory suggests that businesses should use tax benefits effectively.

Drobertz and Fix (2003) used a sample of 124 listed Swiss enterprises and examined the validity of the trade-off and pecking-order theories, comparing their results with those of Rajan and Zingales (1995). The survey results suggest that Swiss companies follow the trade-off theory but are somewhat contradictory. The enterprises with more investment opportunities have less leverage, which is supported by the trade-off theory, while more profitable companies borrow less, confirming the pecking-order theory. Drobertz and Fix (2003) used technical panel data. Aggarwal and Jamdee (2003) added the legal dimension in the work of Rajan and Zingales and the protection offered to investors by each country, creating a set of interpretative variables. According to their study, the leverage overall appears to be located at a lower level in 2001 than in 1991, while it seems that the access to capital is important in making decisions relating to the capital structure.

Flannery and Rangan (2006) tested the trade-off theory with the help of a gradual adjustment model (partial adjustment model) and compared cases of this particular model with the assumptions of the pecking-order, market-timing and inertia (Welch, 2004) theories. The two authors concluded that the sampled companies follow the trade-off theory and the gradual adjustment model satisfactorily explains that the above behaviour seems to prevail over the pecking-order, market-timing and inertia theories. Shah and Khan (2007) found that, when a company has a large percentage of tangible assets, it usually pays a lower interest rate. The pecking-order theory attaches great importance to the *profitability* of financing decisions, because, of all the sources of financing, internal financing involves less asymmetric information.

Serrasqueiro and Nunes (2009) studied Portuguese companies' adjustment of the level of actual debt towards the optimal level of debt. They found a positive and statistically significant relationship between no debt tax shields and debt, contrary to the expected negative relationship; thus, they could conclude that Portuguese companies do not reduce their debt given the greater possibility of *non-debt tax shields*. They confirmed the existence of a negative relationship between *profitability* and debt. This result suggests that the most profitable Portuguese companies resort less to debt, opting first for internal financing.

Sinan (2010) examined various kinds of business features in the UK, which may be related to the capital structure of companies, and found that *profitability*, tax shields, the volatility of profits and liquidity are significantly negatively correlated with the level of debt, which gives some support to the pecking-order theory. However, the properties and the *size* are positively related to the size of leverage, supporting the trade-off theory.

Most studies show a positive correlation between leverage and tangible assets (and size), implying a role of the trade-off theory in capital structure decisions. However, this role is in contrast to the fact that there is a negative correlation between profits and leverage. Conflicting results may be found in various studies, such as those by Titman and Wessels (1988), Rajan and Zingales (1995), Antoniou et al. (2008) and De Jong et al. (2010). We can highlight the work of Welch (2011), in which the correlation between equity-issuing activity and capital structure changes is either insignificant or outright perverse. There are other problems in the published capital structure research, the most important of which may well be the fact that most research ignores the fact that financial leverage is a bounded variable. Chang and Dasgupta (2009) and Iliev and Welch (2010) showed that placebo processes can generate many findings that have previously been attributed to deliberate managerial behaviour.

In a more descriptive paper, Pattani and Vera (2011) mentioned that public capital markets play an important role in the UK economy and the capital structure of UK firms. Even though only a small fraction of UK companies issue public debt or equity as a form of external finance, those that do account for a relatively large share of economic activity, including domestic employment and investment. Mohamed and Seelanatha (2014)'s findings suggest that equity market liquidity has a negative effect on firms' leverage decisions. Furthermore, the global financial crisis (GFC) has reduced firms' reliance on debt financing. On the other hand, the magnitude and the significance of the impact of liquidity on leverage both diminished during the GFC and post-GFC periods. However, in this case more research is necessary before we can predict that financial distress costs and leverage have different impacts on the capital structure of UK firms. The study by Arvanitis et al. (2012) at a time including the current financial crisis is interesting. It shows a negative relationship between *size* and *profitability* over lending and a positive relationship between tangible assets and the *leverage* ratio for shipping companies in several European countries, while the explanatory variables of growth, age and liquidity appear to play a determinant role.

Market-timing theory

A huge amount of research on long-run stock execution has recommended market inability at the firm level (Ikenberry et al., 1995; Loughran and Ritter, 1995; Spiess and Affleck-Graves, 1995; Loughran and Vijh, 1997; Billett et al., 2001; Hertzel et al., 2002). Korajczyk and Levy (2003) controlled the trade-off and pecking-order theories, taking into account the long-term financial conditions and financial constraints faced by companies and their effect on their financial decisions (issue debt

instruments–repurchase shares). Korajczyk and Levy (2003) concluded that macroeconomic conditions explain a sizable part of the temporal variability in the capital structure of companies that are not facing financial constraints. Another addition to the academic studies dealing with the market-timing theory is that by Hovakimian (2006), who tried to determine whether the significant negative correlation between historical *market-to-book* ratios and leverage (Baker and Wurgler, 2002) indeed reflects the past efforts of managers to take advantage of favourable market conditions. Hovakimian (2006) concluded that the long-term effects of the market-to-book ratio on the capital structure are a result of the equity market timing, which was not confirmed in the case of issuance or repayment loans or in cases of issuance and repurchasing of new shares.

The market-timing theory does not rely on the proposition of semi-solid structure commercial centre viability. Only if the relative expense of value demonstrates an inconsistency after some time for either counterintuitive or consistent grounds does the window of chance exist. Alti and Sulaeman (2012) documented in their study that such planning conduct is shown by firms because of higher returns that are produced by solid speculation requests by foundations. They clarified that, if institutional purchases do not achieve such returns, value issuance will demonstrate a small effect by stock cost increments. This hypothesis reveals that it is more plausible for organizations to issue new stock when the business sector quality is higher than the book estimation of their stock (Bolton et al., 2013). This budgetary conduct implies that organizations lean towards outside financing when the expense is low. However, when the financing expense is high, firms incline towards obligations. In light of the previously mentioned hypothetical suspicions, different specialists, for example Frank and Goyal (2004), Huang and Ritter (2005), Hovakimian (2006) and Mahajan and Tartaroglu (2008), have attempted to discover exact proof of the presence of business sector timing conduct in various capital markets.

Pecking-order theory

Fama and French (2002) argued that each capital structure theory has a flaw in predicting the choice of business financing. For this reason the pecking-order theory fails to explain why small firms with low leverage and growing companies have capital problems, while the trade-off theory is not capable of explaining the negative correlation between leverage and *profitability*. Shyam-Sunder and Myers (1999) provided data using a simple empirical model and a sample of 157 US companies and found that these firms largely finance their deficits with debt. They concluded that the pecking-order theory provides a good approximation of the first order of financial behaviour of research firms. In accordance with this view, Fama and French (2002) indicated that short-term volatility in profits and investment is mostly absorbed by debt. Instead, Frank and Goyal (2003) showed that the findings of Shyam-Sunder and Myers (1999), which support the theory of hierarchy, are not found when using a larger sample of firms or a longer period of time.

The study by Flannery and Rangan (2006) examined the basic capital structure theories using annual observations for the period from 1965 to 2001 for companies that do not belong to the financial industry (in contrast to the present study, which takes such companies into account while appropriately correcting the data). The study examined the behaviour of leverage with independent *profitability*, *growth* prospects, *size*, *fixed assets*, the uniqueness of the *product* and the *tax relief*. The authors made use of the progressive adaptation method and concluded that the trade-off theory explains the particular sample. A key role in the analysis appears to be played by the rate of lending to companies that are under-lent or over-lent, moving towards the target level with a high annual rate of convergence, growth that is significantly greater in relation to different surveys.

Lemmon and Zender (2001) examined how the borrowing capacity of each enterprise influences its capital structure. The sample is for the years 1971–2001. As explanatory variables the growth prospects, the *profitability*, the volatility in the stock performance, the *size* and the age of each company were adopted. Considering the borrowing capacity of enterprises, the pecking-order theory seems to explain the capital structure of the company satisfactorily. Large, profitable and low-leverage firms use internal capital to finance their growth. In contrast, small businesses with high growth appear to have a unique way of financing their investment lending. However, according to Bradley and Jarrell (1984), Wald (1999) and Booth et al. (2001), there is a negative correlation between the leverage and the variability of cash flows. However, there are empirical studies that have found the opposite (Toy et al., 1974; Long and Malitz, 1985) or a less statistically significant correlation between the volatility of cash flows and the indicators of debt (Titman and Wessels, 1988).

The study by Acaravcı and Doğukanlı (2004) examined the determinant factors of capital for 66 construction companies from 1992 to 2002. They used macroeconomic variables and found that the *size* of the company, the development of the banking sector, the inflation and the corporate tax rate have a positive impact on debt financing. Other studies on tax rates and leverage have indicated the inability of tax rates in the choice of leverage. For example, Bradley and Jarrell (1984) found that companies with ample *non-debt tax shields* (*NDTS*) have higher leverage ratios than those with less *NDTS*. This assumption was confirmed by Titman and Wessels (1988), as they did not find evidence that *NDTS* reduce the lending of a business. Acaravcı

and Doğukanlı (2004) concluded that the characteristics of companies affect capital structures more than the financial and macroeconomic variables. Finally, the capital structure of businesses in the Turkish economy is characterized by high leverage, indicating that companies tend to use debt rather than equity funds.

Bancel and Mittoo (2004) considered the relationship between theory and practice in the capital structure decisions in 16 European countries with different legal systems. Their results show that financial flexibility is an important factor in economic decisions. Financial flexibility is gained by having the ability to appreciate in a timely and correct manner the debt or issue of shares according to the level of interest rates and the stock market price. Moreover, their findings show that companies do not classify agency costs or asymmetric information as important issues in capital structure decisions. The authors concluded overall that the support for the trade-off theory in choosing the capital structure is more evident than the support for the pecking-order theory. Lemmon and Zender (2010) checked the capacity of debt during an investigation of the capital structure of public limited companies in the US between 1971 and 2001. They found that the pecking-order theory explains the observed financing behaviour of a wide selection of businesses, because on average companies use their internal finance investments.

In a different study, Antoniou et al. (2008) argued that, despite the extensive capital structure research, two areas remain unexplored. One is the impact of differences in legal and environmental governance. The UK and the USA have common law and a governance structure based on the market, while in France and Germany the law is codified (code law) and bank governance structures are the norm. Japan is a hybrid of the two. The second factor is the impact of macroeconomic conditions that could affect companies' choice of capital structure. Antoniou et al. (2008) found similarities between the determinants of capital structure in the five countries surveyed, but the importance of these factors varied between the countries, suggesting that the company-specific factors cannot completely explain the capital structure and that the country-specific factors are also important. They also found evidence that the macroeconomic environment is important in explaining the capital structure choice, but again the importance of this varied between the countries surveyed.

Similarly, De Jong et al. (2008) investigated the effect of special factors of the company and the country on firms' choice of capital structure in a sample of 42 countries between 1997 and 2001. They found that the company's characteristics (tangible assets, firm size, *profitability* and *growth* opportunities) influence the choice of capital structure in most countries. However, they also noted that, for each country surveyed, at least one of these factors was not statistically significant and in some countries the capital structure was not consistent with the predictions of any capital structure theory. They also reported that the creditors' rights, the course of the bond market and the GDP have a significant impact on the capital structure. The consequence is that companies in countries with stronger legal protection and a healthier economic environment are more likely to take on debt. In other words, the country factors are important to capital structure decisions.

De Jong et al. (2011) inspected the static trade-off theory versus the pecking-order theory for US firms, concentrating on a primary dissimilarity in notional expectation. Dutta et al. (2013) explored the pecking-order theory in 652 Indian firms around 2002 and 2010, but the outcomes dismiss the pecking-order theory, which is consistent with past studies on India, for example those by Singh (1995), Mahakud (2006) and Kumar and Singh (2012). This recommends that Indian firms do not utilize the pecking-order theory when making capital choices.

Representation costs theory

Jensen and Meckling (1976) characterized the office relationship when one gathering (shareholders) is representative of another gathering (managers) to conduct some work on their part. The shareholders open the door for supervisors to decide, yet they can diminish the strife and intrigues that may emerge from the administering of their managers, regardless of the fact that the assessment expenses are in some cases too high.

On account of over-venturing (the asset substitution issue), shareholders have the chance to misuse their moneylenders following the issued obligation (bank shareholder struggle) on the grounds that the credit contract gives the right to proprietors to contribute underneath the ideal level. The issue of underinvestment (refereeing shareholders) alludes to managers' inclination to abstain from taking venture extensions, the effect of which on the estimation of the firm involves an expansion in the loaning esteem and a smaller decrease in the estimation of value. The issue of underinvestment influences all firms with leverage; however, it is vital for those that are near insolvency. Much more prominent is the probability that moneylenders will profit from venture undertakings. The theory of free cash flow demonstrates that firms that can create free working money streams can use loans as a disciplinary component for supervisors. At the point at which the organization has free income, it implies that it has more income from those who are really expected to back speculation ventures, having ascertained the relative expense of capital.

In accordance with the hypothesis of representation costs, greater leverage takes care of the issue of free income, compelling the directors of firms to utilize the majority of free income to reimburse the advance. The

appointed costs that emerge from the propensity of managers to expand the free trade stream to wasteful speculation ventures or individual increases (higher wages, advantages, rewards, etc.) are higher for firms that have fewer resources, which could serve as certification for the exertion of the lending firm. The bigger the firm, the lower the risk of bankruptcy and the firm expands more. On the off chance that this expansion is accompanied by the steadiness of money streams, there is a negative connection between the firm's *size* and the default likelihood.

DATA SAMPLE AND PRELIMINARY STATISTICS

Sample

This study was conducted using data for the UK firms quoted on the LSE in the period from 2000 to 2012. The reporting period is considered to be representative of the upward and downward movements of the UK economy. The data came from the Worldscope database Thompson Financial. The companies that constitute our final sample belong to the vast majority of the branches of the LSE, apart from the companies belonging to the banking, insurance, equity, investment and leasing companies in the industry. The exclusion of businesses in these sectors is necessary because of the limitations regarding the configuration of their capital structure due to the existing institutional framework. In addition, companies were excluded for which there were no data existing for the majority of the years 2000–2012. Because not many observations were available for the *market-to-book* value ratio index, two samples were used for our research. The above limitations set our final sample, which comprises 503 (with the variable *market-to-book* ratio) and 1081 (without the *market-to-book* ratio) enterprises, respectively.

Preliminary statistics

As mentioned above, due to the unavailability of data in the case of the *market-to-book* variable, the empirical analysis was performed considering two company specimens. In the first case, we included in our model the *market-to-book* variable, resulting in a reduction of the final sample, which includes 503 companies and 4023 observations, due to the unavailability of data on this variable. In the second case, the empirical analysis does not include the *market-to-book* variable. The result is the increment of the sample to 1081 companies and 8909 observations. Table 2 presents the descriptive statistics of the dependent and independent variables referring to the final sample of companies researched. According to Table 2, all the variables present a positive mean value except for *non-debt tax shields* and *growth*.

Table 3 contains the diachronic process of the mean value of the variables listed in Table 2. As can be seen from Table 2, the *leverage* levels remain at low levels from 2000 to 2002 and 2005 to 2008 but instead grow rapidly from 2008 to 2012. The variable *fixed assets to total assets* (PPE) moves downwards during the entire time period of our sample. The variable *market-to-book* ratio seems to reflect the true value of the business in the years 2003 to 2008. After the crisis the average price of the companies rises inexplicably, warning that the market value of a company is not its relative accounting value. The *size* of UK firms remains constant during all the years except 2012, which shows a negative trend. The *profitability* shows that the businesses are not stable and do not have the capacity even before the crisis to produce earnings on their spending. The negative average that appears just shows the weaknesses and not the business expenditure audited. The size of businesses, in accordance with Table 2, seems to be stable, something that is quite problematic as it does not follow the rules of business restructuring to enable them to respond to a crisis. Nevertheless, it seems that there is only a change and an adaptation in 2012, having spent four years of the crisis without major upheavals. The *liquidity* variable indicates that the asset transactions do not affect the prices, which remain stable, opposite to the situation in a crisis. According to the table, the variable *investment* is only affected by the crisis; nevertheless, it remains constant and increases during the years 2011 and 2012. The *tax shield non-interest* seems to be used by UK companies to reduce their taxes owed. This happens in all the years from 2000 to 2010. In the last two years of the sample, it appears that businesses comply, having fewer tax deductions.

As we can see from Figure 1, the leverage increased in 2003, and then, in the period 2011–2012, when the financial crisis had passed in the UK, the borrowing cost is low.

Tables 4 and 5 show the correlation coefficients between the variables used in our econometric model. A Pearson correlation matrix is provided for the dependent and independent variables. From Table 4 it is apparent that there is a statistically significant and positive correlation (*r=0.3127*) between *leverage* and *non-debt tax shields* at the 5% significance level, a statistically significant and positive correlation (*r=0.0762*) between *leverage* and the corporate tax rate at the 5% significance level, a statistically significant and negative correlation (*r=-0.083*) between *leverage* and *investments* at the 5% significance level. a statistically significant and negative correlation (*r=-0.0328*) between *leverage* and *liquidity* at the 5% significance level, a statistically significant and positive correlation (*r=0.3228*) between *leverage* and *profitability* at the 5% significance level, a statistically significant and positive correlation (*r=0.0013*) between *leverage* and *size* at the 10% significance level and finally a statistically significant and negative correlation (*r=-

Table 2. Descriptive statistics.

Variable	LEV	NTDS	PPE	I	LIQ	PROF	SIZE	GROWTH	MTB
Mean	0.1562	-0.0038	0.2786	333,195	177,196	0.0441	5,025,145	-0.0208	3,368,139
Median	0.1168	0.0248	0.2254	4267	1,367,716	0.0688	5,084,959	0.0576	1355
Maximum	19.3000	9.1000	0.9968	3.68E+08	1,237,351	9.1000	8,628,481	1.0000	31,899
Minimum	0.0000	-685767	0.0001	-1.18E+08	0.0073	-685,767	0.3010	-333	0.0020
Std Dev.	0.3616	0.3063	0.2257	6,929,691	2,704,462	0.3101	1,096,055	5,264,804	606,897
Skewness	3,910,785	0.4761	0.9196	3,985,302	2,637,622	0.1168	-0.2588	-6,291,182	4,169,695
Kurtosis	1,988	3,472,191	306,715	2,078,648	1,075,976	3,300,548	364,258	3,979,293	2,021,224
Jarque–Bera	6.61E+08	19861499	5678036	7.23E+08	1.93E+08	1.79E+07	1141192	2.65E+09	6.84E+08
Probability	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Sum	6,285,404	-151,723	1,120,799	1.34E+09	7,128,597	177,301	20,216	-835463	135500
Sum Sq. Dev.	5,257,705	3,773,665	2,048,076	1.93E+17	29,417	3,867,339	4,831,778	111,483	1.48E+09
Observations	4,023	4,023	4,023	4,023	4,023	4,023	4,023	4,023	4,023

Table 3. Mean variables.

Variable/Time	LEV	PPE	MTB	GROWTH	PROF	SIZE	LIQ	I	NTDS
2000	0.1538	0.2902	191456	0.2559	0.0076	4687345	2612045	85231	-0.0507
n	577	755	348	763	754	725	755	754	755
2001	0.1738	0.2891	6023172	0.0268	-0.0609	4641476	2761441	101468	-0.1118
n	613	821	365	833	825	798	825	832	825
2002	0.1986	0.2821	2522838	-0.0597	-0.0450	4566333	2472417	95818	-0.0949
n	669	910	385	936	927	891	926	924	927
2003	0.2890	0.2740	1996484	-0.0590	-0.3492	4544945	2609546	75304	-0.3929
n	718	1000	400	1030	1018	966	1019	1007	1019
2004	0.2135	0.2633	1118423	0.1212	-0.0695	4570147	3339635	73070	-0.1153
n	757	1079	444	1119	1111	1039	1110	1084	1115
2005	0.1879	0.2513	2347044	0.1313	0.0191	460617	3144919	169678	-0.0304
n	795	1129	491	1162	1154	1086	1155	1141	1157
2006	0.1802	0.2328	1915431	0.0803	0.0197	4652031	2822086	95128	-0.0248
n	829	1159	529	1176	1169	1120	1172	1162	1173
2007	0.1815	0.2219	2237978	0.0748	0.0114	4700321	2567117	65110	-0.0324
n	820	1141	539	1153	1143	1102	1151	1163	1149
2008	0.1973	0.2243	1121076	-0.0309	-0.0155	4748691	2525945	180815	-0.0597
n	765	1081	533	1100	1092	1053	1099	1146	1096
2009	0.2130	0.2273	6300454	-0.1189	-0.0198	4762474	2111918	-19248	-0.0638
n	715	1022	509	1041	1026	1003	1039	1081	1030
2010	0.2112	0.2195	6379037	0.0128	0.0180	4816717	2455449	128076	-0.0198
n	657	957	485	976	972	934	974	1023	974
2011	0.2128	0.2242	4759424	0.0350	-0.0112	4861665	2491203	517934	-0.0478
n	620	908	462	926	918	889	925	961	921
2012	0.3866	0.2273	4427824	-4.03E+08	-0.0881	491183	2386336	306933	-0.1219
n	584	850	449	870	861	826	868	909	866

0.0095) between *leverage* and *growth* at the 5% significance level.

Table 5 reports the correlation coefficients between the variables without including the *market-to-book* variable. We observe that, if we include the specific variable in our analysis, the results change significantly. Specifically, it is apparent that there is a statistically significant and negative correlation (*r=-0.1262*) between *leverage* and *non-debt tax shields* at the 5% significance level, a statistically significant and negative correlation (*r*=-

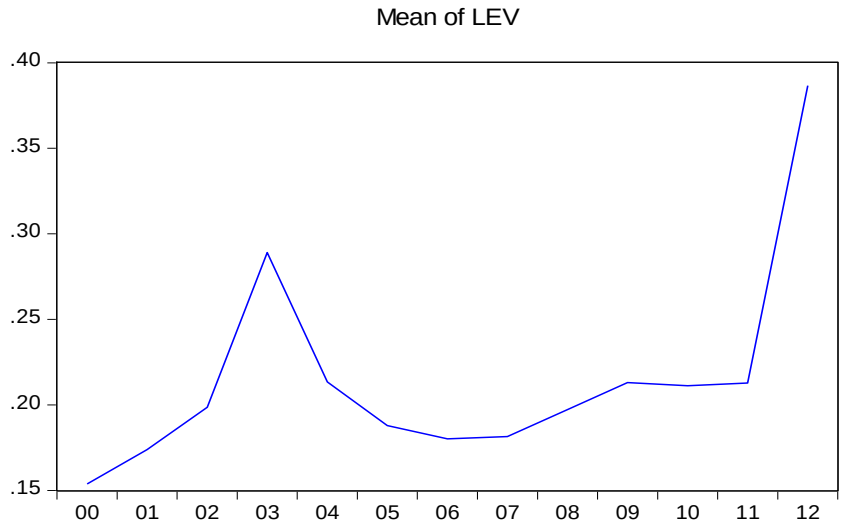

Figure 1. Mean of the leverage variable.

Table 4. Correlation of variables with the MTB index.

Variables	LEV	NTDS	PPE	I	LIQ	PROF	SIZE	GROWTH	MTB
LEV	1								
NTDS	0.3127	1							
PPE	0.0762	0.0521	1						
I	-0.0083	0.0158	0.0563	1					
LIQ	-0.0372	0.0067	-0.0525	0.0106	1				
PROF	0.3228	0.9794	0.0312	0.0127	-0.0115	1			
SIZE	0.0013	0.1650	0.0811	0.1247	-0.1691	0.2053	1		
GROWTH	-0.8375	-0.4530	0.0127	0.0086	0.0164	-0.4457	0.0575	1	
MTB	-0.0095	-0.0057	-0.0231	0.0316	0.0141	-0.0094	0.0013	0.0033	1

Table 5. Correlation of the variables without the MTB index.

Variables	LEV	NTDS	PPE	I	LIQ	PROF	SIZE	GROWTH
LEV	1							
NTDS	-0.1262	1						
PPE	0.0885	0.0703	1					
I	-0.0053	0.0126	0.0404	1				
LIQ	-0.0679	0.0111	-0.1219	0.0058	1			
PROF	-0.1219	0.9846	0.0541	0.0115	-0.0043	1		
SIZE	-0.0419	0.2250	0.1229	0.1065	-0.1863	0.2697	1	
GROWTH	-0.4674	-0.2363	0.0069	0.0086	0.0160	-0.2326	0.0325	1

0.1269) between *leverage* and *profitability* at the 5% significance level and a statistically significant and negative correlation (*r=-0.0469*) between *leverage* and *size* at the 5% significance level. In the remaining variables, there are minor changes. Generally, as we can observe that the correlations between the variables are low, we can conclude that multicollinearity is not a problem. The results are different because our sample

changes.

METHODOLOGY AND FORMULATION OF HYPOTHESES

Methodology

The purpose of this study is to identify the factors affecting the capital structure of UK quoted companies during the period 2000–2012 in the light of the main capital structure theories. We try to determine which of these theories (trade-off theory, agency cost theory and pecking-order theory) is best suited to explaining empirically the capital structure of UK firms. Therefore, the tasks to be undertaken in this study are the analysis of the variables for each of the theories and the identification of the one that best explains the index of long-term debt *leverage*. We use a panel data sample and a fixed-effects model following Greene (1997) and Greene and Choi (1998).

With panel models of random or fixed effects, it is possible to control the implications of companies' non-observable individual effects on the estimated parameters. The benefits and the reasons that led us to use panel data are the following. First, if we study a dynamic phenomenon, a phenomenon that changes in time, panel data are the most suitable, while on one hand the cross-sectional data cannot express such dynamic relations and on the other the time series data express dynamic relations, the estimates produced are not highly accurate due to the existence of multicollinearity. Second, panel data provide estimates of increased accuracy, while the total number of observations that they use is more than double the number of total observations that it is used in both the assessment with the cross-sectional data and the assessment with the time series data. Third, they provide the possibility to control the invariable features, those elements that change between firms but are stable over time. Panel data take into account greater heterogeneity. We have a reduction in multicollinearity and an increase in the accuracy of the estimates. Fourth, they give us the possibility to subsample a behaviour over time that characterizes each separate entity, avoiding the additionality error. Finally, fifth, they allow us to fix the result of the partiality of omitted variables in the model, variables that differ among firms but are stable over time.

For the purposes of our empirical study, we will use the model of Miguel and Pindado (2001). The model focuses on the fact that UK companies do not only increase their corporate debt with their investment opportunities like US organizations but also increase their corporate debt to cover their short-term liabilities. The standard model is presented in equation 1, as follows:

$$LEV_{i,t} = a_1 + a_2\left(NDTS_{i,t}/TA_{i,t}\right) + a_3 FA_{i,t} + a_4\left(GROWTH_{i,t}/TA_{i,t}\right) + a_5\left(I_{i,t}/TA_{i,t}\right) + a_6\left(PROF_{i,t}/TA_{i,t}\right) + \\ + a_7\left(SIZE_{i,t}/TA_{i,t}\right) + a_8\left(LIQ_{i,t}/TA_{i,t}\right) + a_9\left(MTB_{i,t}\right) + e_{i,t} \quad (1)$$

where $LEV_{i,t}$ is the measurement of *leverage* that has been widely used as a measure of long-term debt per the book value of total assets. Long-term debt (as opposed to total debt) is used most often in capital structure studies (for example Titman and Wessels, 1998; Demirguc-Kunt and Maksimovic, 1999; Booth et al., 2001), because short-term debt consists primarily of commercial credit. The inclusion of trade credit can lead to unreliable results, because trade is not affected by the same determinants as *leverage* (De Jong et al., 2008; Miguel and Pindado, 2001). $NDTS_{it}$ is the *non-debt tax shields* (tax shields excluding interest), as used by Titman and Wessels (1998), Barton et al. (1989), Prowse (1990) and Miguel and Pindado (2001), who found an inverse relationship between *leverage* and *non-debt tax shields*; Equation 2 shows the *non-debt tax shields* as follows:

$$NDTS_{i,t} = EBIT_{i,t} - IP_{i,t} - \left(T_{i,t}/T\right) \quad (2)$$

where $NDTS_{i,t}$ is *non-debt tax shields*, $IP_{i,t}$ is the interest payable, $T_{i,t}$ is the income tax, T is the corporate tax rate and $PPE_{i,t}$ is the fixed assets to total assets, as used by Rajan and Zingales (1995), a difference in the total assets ratio for the company's development, as used by Voulgaris et al. (2002). Equation 2 shows the *growth* variable as follows:

$$Growth_{i,t} = \left(TA_{i,t} - TA_{i,t-1}\right) \quad (3)$$

$I_{i,t}$ is the *investments*, in accordance with Lewellen and Badrinath (1997), where:

$$I_{i,t} = NPPE_{i,t} - NPPE_{i,t-1} + D_{i,t} \quad (4)$$

where $NPPE_{i,t}$ is the fixed assets (tangible fixed assets data) and $D_{i,t}$ denotes the depreciation. *Profitability* $\left(PROF_{i,t}\right)$ is the profits before interest and taxes to total assets, as used by Lemmon and Zender (2010). *Size* $\left(SIZE_{i,t}\right)$ is the turnover logarithm, as used by Rajan and Zingales (1995). *Liquidity* $\left(LIQ_{i,t}\right)$ is the ratio of current assets to current liabilities, as used by Graham and Harvey (2001) and De Jong et al. (2008). The market-to-book ratio $\left(MTB_{i,t}\right)$ was used by Rajan and Zingales (1995), De Jong et al. (2008), Lemmon and Zender (2010) and Sinan (2010).

The most important elements of the research are focused on a large number of data concerning the years 2000–2012, the longest period so far in research. The survey covers almost all business categories, small, medium and large. A considerable number of previous researchers have attempted to understand the determinants of firms' capital structure, for example Myers (1977), Bradley and Jarrell (1984), Titman and Wessels (1988), Ozkan (2001), Akhtar (2005) and Huang and Song (2006). Furthermore, some of the other important elements of the recorded evidence in previous empirical works may not be able to explain the real relationship between the capital structure choice and the *leverage*. Several authors have established empirical models, such as Miguel and Pindado (2001). The estimation was carried out using the Dynamic Panel Data (DPD) program written by Arellano and Bond (1988). Furthermore, Serrasqueiro and Nunes (2009) presented their results using the generalized method of moments (GMM) and GMM system dynamic estimators. In this model the estimation of the dynamic model with predetermined variables is carried out using a two-step GMM.

The model tries to offer the best solution to the problem of the shareholders' decision of UK businesses affected in the short term. The model uses variables that are divided by the total assets of the company. This process affects the short-term shareholders and is evaluated in the medium and long term, at least for major decisions (initial investment, expansion, etc.). However, it gives a measure of the efficiency of the exploitation of the total capital employed by the company, because, when the long-term capital resources exceed the value of the long-term assets, the surplus finances the permanent working capital (percentage of short-term current assets). Something that the results show us is that this procedure

does not apply to UK businesses, which resort to strong lending to meet their current liabilities and thus have an impact on shareholders' decisions.

Formulation of hypotheses

As already mentioned, the purpose of this study is to identify the factors that affect the capital structure of listed companies in the UK in the period 2000–2012 in the light of the main capital structure theories. We try to determine which of these theories (trade-off theory, agency cost theory and pecking-order theory), is the most suitable for providing an empirical explanation of the capital structure of UK listed companies. The hypotheses for the examination of each of the above theories are as follows:

H1. There is a positive correlation between *leverage* and *profitability*, as companies that are profitable $(i>)$ should prefer debt financing to take advantage of the tax breaks offered by debt interest.
H2. There is a positive correlation between *leverage* and the value of tangible assets (fixed assets), as the more assets are available to the company, the greater will be the pledge that will serve as collateral to attract more funds through lending.
H3. There is a positive correlation between *leverage* and firm *size*, and the larger the company, the more diversified it is and the less volatility will be seen in the cash flows, thus having the potential for higher lending.
H4. There is a negative correlation between *leverage* and *growth* prospects, as companies with high *growth* potential will have a greater incentive to avoid the problems arising from the conflict of interest between lenders and shareholders.
H5. There is a negative correlation between *leverage* and tax shield derived factors that have nothing to do with debt, as companies are able to reduce their tax liabilities in other ways; for example, through depreciation they will have less incentive to take advantage of the tax benefits of debt.
H6. There is a negative correlation between *leverage* and the market value of the company.
H7. There is a negative correlation between *leverage* and the index of current *liquidity*.
H8. There is a positive correlation between *leverage* and the company's investment, as the more investments a company makes, the more it will need finance. Additionally, more investments indicate that the company is able to find investment opportunities and therefore have greater *leverage growth* prospects and the index of current *liquidity*.
H9. There is a positive correlation between *leverage* and the company's *investments*.

The model controls that the *leverage* of the company is a function of the company's *profitability*, value of fixed assets, *size*, *growth* prospects, investment, tax relief resulting from factors other than credit, index *liquidity* and share price. A way to check the statistical significance of the model, which we also use in this study, is through the price of probability. If the value is greater than 5% (10%), then we accept the null hypothesis that the variable is not statistically significant at the 5% (10%) level, while if the value is less than 5% (10%), then we accept the alternative case that the variable is statistically significant at the 5% (10%) level.

EMPIRICAL RESULTS

Regression analysis

As mentioned above, due to the unavailability of data in the case of the $MTB_{i,t}$ variable, an empirical analysis was performed considering two samples of companies. In the first case, we included the $MTB_{i,t}$ variable in our model, resulting in the reduction of the final sample, which contains 503 companies and 4023 observations, due to the unavailability of data on this variable. In the second case, the empirical analysis does not include the $MTB_{i,t}$ variable. The result is the increment of the sample to 1081 companies and 8909 observations. To choose between pooled regression, REs and fixed effects (FEs), we conducted the redundant FEs test to establish whether pooled regression is appropriate and the Hausman (1978) test to choose between REs and FEs. The Hausman (1978) test is essentially a test of whether the loss in efficiency is worth removing the bias and inconsistency of the ordinary least squares (OLS) estimators. REs are widely considered to be preferable, because they allow correlation between variables. Given that the common effects are aggregated to be correlated with the independent variables, an obvious advantage of the FEs is that they also allow the estimation of the effects of factors that do not change over time. Typically, the condition that common effects are not correlated with the repressors should be considered more like an exception than a rule, which favours REs.

Table 6 reports the empirical results of the redundant fixed-effects test with and without the market-to-book ratio. According to Panel A and Panel B of Table 6, we observe that the pooled regression is not suitable for both equations at the 5% significance level. This is an F-test to determine whether all the coefficients in the model are different from zero. Panel C of Table 6 presents the results of the Hausman (1978) test, which concludes that for both equations, with the statistical probability of 95%, the model of REs (Panel B and Panel C) is the best for our samples.

Tables 7 and 8 report the estimates of equation (1) with (random-effects model) and without the market-to-book ratio, respectively. Observing from Table 7 the t-statistic and the probability test criteria, we arrive at the final form of the model, since we are able to exclude the variables that are not statistically significant. Because of the low price of the t-statistic, we reject hypothesis H9. The same happens with the variable that represents the *liquidity* ratio, and we reject hypothesis H7.

From Table 7 it is apparent that there is a significant and negative impact between $LEV_{i,t}$ and $MTB_{i,t}$ at the 5% significance level. The final form of the model is shown below in equation (5):

$$LEV_{i,t} = +0.015 - 0.532 * NTDS_{i,t} + 0.154 * PPE_{i,t} - 0.000 * I_{i,t} - 0.000 * LIQ_{i,t} + \\ + 0.415 * PROF_{i,t} + 0.015 * SIZE_{i,t} - 0.060 * GROWTH_{i,t} - 0.000 * MTB_{i,t} \quad (5)$$

Observing from Table 8 the t-statistic and probability test criteria, we arrive at the final form of the model, since we

Table 6. Hausman test.

Panel A. Redundant fixed-effects test – Eq. (1)			
Effects test	**Statistic**	**d.f.**	**Prob.**
Cross-section F	7.7085E+06	-502.3512	0.0000
Cross-section chi-square	2.9884E+09	502.0000	0.0000
Panel B. Redundant fixed-effects test – Eq. (1) without market-to-book ratio			
Effects test	**Statistic**	**d.f.**	**Prob.**
Cross-section F	4.5295E+06	-1080.7821	0.0000
Cross-section chi-square	4.3280E+09	1080.0000	0.0000
Panel C. Correlated random effects – Hausman test			
Test summary	**Chi-sq. statistic**	**Chi-sq. d.f.**	**Prob.**
Cross-section random EQ(1)	3.2822E+07	8.0000	0.0001
Cross-section random EQ(2)	5.3439E+07	7.0000	0.0000

Table 7. Estimation of the model with MTB (random-effects model).

Variable	**Coefficient**	**Std error**	**t-statistic**	**Prob.**
C	3.5216E-02	2.4583E-02	1.4325*	0.1521
NTDS	-4.5636E-01	4.8453E-02	-9.4185*	0.0000
PPE	1.2210E-01	1.9597E-02	6.2306*	0.0000
I	1.9800E-10	3.5900E-10	0.5500	0.5825
LIQ	-3.5400E-04	1.0840E-03	-0.3270	0.7439
PROF	3.6772E-01	4.8237E-02	7.6232*	0.0000
SIZE	1.3785E-02	4.7460E-03	2.9048*	0.0037
GROWTH	-6.0749E-02	6.1400E-04	-9.8977*	0.0000
MTB	-7.0200E-06	4.1000E-06	-1.7116*	0.0870
	Effect specification			
			S.D.	**Rho**
Cross-section random	0.1268	0.4502		
Idiosyncratic random	0.1401	0.5498		
	Weighted statistics			
R-squared	0.7583	Mean dependent var.	0.0554	
Adjusted R-squared	0.7578	S.D. dependent var.	0.2918	
S.E. of regression	0.1434	Sum squared resid.	8250053	
F-statistic	1573857	Durbin–Watson stat.	1310414	
Prob. (F-statistic)	0			
	Unweighted statistics			
R-squared	0.7232	Mean dependent var.	0.1562	
Sum squared resid.	1455596	Durbin–Watson stat.	0.7446	
* and ** indicate the statistical significance levels of 5% and 10%.				

are able to exclude the variables that are not statistically significant. Because of the low price of the t-statistic, we reject hypothesis H9. The same happens with the variable that represents the *profitability* index, as the t-statistic continues to remain low, and we reject hypothesis H1. Meanwhile, it should be noted that the variable

Table 8. Estimation of the model without MTB (random-effects model).

Variable	Coefficient	Std error	t-statistic	Prob.
C	1.9708E-01	2.9698E-02	6.6361*	0.0000
NTDS	-3.1802E-01	6.6504E-02	-4.7819*	0.0000
PPE	1.9363E-01	2.4197E-02	8.0024*	0.0000
I	4.8400E-10	7.6700E-10	0.631	0.5283
LIQ	-7.3350E-03	1.8420E-03	-3.9815*	0.0001
PROF	2.3555E-02	6.6485E-02	0.3540	0.7231
SIZE	-1.2880E-02	5.8100E-03	-2.2170*	0.0266
GROWTH	-6.5714E-02	1.0840E-03	-6.0640*	0.0000
Effect specification				
			S.D.	**Rho**
Cross-section random	0.1983	0.2972		
Idiosyncratic random	0.3050	0.7028		
Weighted statistics				
R-squared	0.2994	Mean dependent var.	0.0860	
Adjusted R-squared	0.2989	S.D. dependent var.	0.3737	
S.E. of regression	0.3126	Sum squared resid	8695622	
F-statistic	5434419	Durbin–Watson stat.	0.8882	
Prob. (F-statistic)	0			
Unweighted statistics				
R-squared	0.2897	Mean dependent var.	0.1891	
Sum squared resid.	1186991	Durbin–Watson stat.	0.6508	
* and ** indicate the statistical significance levels of 5% and 10%.				

$SIZE_{i,t}$ is statistically significant at the 5% significance without the $MTB_{i,t}$ variable is shown below in equation (6):

$$LEV_{i,t} = +0.197 - 0.318 * NTDS_{i,t} + 0.193 * PPE_{i,t} - 0.000 * I_{i,t} - 0.007 * LIQ_{i,t} + \\ + 0.023 * PROF_{i,t} - 0.012 * SIZE_{i,t} - 0.065 * GROWTH_{i,t} \quad (6)$$

Although we have changes in statistical significance, as can be seen in Table 9, we do not have changes in the signs of the variables. Therefore, we can present a pooled analysis of the results of our model. When the equation includes the variable $MTB_{i,t}$, there are significant relationships between *leverage* and $NTDS_{i,t}$, $PPE_{i,t}$, $PROF_{i,t}$, $SIZE_{i,t}$, $GROWTH_{i,t}$ and $MTB_{i,t}$. All the variables have a statistically significant effect at the 10% significance level. This result supports the trade-off theory. However, when the equation does not include the variable $MTB_{i,t}$, there are significant relationships between *leverage* and $NTDS_{i,t}$, $PPE_{i,t}$, $LIQ_{i,t}$, $SIZE_{i,t}$ and $GROWTH_{i,t}$. In addition, in both equations the $NTDS_{i,t}$, $LIQ_{i,t}$, $SIZE_{i,t}$ and $GROWTH_{i,t}$ variables have negative effects at the 10% level. We observe that the cost of debt has negative effects. Undoubtedly the interest paid by UK firms to repay their debt affects the total amount of debt involved. Thus, the low interest helps in the demand for business debt. The trade-off theory further explains the leverage factors. This is consistent with the previous findings of Sun et al. (2015) regarding the importance of the relation between ownership and leverage ratio in the UK context. Directors and executives holding high rates of company shares are in a better position to protect the private interests of the risk of bankruptcy related to the high leverage ratio.

Tax shields excluding interest (tax credit derived from lending)

According to the trade-off theory, companies that have the potential to reduce their tax liabilities in other ways, for example through depreciation, will have less incentive to take advantage of the tax benefits of lending, resulting in low lending levels of these companies. According to our results, the tax relief that is not derived from lending

Table 9. Regression coefficients.

Variable	Coefficient with MTB		Coefficient without MTB	
NTDS	-0.456359**	TOT	-0.318015**	TOT
PPE	0.122102**	TOT, AT	0.193633**	TOT, AT
I	0.0000		0.0000	
LIQ	-0.0004	POT	-0.007335**	POT
PROF	0.367722**	TOT	0.0236	TOT
SIZE	0.013785**	TOT	-0.012880**	TOT
GROWTH	-0.060749**	TOT	-0.065714**	TOT
MTB	-7.02-06*	MTT	-	

* and ** indicate the statistical significance levels of 5% and 10%. TOT, POT and AT are short for trade-off theory, pecking-order theory and agency cost theory.

adversely affects the *leverage*, which is consistent with the trade-off theory, as Titman and Wessels (1988) found. UK firms do not have strong reliance on short-term debt in their capital structure, which may explain the negative association with *non-debt tax shields*. Generally, smaller firms should use less debt, because they derive less benefit from the tax shelter of debt, especially long-term debt (McConnell and Pettit, 1984; Ang, 1991, 1992). It seems that UK firms have not taken advantage of the tax shelter of corporate deductible interest that arises from short-term debt, which in turn can reflect positively on their *profitability*. The negative correlation between *leverage* and $NTDS_{i,t}$ does not find support for the positive association findings among the previous literature, including the studies by Chiarella et al. (1991), Michaelas et al. (1999), Hall et al. (2000) and Sogorb-Mira (2005).

Value of fixed assets

The investigation conducted on the correlation between the value of fixed assets that exist in the business and the *leverage* in both developed and developing countries showed that there is a positive relationship, as the company has the ability to pledge more valuable assets in the form of a pledge that serves as collateral for lenders and can use them to attract more funds through lending. Through this process the risk of creditors is reduced, as creditors require assets that can be used as collateral as compensation for the case in which companies do not have the ability to meet their debt obligations.

This association, which is a prediction of the trade-off theory, provides the theory of agency costs (Jensen and Meckling, 1976). This is because the agency costs that arise from the tendency of managers to consume the free cash flow for inefficient investment projects or for personal gain (higher wages, bonuses, etc.) are higher for firms that have fewer assets. These assets could serve as a guarantee to the company effort to be loaned to prevent such speculative behaviour on the part of managers. The pecking-order theory instead provides a negative correlation between the percentage of fixed assets in the company's assets and the *leverage*. The above relationship is derived from the fact that companies with fixed assets of low-value items are more sensitive to the problem of asymmetric information and therefore will prefer to issue debt finance than to proceed with the issue of new share capital when they need external financing (Harris and Raviv, 1991).

Our study confirms the positive correlation between the *leverage* of the company and the value of fixed assets that it has to its credit, since this variable is proved to be statistically significant in the case of *leverage*. The above fact demonstrates that companies with fixed assets of high-value items have higher debt levels than companies that have fixed assets of small-value items. The result shows that credit institutions take into account the proportion of fixed assets held by companies, as they want to be assured that the companies in the future will be able to meet their debt obligations. The result is compatible with both the trade-off theory and the theory of agency costs and is contrary to the predictions of the pecking-order theory. The studies that concluded that there is a positive correlation between the *leverage* and the rate of fixed assets in the company's assets are those by Harris and Raviv (1991), Rajan and Zingales (1995), Colombo (2001), Hovakimian et al. (2001), Baker and Wurgler (2002), Frank and Goyal (2003), Kayhan and Titman (2007) and Daskalakis and Psillaki (2008).

Investments

The rate of investment is not statistically significant and tends to be zero for both models. We would expect a positive relationship between investment and debt, as investing companies require continuous long-term financing. Our study tries to focus on the lending strategy that has been developed in UK companies, which finance their investments from profits, as there is a positive

correlation, as shown by the correlations in Tables 4 and 5, between *profitability* and *investments* and use the loan to face short-term lending.

Liquidity index

The coefficient of *liquidity* is not statistically significant and has a negative sign for both models. The result is consistent with the pecking-order theory. A negative correlation between *liquidity* and *leverage* was also established by Sinan (2010), who examined a sample of UK firms. This means that a portion of the loans related to *investments* are transferred to investment but concentrated on facing short-term lending. The model revealed a negative relationship between *liquidity* and *leverage*, suggesting that firms with higher *liquidity* levels tend to rely more on long-term debt. This may be explained by the fact that the *liquidity* of a firm's equity may not ease a firm's access to external financing and not be able to mitigate the problems associated with potential bankruptcy. The majority of the literature supports the notion of a negative relationship. However, Anderson (2002) found a positive relationship between *liquidity* and long-term debt.

Profitability

The theoretical framework developed on the effect of a certain *size* on the level of debt indicates a negative correlation between *leverage* and *profitability*, a relationship that is not anticipated by the trade-off theory and the theory of the cost of representation costs. According to the trade-off theory, a positive correlation is expected, as the more *profitability* the business has, the greater the lending should be to take advantage of the tax breaks offered by debt. Even if past *profitability* is a good estimator of future *profitability*, profitable companies are able to lend more, as the probability of repayment of the loans is greater (Gaud et al., 2005). The above relationship applies to both models used.

Instead, the pecking-order theory expects a negative correlation between *profitability* and *leverage*. This theory argues that firms will prefer to finance their needs first using sustainable gains, then through lending and then by issuing new shares. This behaviour is related to the existence of transaction costs that accompany the issue of new shares under the influence of asymmetric information. The use of retained profits is the most attractive option for businesses, as the issue of share capital implies lower prices for their shares and large transaction costs. Furthermore, according to the pecking-order theory, companies are rapidly developing and have large financing needs that will be directed to short-term financing, which is less subject to asymmetric information. If these companies are closely related to credit institutions, there will be fewer asymmetric information problems and they will be able to have access to long-term financing (Gaud et al., 2005).

Companies' size

According to the trade-off theory, the larger the company is the greater the ability to lend and thus the ability to have higher *leverage* levels than a smaller company. In addition, according to Titman and Wessels (1988), the larger the company, the more diversified it will be, the less chance there is of it becoming bankrupt and the less volatility will be seen in the cash flow, so it has the ability to lend to a greater extent than a smaller company. Furthermore, larger companies have the ability to reduce the transaction costs associated with the conclusion of long-term loans as opposed to smaller companies that pay larger sums to conclude long-term debt. Our results are consistent with the trade-off theory, similar to Voulgaris et al. (2004) and Daskalakis and Psillaki (2008).

Companies' development

According to the trade-off model, companies with high *growth* (investment) perspectives should have low debt levels. This is because the investment opportunities may be perceived as a form of intangible assets, which cannot be used as collateral in the effort by companies to be landed, while they also do not create current taxable income. Our results are consistent with the trade-off theory. The analysis shows a significant negative relationship between firm *growth* and long-term debt, suggesting that as the firm *size* grows, the firms depend less on long-term debt. Myers (1977) noted that firms with higher *growth* tend to use more short-term and less long-term debt to reduce the agency costs (Titman and Wessels, 1988). More recently, Havokimian et al. (2001), Ozkan (2001) and Daskalakis and Psillaki (2008) provided evidence of a negative association of firm *growth* with *leverage*. The company's development has a negative effect. Large-sized companies are less vulnerable to failure, because they have diversified their risks better than smaller companies (Ang et al., 1982). Moreover, according to Jensen (1986), large companies should use more debt to control their managers effectively.

Market-to-book ratio

Baker and Wurgler (2002) showed that, when the stock price of a company is overvalued, administrators prefer to issue new shares, as the company will obtain a higher price for a new share issuance in connection with the carrying value of contrast when the price of the share is undervalued, so managers prefer to buy back common

shares, since the company could receive a lower price for each share redeemed. Businesses would rather raise capital through debt issuance despite the issuance of new shares in an undervalued situation. Effect model 1 supports the findings of Baker and Wurgler (2002). The negative sign indicates that, when the ratio $MTB_{i,t}$ is relatively high, the company is overvalued. Similar findings were obtained by Rajan and Zingales (1995), Graham and Harvey (2001), De Jong et al. (2008) and Sinan (2010). Our results are consistent with the market-timing theory.

Conclusion

The purpose of this study was to identify the factors affecting the capital structure of UK quoted companies during the period 2000–2012, incorporating different market phases and various stock market crashes and booms, in the light of the main capital structure theories. We tried to find out which of these theories (trade-off theory, agency cost theory and pecking-order theory) is best suited to explaining empirically the capital structure of the UK firms. Therefore, the case for consideration in this study was the analysis of the variables for each of the theories and the determination of which one best explains the index of long-term debt leverage. We used the method of panel data with random effects (REs). This paper's differentiation lies in the result that the investment companies have no impact on the borrowing levels of all the UK quoted companies; thus, lending mainly serves their current liabilities. To the best of our knowledge, this paper is the first to examine the applicability of the capital structure theories in UK firms with an extensive data set for this period. We added to the research literature in a number of ways. First, we examined the variables that affect the leverage of the London Stock Exchange (LSE) firms for the first time with the largest number of data; second, the research expanded to cover almost all business categories, small, medium and large. The result is the increment of the sample to 1081 companies and 8909 observations, which is the largest sample size in the research literature for the economy of the UK. Thirdly, the period of analysis is the longest so far in the research literature.

The empirical results indicate that the trade-off theory explains more factors of *leverage*, as we found results that are compatible with all four theories of capital structure that we examined. According to the empirical analysis, we found a positive correlation between the percentage of fixed assets and *leverage*, and we also identified a positive correlation between *profitability* and *leverage* and firm *size*. However, we obtained a negative correlation between the development of companies and *leverage* as well as the *non-interest tax relief*. All these results are consistent with the trade-off theory. In addition, they are consistent with the previous findings of Sun et al. (2015) regarding the importance of the relation between ownership and the leverage ratio in the UK context. Directors and executives holding high rates of company shares are in a better position to protect the private interests of the risk of bankruptcy related to the high leverage ratio. The positive correlation between tangible assets and *leverage* is also consistent with the representation costs theory, but there is a negative correlation between *liquidity* and *leverage* that is consistent with the pecking-order theory. Lastly, the investment company does not have an impact on the lending levels. We showed that UK firms do not follow the pecking-order theory's prediction. The positive correlation between tangible assets and leverage is also consistent with the representation costs, while we found a negative correlation with the liquidity and leverage, which is consistent with the pecking-order theory. Our finding is consistent with the study by Dang (2013) in that UK firms only use debt to offset a small fraction of their financing deficit or surplus. In future research we could use another econometric method, such as the difference GMM proposed by Holtz-Eakin et al. (1988), or analyse the sample in sub-periods.

Conflict of Interests

The authors have not declared any conflict of interests.

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