Essays in Empirical Corporate Finance

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Abstract

This thesis examines three studies related to the effect of information asymmetry on capital structure and cash holdings of firms. Firstly, we examine the funding patterns of large and regular investments by large and small public UK firms. Our main finding is that both size of firm and investment are important in explaining differences in funding patterns of firms though size of the firm dominates. Funding deficit covered by external capital consists predominantly of equity funding for small firms and predominantly of debt funding for large firms. The main reason firm size matters is that smaller firms tend to grow faster than large firms and have fewer tangible assets on their balance sheets. Both factors make debt financing unattractive.

Secondly, we examine financially constrained private UK firms facing large investments. We find that the leverage of constrained firms is generally nonresponsive to changes in traditional determinants of leverage. This contrasts with unconstrained firms who show the expected negative relationship between profitability and leverage. When faced with financing deficits, constrained firms are nonresponsive to new debt or new equity while unconstrained firms make changes to new debt. We attribute this to a relatively higher level of information asymmetry of constrained private firms limiting their ability to address financing deficits by changing their debt and equity holdings.

The third paper examines excess cash holdings among European firms. The results indicate that determinants of excess cash depend on the level of turnover growth a firm falls in any given year. The middle group however dominates whenever there is a difference between groupings. When different combinations of high debt and high excess cash are considered, it appears that the unusual combination of a simultaneous high-level debt and excess cash results from greater investment in Research and Development and CAPEX unlike High Debt-Low-Excess cash firms.

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Chapter 1 Introduction

Firms exist to carry out investments on a continuous basis. The amount and type of investments they carry out often influences how such investments are funded and how much cash is held in reserve in anticipation of current and future investments. The choice is usually between internal funding sources, like retained earnings, external funding sources, like new debt or new equity, or a mix of all types of funding. Therefore, the type of instruments firms employ in financing their investments, as well as, the composition and mix of such instruments has been a longstanding subject of interest. Capital structure theories have thus evolved with the basic aim of rationalizing the financing decisions of firms alongside their corresponding investment and dividend decisions. Theories have attempted to explain why a firm will have a particular mix of equity and debt and/or in what order financing instruments will be employed. The implications of these theories can also be extended to the amount of cash and near cash instruments firms will hold at any given time (Frank and Goyal, 2007).

Equity and debt instruments differ in terms of three major characteristics, seniority, amount and timing of repayments as well as ownership and control rights. Seniority of repayment implies that holders of debt instruments have priority in being paid over and above holders of other types of securities. Amount and timing of repayments implies that debt holders are paid predefined amounts at predefined intervals. These payments must be made irrespective of company performance. The residual of whatever is left after debt holders have been paid is reserved for equity holders. Ownership and control rights of debt holders is however limited to insolvency of the firm. That is, debt holders do not have rights as to how the company is run except in the event of the inability of the firm to make the predefined payments. This is when they can take over the assets of the firm in line with pre agreed covenants (Vernimmen et al., 2014).

These peculiar characteristics of debt and equity have implications for profitability, liquidity and long-term survival of firms. Managers are therefore concerned with creating an optimal mix of debt and equity financing in line with their strategic goals. The mix of debt and equity held by managers also influences the amount of and/or need for cash or near cash instruments. Several theories have attempted an explanation of how and why managers make decisions with respect to what financing mix they should have in their capital structure.

The Pecking order and Trade-off theories are two such theories which attempt to rationalize the capital structure choices of firms. The pecking order theory (Myers, 1984; Myers and Majluf, 1984) holds that firms will employ internal sources of capital before external sources and, when external sources are required, debt will be preferred to equity. Rationalizations for this behaviour have included transaction costs associated with issuing new securities (Donaldson, 1961) and, more recently, information asymmetry (Myers and Majluf, 1984). On the other hand, the Trade-off theory is based on the premise that debt has certain benefits and costs. The benefits of debt include their tax deductibility while costs include potential bankruptcy and agency costs. Firms must, therefore, balance the potential benefits of debt financing against related costs. According to this theory, the major challenge for firms is to design their capital structure in such a way that the costs and benefits of debt are optimized (Fama and French, 2002; Frank and Goyal, 2007).

Empirical studies have attempted to test the validity of the trade-off and/or the pecking order theories with mixed results. They include those of Shyam-Sunder and Myers (1999); Chirinko and Singha (2000); Frank and Goyal (2003) and Mayer and Sussman (2003). The next section will examine in more detail the main arguments of the trade-off and pecking order theory within the context of this study.

Theoretical Background

Modigliani and Miller Irrelevance Theory

Modern corporate finance theories are largely founded on the Modigliani and Miller (1958) irrelevance theory. The theory assumes a perfect capital market with free borrowing and lending, no market frictions and no information asymmetry among other simplifying assumptions. The implication of these assumptions is that private investors can easily undo any unwanted actions of firms and thus be able to create debt where desired but not available from firms, or offload debts where firms create unwanted debts. Consequently, according to this theory, the structure and mix of securities employed by firms is considered irrelevant to the value of the firm (Frank and Goyal, 2007).

Modigliani and Miller (1958) made a few propositions. According to them, securities having a similar pattern of return will have a similar price. Thus, with the assumption of a perfect capital market, equilibrium will result in a situation where the financing choices of firms will have no effect on their market value. Indeed, according to them, if the contrary was the case, arbitrage opportunities will arise resulting in a reversal to equilibrium. Fama (1976) pointed out several necessary conditions before arbitrage can be possible. They include, a perfect capital market with zero taxes, transaction, bankruptcy and agency costs; uniform expectations and absence of information asymmetry; ability of individual investors to create similar securities to those created by firms; presence of debt covenants to protect risky debts amongst others.

However, the theory becomes somewhat impractical if one or more of its simplifying assumptions are relaxed. The relaxation of one or more of the assumptions of this theory has resulted in other capital structure theories including the trade-off, pecking order theories of capital structure.

Trade-off Theory

Under the trade-off theory of capital structure, firms attempt to optimise the costs and benefits of debt financing. Benefits of debt include its tax deductibility and reduction in the agency cost of equity. Costs of utilizing debt financing include increase in the possibility of financial distress or bankruptcy and increased agency costs related to debt issuance (Fama and French, 2002).

The tax deductibility benefit arises because interest due to debt holders is deductible from income before taxes are charged. Therefore, the higher the level of interest payable on debts, the lower the tax payable by firms thus increasing the total value attributable to all types of fund providers. Agency costs of equity are also reduced when debts are held. It is believed that debt financing ensures the greatest discipline from managers and forces them to produce a higher level of output relative to equity financing (Fama and French, 2002).

However, as firms are subject to takeover by debt holders if interest payments are not made as and when due, the risks of bankruptcy and/or insolvency is increased with higher levels of debt. Agency costs of holding debts, including the 'debt overhang' and 'risk shifting' problem, are also increased. The debt overhang problem refers to a situation where firms must pass off profitable projects due to high levels of debt. The risk shifting problem emanates from the fact that debt holders receive pre-determined fixed payments and equity holders are entitled to the residual. This could encourage managers to take excessive risk as debt holders will bear a large share of the loss if the project is unsuccessful, but equity holders will receive huge benefits if the project does excessively well (Jensen and Meckling, 1976).

The Trade-off theory thus predicts that firms will continue to acquire debt, up to a point where the benefits obtainable from an additional unit of debt just offsets increased costs (Myers, 2001). The implication of this theory is that, there is an optimal capital structure and, other

things being equal, firms will continue to borrow if they still have the capacity to do so. Thus, irrespective of their current levels of investment, firms will be expected to continue borrowing as long as they still have incremental benefits to be derived from additional units of borrowing relative to potential costs. Based on this argument, we should expect that more profitable firms will utilize debt financing to a greater extent. This could also mean that firms may simultaneously hold high cash reserves and high debt if it is optimal to do so. This will serve as a means of optimizing tax benefits and ensuring that managers utilize resources and efforts optimally.

However, empirical studies including that of Rajan and Zingales (1995) have found that leverage varies negatively with profitability. This result is seemingly at variance with the trade-off theory. Increased profitability should mean that, other things being equal, firms have a greater capacity and need to borrow to enable them optimize tax advantages and ensure discipline among managers. The documented incidence of the zero-leverage puzzle (Bessler et al, 2013; Dang, 2013) also seems to be at variance with this theory. Firms with adequate capacity, given this theory, should be expected to have some level of debt in their capital structure. In addition, the benefits of tax may not be very important to a number of firms that have elaborate schemes to reduce their taxes to very low levels. The incidence of multinational firms using very elaborate schemes to significantly reduce the level of taxes they pay has been well documented. (See Darby and Lemaster, 2007; Sikka and Hampton, 2005; Sikka, 2010). Thus, a major benefit of having debt in their capital structure may not be very relevant to this category of firms. An alternative explanation to the nature of financing mix of firms is the pecking order theory of capital structure.

Pecking Order Theory

Donaldson (1961) premised his version of the pecking order theory on increasing transaction costs related to employing external sources of funding. Thus, according to him, firms will

prefer internal to external financing to avoid transaction costs. He also employed this argument in justifying firms' preference of debt over equity as, according to him; costs of raising debts were less than that of raising equity.

Myers and Majluf (1984) however based their own theory on the existence of information asymmetry. According to them, managers have more information about the true state of their firms than external investors. The concept of information asymmetry was popularized by Akerlof (1970) who employed the used car market to illustrate how potential investors demand a huge discount on the price of products for which they are uncertain about its quality. The pecking order theory thus posits that external investors will demand a discount on the value of securities offered by firms in accordance with the degree to which such securities are sensitive to information asymmetry. This will lead to the under-pricing of securities which are more sensitive to information asymmetry. This results in a 'pecking order' of retained earnings, then risk free debt, followed by more risky debt and finally, equity, which is employed only as a last resort (Harris and Raviv, 1991).

Internal funds, being owned by the firm itself, will be the least sensitive to information asymmetry and thus would demand no discount to its value and thus will be first in line for employment when investment opportunities arise. Risk free debt will be the next in line due to its seniority, fixed amount and timing of repayment. It will be more sensitive to information asymmetry than internal funds as investors are not privy to the day to day running of the business but less sensitive than other forms of financing. Equity financing will be the most sensitive to information asymmetry and thus will be the last in line. According to the pecking other theory, it will only be used as a last resort by firms that have some form of financing constraint. This is because not only are new investors in equity external to the business, they are also lowest in priority for repayment and in fact have no fixed repayment. They thus are they most likely to lose out on some or all their investments if investments become

unprofitable. New equity holders will thus demand a higher discount on the pricing of the security to compensate for this possibility. Thus, firms issuing equity will receive the least value for securities issued relative to other forms of financing (Myers and Majluf, 1984).

In the light of the above, the pecking order theory implies that the major motivation for firms to employ external financing is financing deficits occasioned by high levels of investments that cannot be adequately covered by internal funds. Thus, firms who do not have any funding gaps, that is whose internal funds can adequately take care of current levels of investment will not be expected to have any borrowing. Furthermore, it should also be expected that additional units of debt financing will be as a result of one-unit deficiency in internal funds, given current levels of investment (Harris and Raviv, 1991; Fama and French, 2002).

However, as pointed out by Frank and Goyal (2007) the strict interpretation of the theory will imply that firms use all internal funds before external sources of funding are explored. This may also imply that firms hold very little to no cash reserves if investment opportunities are available. This is considered somewhat inconsistent with reality as internal funds are often kept for transaction and other purposes even when external funds are raised. They further pointed out the lack of clarity as to when equity is to be introduced leading to the issue of 'debt capacity. The introduction of tests for debt capacity, according to them, could lead to challenges with differentiating findings from those consistent with the trade-off theory. In the light of the above, the next section will focus on a discussion of the motivation, objectives and contributions of the study.

Motivation, Objectives and Contributions

This thesis examines three studies related to capital structure and cash holdings of firms when they experience unusual events. A common theme across all three papers is the influence of information asymmetry on capital structure and cash holding decisions of firms. Paper 1 addresses the role played by size in corporate finance. The analysis involves an examination of

the financing mix of large and small firms when they are faced with large and small investments. We focus on publicly listed non-financial and non-utility UK firms in the period from 1996 to 2014. Large investments, in our paper, are classified as firms making more than twice their historical median investment. Our definition is based on Whited (2006). Furthermore, we define small and large firms as those within the first and last quartiles of our sample sorted by total assets respectively (Dang et al., 2018).

Our primary motivation is to compare the effects on firms' capital structure of investment size to that of firm size under different scenarios in order to see which of the effects dominate. This, we believe, will be a useful extension of existing studies especially those related to capital structure and small business financing. We find that both size of firm and size of investment are important in explaining differences in funding patterns of firms. However, size of the firm is a relatively more important factor. Large firms use proportionally more external capital when funding huge investments than when funding standard investments and large firms use proportionally more of both external debt and external equity when doing so. For large firms, external capital consists predominantly of debt capital. Small firms use roughly the same amount of external capital when funding huge investments as compared with regular investments. However, external capital consists almost exclusively of new equity capital for small firms. This is irrespective of whether they face huge or regular investments.

Consistent with Frank and Goyal (2003), our findings contribute to the notion that the pecking order predictions are consistent with the evidence for large firms only. The small firm effect is therefore not driven by the difference in the funding patterns for different levels of investments, but rather by firm size.

Our paper is related to Frank and Goyal (2003) and Mayer and Sussman (2004). Our main contribution is that we establish a link between the funding patterns and the size factor in two

dimensions: investment size and firm size. Consistent with Frank and Goyal (2003) we find that equity financing is significantly and economically more related to a firm's financing deficit than debt financing. Consistent with Mayer and Sussman, 2004, we find significant differences in the financing mix of large and small investments. However, these differences are relatively smaller when compared to the differences between the funding patterns of large and small firms.

In paper two we examine private firms financing constraints and investment spikes. This is set against the background of some of the results obtained in paper one which, in consistency with Frank and Goyal (2003), show that equity has a more important role in financing funding deficits than that suggested by the pecking order theory. This is especially the case for small public firms. Given that private firms in general and constrained private firms in particular are likely to experience an even greater level of information asymmetry than their small public counterparts our primary motivation for this study is therefore to see how constrained private firms respond to financing deficits. In a comparative empirical analysis of funding patterns of public and private firms, Brav (2009) found that private firms are almost entirely debt financed. He attributed this to relatively more costly private equity resulting from a relatively higher level of information asymmetry and the reluctance of private firms to dilute their level of control. We extend this study by distinguishing between constrained and unconstrained private firms.

The paper examines the determinants of leverage ratios of private UK firms distinguishing between funding dynamics of constrained and unconstrained private UK firms. Furthermore, we examine the relationship between changes in financing deficit and/or its component and changes in new debt and equity financing for these groups of firms. We look at the differences between these relationships during periods of financial crisis versus non-crisis periods. We also examine these interactions during periods of investment spikes when financing deficit is likely

to be greatest. Our analysis is based on a sample of private UK firms in the FAME database from 2000 to 2017.

We find differences in the extent of influence of the traditional determinants of leverage between constrained and unconstrained private firms. The widest differences relate to the influence of tangibility, growth and age on leverage ratio. This is consistent with a limited access of constrained private firms to borrowing due to their smaller size, less tangible assets and younger age when compared with their unconstrained counterparts.

Given that capital structure decisions of firms very often influence the amount of cash and near cash instruments by firms, our third paper looks at the issue of firms holding excess cash, relative to what would normally be required for their day to day operations. This is motivated by recent studies which seems to suggest that firms have increased the level of their cash holdings over time. For example, Iskandar-Datta and Jia (2012) in carrying out a cross country analysis of trends in cash holdings, found that there is a near systemic uptrend in cash holdings. J.P. Morgan Corporate Finance Advisory (2015) also suggested that high cash balances are due to large profitable firms, the slow economic growth, the recent financial crisis and tax considerations. They concluded that more efforts should be geared towards effective management of excess cash. This implies that excess cash holdings of firms could possibly be put to better use elsewhere. However, according to Azar, Kagy and Schmalz, (2016), cash holdings of firms in their sample were not necessarily larger than in previous years, if cost of holding cash is adjusted for. They thus attributed the level of cash holdings of firms to the cost of holding cash.

In the light of the above conflicting results, we attempt an empirical analysis of the cash holding patterns of firms in major European economies in our third paper. We test, empirically, some aspects of the theoretical analysis by Harris and Raviv (2017) and further extend the analysis to examine scenarios where a combination of high levels of excess cash and high debt levels

occur simultaneously as per Huang, Instefjord and Shen (2016). We further examine different quartiles of excess cash holdings and compare the major determinants of excess cash across quartiles of excess cash and Turnover growth.

Harris and Raviv (2017) suggested that huge cash holdings are more associated with firms in the middle brackets of growth opportunities as firms in the top and bottom brackets will normally not keep excess cash. We carry out an empirical analysis of their theoretical model by regressing excess cash holdings against relevant proxies for information asymmetry, growth, asset value, costs of holding cash, current levels of investment and other control variables. We carry out our regressions in several groups examining the major European economies as a whole and each individual country separately. We also consider all high technology firms in these countries separately as they are likely to hold more cash than firms in other industries.

Our results are as follows: across all groupings, key determinants of excess cash holdings in EU firms in our sample, are Size and earnings (negative). Other determinants, which are economically less so, are Research and Development Expenses – our proxy for information asymmetry (positive), Market to Book Ratio – our proxy for growth opportunities and Cost of Carry (negative). Results for cost of carry and debt vary across groupings possibly suggesting the influence of the existing interest rate regimes in particular countries.

However, when all EU firms are analysed in various quartiles of excess cash, we find that, across all quartiles, size and debt are a negative and significant determinant of excess cash as well as for all firms considered together. Cost of carry is uniformly negative and significant except for the first quartile which is not statistically significant. Market to book ratio is uniformly negative but only significant at the second and third quartile of excess cash holdings. Research and development expense is only positive and significant at the top quartile of excess

cash suggesting the influence of group of firms with the highest levels of excess cash when all firms are considered together. It thus appears that, apart from size, the key determinants of excess cash depend on the quartile of excess cash holdings a firm falls in any given year.

When terciles of turnover growth are considered, it appears that, size and earnings (negative) and research and development (positive) are fairly consistent across terciles of turnover growth as key determinants of excess cash. However, the significance of other variables considered depends on the tercile of turnover growth a firm falls in any given year. We show that the middle tercile has the greatest number of significant variables and greatest explanatory power. This is consistent with Harris and Raviv (2017) who alluded to this when they showed that only firms in the middle range of opportunities will hold excess cash.

Finally, when different combinations of relatively high debt and high excess cash are considered, it appears that High Debt-High Excess cash firms are quite different from High Debt-Low Excess cash firms. While Research and development expense is a positive determinant of excess cash for High debt, low excess cash firms it is negative and not a significant determinant for high debt low excess cash firms. CAPEX is a highly significant determinant of excess cash for high debt high excess cash firms, both statistically and economically. This is however not the case for High debt, low excess cash firms. This suggests that High Debt High excess cash firms invest heavily in research and development and CAPEX which accounts for the unusual combination of a simultaneous high level of debt and excess cash.

The rest of the thesis proceeds as follows; Chapter two examines Investment Size and the extent to which it influences funding patterns of large and small UK firms Chapter three looks at financing Constraints and Investment Spikes of private UK Firms. Chapter four examines

excess cash holdings of corporate Firms in major European economies. The final chapter concludes the thesis.

Chapter 2 Investment Size and Funding Patterns of Large and Small UK Firms

2.1 INTRODUCTION

What role does size play in corporate finance? We address this question in this paper where we study the funding patterns of different sizes of investments by large and small firms, using publicly listed non-financial and non-utility UK firms in the period from 1996 to 2014. One would think size could be an essential factor for investments: if the firm is planning a significant investment, it will not easily find the financial resources available internally, so external funding is needed. Moreover, the investment decision will generally need the approval at the highest level in the corporation, with all aspects of the decision carefully planned. In contrast, the firm can make smaller maintenance investment within limits set for divisional budget spends. Therefore, we should expect that theory more readily explains the funding of a significant investment decision. The pecking order theory in the main explains the acquisition process of external capital. It is, in contrast, much harder to explain why firm size should matter for investment decisions. There is, nonetheless, considerable literature that demonstrates that firm size effects are common. For instance, Frank and Goyal (2003), show that the pecking order theory is consistent with data for large firms only, and Rajan and Zingales (1995), find that leverage and firm size are positively associated. Beck et al. (2008), find that small firms finance a smaller proportion of their investments externally, explained mainly by their reluctance to use bank debt. Also, firm size seems to matter for corporate governance. Cremers and Nair (2005), argue for instance that small firms rely less on internal and more on external governance mechanisms, and Vijh and Yang (2013), find that the probability of being targeted by a raider depends on firm size. There are, therefore, genuine questions to be asked about funding patterns and size effects. In our paper, we define large investments (referred to as investment spikes) as cumulative investments made during a year that is greater than twice the historical median investment for the firm. This definition is consistent with Whited (2006).

Previous studies such as Cooper et al. (1999), and Doms and Dunne (1998), show that firms commonly experience investment spikes. Large and small firms are defined in our example by the first and last quartiles of the sample sorted by total assets (see Dang et al., 2018). Dang et al. (2018), find that the choice of size proxy can be significant, in particular, for the sign and magnitude of coefficients on other variables in the data analysis. Two factors determine funding patterns: the mix of external and internal funds used to fund investments, and secondly, the mix of debt and equity in the external funding package. Capital structure theory provides answers to the second question (see surveys and recent contributions to this theory in, for instance, Harris and Raviv (1991); Rajan and Zingales (1995); Fama and French (2002); Stenbacka and Tombak (2002); Frank and Goyal (2003); Morrellec, Valta and Zhandov (2015). The pecking order theory (see Myers, 1984; Myers and Majluf, 1984; Myers, 2001) holds that firms will minimise the cost of acquiring capital, and is, therefore, an essential cornerstone of this theory relevant to our study.

We summarise the findings of our study as follows. Size is an important determinant of funding patterns of firms in two dimensions. However, the size factor is more important in explaining the difference in funding patterns between large and small firms than in explaining the difference in funding patterns between large and small investments. Large firms use proportionally more external capital when funding huge investments than when funding standard investments and large firms use proportionally more of both external debt and external equity when doing so. External capital consists predominantly of debt capital. Small firms use roughly the same amount of external capital when funding huge investments as compared with regular investments. However, external capital consists almost exclusively of new equity capital for small firms. This is irrespective of whether they face huge or regular investments.

As documented by Frank and Goyal (2003), our findings add to the notion that the pecking order predictions are consistent with the evidence for large firms only. The small firm effect is

therefore not driven by the difference in the funding patterns for different levels of investments, but rather by firm size. There is a big difference between the drivers of changes in long-term debt. Long-term borrowing is surprisingly unresponsive to investments for small firms, even for spike periods. Changes in long-term borrowing are, in contrast, explained to a high degree by investments for large firms both in spike periods and off-spike periods. The latter point supports the notion that small firms are reluctant to utilise debt capital, consistent with existing findings, regardless of using debt capital as funding for large or standard investments. The size factor impacts on the relationship between the firm and debt-investors directly, therefore. According to Frank and Goyal (2003), an explanation for the notion that small firms are unique is that the information asymmetry between firm insiders and the firm's investors is higher for small firms than for large firms. However, they also indicate how empirical evidence points to the pecking order theory as a better fit with the data for large firms than small firms (Frank and Goyal, 2003). This is somewhat problematic as information asymmetry is the key driver of the pecking order theory. However, smaller firms are also more likely to experience higher growth, which mitigates the adverse selection cost for the firm.

A second point is the desire (or lack thereof) to retain control of the firm by remaining private (or seeking stock market listing). Brav (2009), in a study of private and public UK firms, finds that private UK firms tend to be heavy users of debt financing. The desire to retain control makes the firm reluctant to seek equity financing. Thus, the owners that are willing to go public and risk losing control of their firms may effectively self-select into being favourable towards equity financing. Thus, it may be possible that smaller firms in our sample consist of firms with shorter tenure as listed firms. Our data indicate that small firms are generally firms with shorter tenure as listed firms. However, the difference in tenure during spike periods is not statistically significant. It may also be possible that smaller firms in our sample are high growth firms for which the pecking order theory applies to a lesser extent (Myers and Majluf, 1984). Our data

also supports this notion as small firms are generally higher growth firms with the most significant difference in growth during spike periods. Our data also suggests that small firms have significantly fewer tangible assets. Therefore, large firms are more likely to offer collateral for borrowing than small firms. Even if this explanation is correct, however, it does not adequately explain why private firms and large public firms prefer debt financing while small public firms prefer equity. The firm size effect appears, therefore, a puzzle. Our paper is related to Frank and Goyal (2003), and Mayer and Sussman (2004). Our contribution is, essentially, to establish a link between the funding patterns and the size factor in two dimensions: investment size and firm size. Consistent with Frank and Goyal (2003), we find that for pooled regressions, equity financing is significantly and economically more related to a firm's financing deficit than debt financing. Consistent with Mayer and Sussman (2004), there are significant differences in the funding patterns of large and small investments. As discussed above, these differences are however small when compared to the differences between the funding patterns of large and small firms.

The rest of paper is structured as follows. The next section examines the major theoretical underpinnings of selected capital structure theories and provides a review of related empirical studies. This is followed by a description of the data and methodological issues. Next is a discussion of the results. The final section concludes the paper.

2.2 LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Modigliani and Miller (1958) argue that if the operational cash flow can be distributed without frictions to the firm's investors, the value of the firm is irrelevant to its capital structure. However, the theory becomes impractical if one or more of its simplifying assumptions are relaxed. Such a relaxation has resulted in, among others, the trade-off theory and the pecking order theory of capital structure.

Pecking order theory is based on frictions in the acquisition process of capital. Donaldson (1961) premised his version of the pecking order theory on increasing transaction costs related to employing external sources of funding. Firms prefer internal to external financing to avoid transaction costs associated with external capital. Firms' preference of external debt over external equity is similarly based on the assumption that the transaction costs of raising debts are less than those of rising equity.

Myers and Majluf (1984) rationalize such transaction costs by the assumption of information asymmetry between the firm's management and the firm's investors. Managers have more information about the true state of their firms than external investors. This can lead to adverse selection in the market for risky claims (Akerlof, 1970). Internal funds, being owned by the firm itself will demand no discount to its value and thus will be first in line for employment when investment opportunities arise. Risk free debt will be the next in line due to its seniority, fixed amount and timing of repayment. It will be more sensitive to information asymmetry than internal funds as investors are not privy to the day to day running of the business but less sensitive than other forms of financing. Equity financing will be the most sensitive to information asymmetry and thus will be the last in line. According to the pecking other theory, it will only be used as a last resort by firms that have some form of financing constraint. Not only are new investors in equity external to the business, they are also lowest in priority for repayment and in fact have no fixed repayment. Thus, these investors are most likely to lose out on some or all their investments if investments become unprofitable. Equity holders will therefore demand the higher discount on the pricing of the security to compensate for this possibility. As a result, firms issuing equity will receive the least value for securities issued relative to other forms of financing (Myers and Majluf, 1984).

In the light of the above, the pecking order theory implies that the major motivation for firms to employ external financing is financing deficits occasioned by high levels of

investments that cannot be adequately covered by internal funds. Thus, firms who do not have any funding gaps (that is whose internal funds can adequately take care of current levels of investment) will not be expected to have any borrowing. Furthermore, it should also be expected that additional units of debt financing will be as a result of one-unit deficiency in internal funds, given current levels of investment (Harris and Raviv, 1991; Fama and French, 2002).

However, as pointed out by Frank and Goyal (2007), the strict interpretation of the theory will imply that firms use up all of their internal funds before external sources of funding are explored. This is considered inconsistent with reality as internal funds are often kept for transaction and other purposes alongside the use of external funds. They further point out the lack of clarity as to when equity is to be introduced leading to the issue of 'debt capacity'. The introduction of tests for debt capacity, according to them, could lead to challenges with differentiating findings from those consistent with the trade-off theory.

Under the trade-off theory of capital structure, the operational cash flow is subject to corporate taxation when the firm does not default on its debt liability and to bankruptcy costs when it does. Benefits of debt include its tax deductibility and reduction in the agency cost of equity. Costs of utilizing debt financing include increase in the possibility of financial distress or bankruptcy and increased agency costs related to debt issuance. Thus, firms have an "optimal" or "target" debt ratio to which they revert in the event of deviations which are considered temporary (Fama and French, 2002). Firms that experience investment spikes may therefore temporarily adopt a suboptimal mix of external capital, but over time revert to a long-term target. Therefore, we do not expect the trade-off theory can adequately explain the mix of external funding for investment spikes.

The following section carries out a brief overview of related empirical works.

2.2.1 RELATED EMPIRICAL STUDIES

2.2.1.1 Pecking Order Theory

Shyam-Sunder and Myers (1999) study a sample of 157 American firms included in the Compustat industrial database from 1971 to 1989. They employ a concise model which tests debt financing against internal financing gaps. Thus, Shyam-Sunder and Myers (1999) test of the Pecking Order Theory (POT) is based on:

$$\Delta D_{it} = a + b_{po} DEF_{it} + e_{it} \quad (1)$$

Where ΔD is the amount of debt issued or retired, i is a firm index, t is time index, and b_{po} is the pecking order coefficient.

Under their model, the major determinant of debt financing is financing deficit (DEF in equation 1) as follows:

$$DEF_t = DIV_t + X_t + \Delta W_t + R_t - C_t \quad (2)$$

DIV is dividends, X is capital expenditures, ΔW is the net increase in working capital, R_t is the current portion of long-term debt, and C_t is operating cash flow.

Under this scenario, Shyam-Sunder and Myers (1999) hold that a change in financing deficit should lead to a (near) unity change in debt financing. Furthermore, they hold that the pecking order theory was better at predicting financing behaviour of firms than the static trade off theory. They, however, had a number of restrictions including, importantly, a requirement that firms have no reporting gaps in their financial statements. This they admit could lead to a greater probability of selecting large firms. They claim this would have limited effect on tests of the pecking order theory. However Frank and Goyal (2003) show how these restrictions result in biased estimates. Furthermore, Chirinko and Singha (2000), analyse different scenarios were this model could lead to misleading conclusions. We partly address this by including relatively smaller firms in our sample.

Chirinko and Singha (2000) show that the conclusions of Shyam-Sunder and Myers (1999), when set in more realistic contexts, could result in inaccurate inferences. According to them, tests of Shyam-Sunder and Myers (1999) could neither explain the pecking order nor the static trade-off theory. They arrive at this conclusion by considering three situations and showing that under these scenarios, it would be inappropriate to conclude that the pecking order theory dominates the trade-off theory. The three scenarios they analyse are, when the share of equity financing is substantially increased; when equity is not employed in the exact order predicted by the POT and when debt and equity are consistently issued in fixed amounts. They thus recommend alternative tests which can adequately differentiate alternative theories.

Frank and Goyal (2003), used a similar model as that of Shyam-Sunder and Myers (1999). They however exclude the current portion of long term debt in the calculation of the financing deficit, as according to them, the inclusion of this variable was not necessary in this context. Furthermore, in addition, they also carry out a regression of debt financing against its components as follows;

$$\Delta D_{it} = a + b_{DIV} DIV_t + b_I I_t + b_w \Delta W_t - b_C C_t + e_{it} \qquad (3)$$

Where *I* is investments.

They hold that under this scenario, the pecking order theory should result in $b_{DIV} = b_I = b_w = b_C = 1$. They show that, results obtained by Shyam-Sunder and Myers (1999) were heavily influenced by the requirement of no reporting gaps and the time period used in their analysis. They also show that allowing for the inclusion of firms with reporting gaps, which they argue, is allowable under the pecking order theory, results in a major difference in results obtained. They thus conclude that the pecking order theory could not adequately rationalize the financing behaviour of most firms. We take their analysis further by isolating periods of huge investments for closer examination. This is on the premise that this should be the scenario where the pecking

order theory can be expected to perform best as this is likely to be the period that coincides with the highest levels of financing deficits relative to other periods. We use a similar regression model in our analysis.

2.2.1.2 Large Investments

Mayer and Sussman (2004) introduce the idea of investment spikes by using a filter that identifies investments that are significantly above the average for a moving five-year period (with the spike in the middle year). Although they find that debt is predominantly used to fund investment spikes, there is little evidence in support of the pecking order theory's assertion that the firm prefers internal to external financing. Furthermore, they find evidence in support of firms' mean reversion behaviour as it relates to debt. They conclude that neither theory fully explains the capital structure behaviour of firms. Im, Mayer, and Sussman (2017) extend their analysis, and they conclude that spikes are largely debt financed. However, they also find that small firms with relatively higher growth potentials, less tangible assets and more research and development spending are mainly equity financed.

Mayer and Sussman (2004) and Im, Mayer, and Sussman (2017), employ the same methodology for the identification of investment spikes. In contrast, our paper employs the methodology used in Whited (2006). Mayer and Sussman (2004) and Im, Mayer, and Sussman (2017) make use of five years of data around the occurrence of the investment spike. The methodology in Whited (2006) uses all available data for each firm. Furthermore, similar to Brav (2009), we use a probit model for determining preferences between debt and equity financing during spikes.

Dudley (2012) carries out an empirical analysis of U.S. based industrial firms and finds that large investments are used as a vehicle to adjust leverage towards the target at relatively lower costs. Equity is employed before debt to achieve this end. He concludes that his results are in

line with the trade-off theory. Dudley (2012) defines large investments relative to the industry median.

Other related studies include Morrellec, Valta and Zhandov (2015) and Stenbacka and Tombak (2002). The identification methodology used in Whited (2006) for investment spikes is also adopted by Morrellec, Valta, and Zhandov (2015). Stenbacka and Tombak (2002) examine interactions between different financing instruments and how they influence investment policy, which is not so closely related to our study.

2.2.1.3 Small Firm Effects

There is considerable evidence of a small firm effect in corporate finance. Beck et al. (2008) find that small firms use less external finance. Their analysis span data for 48 countries and they find that the funding patterns of small firms are like those of firms in countries with weak financial infrastructure. The small firm effect is explained, therefore, by the notion that they are more likely to be financially constrained than large firms. In turn, asymmetric information and adverse selection costs explain why they are financially constrained. A higher number of bank relationships causes the cost of borrowing to go down (see Bonfim et al. 2017) which supports the asymmetric information effect.

2.2.2 HYPOTHESIS DEVELOPMENT

We examine two implications of the pecking order theory during investment spikes. The first implication is that the firm prefers internal to external funds (Shyam-Sunder and Myers 1999; Frank and Goyal 2003):

Implication 1: During investment spikes internal funds are preferred to external funds

A change in the financing deficit is expected to result in a similar pound for a pound change in debt financing. This should be more the case during investment spikes with a higher possibility of substantially higher levels of financing deficit. In a regression of debt financing against individual components of the financing deficit, we expect a (near) perfect positive relationship

between debt financing and investment, change in working capital and dividends. We expect a near (perfect) negative relationship between debt financing and internal funds. The pecking order theory predicts that equity, another source of external funding, is only used as a last resort (Frank and Goyal 2003). We, therefore, expect little or no relationship between financing deficit and equity financing, if the pecking order theory holds.

The second implication of the pecking order theory is that the firm prefers debt to equity:

Implication 2: During investment spikes, debt is preferred to equity when firms seek external funds.

Under the pecking order theory, securities that are more sensitive to information asymmetry will be under-priced. Thus, firms tend to prefer debt to equity financing as debt is considered less sensitive to information asymmetry than equity financing. (Harris and Raviv, 1991; Frank and Goyal, 2003). Periods of investment spikes will be expected to be the time when firms need external financing the most. We should, therefore, expect that, given the pecking order theory's suggestions, debt is considered to be the primary method of financing investment spikes. Accordingly, we expect that the debt regression will indicate a preference for debt over equity during investment spikes.

2.3 DATA SOURCES AND METHODOLOGY

We collect a sample of all publicly listed UK firms in the Standard and Poor's Compustat database from 1996-2014. This period was chosen to enable us observe funding dynamics across different crises and non-crises periods. We exclude firms from the financial and utility sectors (SIC codes 4900-4999 and 6000-6999) based on the peculiar nature of their financing mix (Whited 2006). We also exclude firms whose value of total assets is either zero or missing. This process results in a final sample of 1,888 firms and 20,115 firm-years comprised of 3,888 firm-years of investment spikes and 16,427 firm-years with no investment spikes. We employ

clustered fixed-effect panel-data regression analyses on three separate groupings, spike years, off-spike years, and all years.

All variables are winsorized at the 1st and 99th percentile to take care of outliers. A number of diagnostic tests were carried out. Detailed results are in Appendix 2A. Hausman test results indicate that fixed effects panel regression was more appropriate than random effects for the regression analyses. Furthermore, this study carries out Wooldridge test for autocorrelation in panel data and Modified Wald test for group-wise heteroscedasticity. Results indicate the presence of autocorrelation and heteroscedasticity. We, therefore, use robust standard errors, clustered by firm.

2.3.1 ECONOMETRIC MODELS

We employ the following models to carry out the analysis. Following Whited (2006), we define an investment spike as follows:

$$Is_{it} = \frac{I_{it}}{Median\, I_{it}} > 2 \qquad (4)^{1}$$

Where I_S = investment spike, I = investment, t is time index, and i is firm index. Table 2.10.A1 provides a more detailed description of variables. An investment spike occurs when the ratio of investment to total assets in any given year is greater than twice the median ratio of investment to total assets for each firm. The classification of investment spike enables us to divide the sample into three separate groups of firm-years, spike, off-spike, and all years. The analysis follows Shyam-Sunder and Myers (1999) and Frank and Goyal (2003), and Mayer and Sussman (2004) to conduct separate regression estimates for debt financing and equity financing:

$$LTD_{it} = a + \beta_1 FD_{it} + e_{it} \qquad (5)$$

[1] The analysis was also carried out using higher thresholds of 2.5 and 3. Results are qualitatively similar.

$$EQ_{it} = a + \beta_1 FD_{it} + e_{it} \quad (6)$$

Where LTD = *Change-in-Long-Term-Debt*. EQ = *Net-Equity-Finance*. FD= *Financing Deficit*. α, = Constant term. e = Error term. Next, we follow Frank and Goyal (2003) by decomposing financing deficits into its respective components to examine their behaviour in a regression against debt and equity financing during spikes.

$$LTD_{it} = a + \beta_1 I_{it} + \beta_2 WC_{it} + \beta_3 Dv_{it} + \beta_4 CF_{it} + e_{it} \quad (7)$$

Furthermore, following Mayer and Sussman (2004), we include a regression equation for equity as follows:

$$EQ_{it} = a + \beta_1 I_{it} + \beta_2 WC_{it} + \beta_3 Dv_{it} + \beta_4 CF_{it} + e_{it} \quad (8)$$

Where WC = Change-in-Working-Capital. DV = *Dividends*. CF = *Internal-Cash-Flow*.

We repeat the above analysis for small and large firms respectively. Firms are sorted by their total assets. We classify the first quartile as small firms and the last quartile as large firms. Total assets are deflated to 2014 Pound Sterling using the CPI.

It must be noted that a limitation of this approach is the possible existence of endogeneity as the debt financing is likely to be influenced by level of equity financing and vice versa.

2.4. EMPIRICAL RESULTS

2.4.1 DESCRIPTIVE STATISTICS

Table 2.1a presents descriptive statistics of the whole sample while Table 2.1b presents descriptive statistics for small and large firms separately. Investment spikes occur in 18% of firm-years while the remaining 82% of firm-years are off spike periods. As expected, firms experience the greatest degree of funding gaps during spike periods. The average investment ratios (to total assets) are 12% during the spike period and 4% during the off-spike period (5% for all years). These disparities coincide with differences in financing deficit for the different

periods pointing to a higher need for external financing during spike periods. Financing Deficit is only 3% off spike but increases to 10% during spike periods (5% for all years). Furthermore, Change-in-Long-Term-Debt finance is on the average 0% for all periods. On the other hand, Net-Equity-Finance during spike is on the average substantially higher at 14% of total assets relative to 8% off spike (9% for all years). As seen in Appendix Table 2.10.A2, the relatively higher correlation between Financing Deficit and Net-Equity-Financing (0.52) compared with between Financing Deficit and Change-in-Long-Term-Debt (0.10) is noteworthy. Change-in-Working-Capital is on the average -0.01% during spikes compared with 0.02% off spike (0.01% for all years). Average Internal-Cash-Flow during spikes is 1% of total assets. Off-spike it is much higher at 3% (3% for all years). However, Dividends are on the average relatively unchanged at 0.01% of the total asset for all periods implying a stable dividend policy and should normally imply a greater need for financing during spikes given the higher investments. These figures underscore the uniqueness of periods of spikes and further justify a closer examination.

2.4.2 ANALYSIS OF REGRESSION ESTIMATES

2.4.2.1 Internal versus External Financing

Following Frank and Goyal (2003), we carry out a regression of debt financing against the Financing Deficit and subsequently on individual components of the financing deficit. Furthermore, we follow Mayer and Sussman (2004) to conduct a separate regression for equity financing. We present the regression results below. Tables 2.2 shows general relations of the Financing Deficit with debt and equity financing and Table 2.3, in a more granular way, reveals the extent to which firms prefer internal to external funds.

In Table 2.2, the Financing Deficit coefficient on the debt regression is a mere 0.04, very far from the predicted 1 if the pecking order theory were a perfect predictor of firm behaviour under this circumstance. We notice though that this coefficient is higher than that of other

periods, i.e. 0.026 for the off-spike periods and 0.035 for all periods. More interesting is the coefficient of Financing Deficit under the equity financing regression. Under the pecking order theory, the financing deficit should generally have no significant impact on equity financing. This appears not to be the case. We find that equity financing is significantly and economically more related to a firm's financing deficit than debt financing. Our results do not conform to the implication of the pecking order theory that equity plays no significant role in firms' financing, especially during investment spikes. Further, we carry out our analysis with the decomposition method of financing deficit proposed by Frank and Goyal (2003). This is to examine the impact of changes in each of the components of the financing deficit on debt and equity financing, especially during investment spikes. Results ate presented in Table 2.3.

Like the cumulative Financing Deficit, the individual components of financing deficit should have a coefficient of 1 (see equation (3)). However, the coefficients are not close to 1 during spike-years. A one unit change in investment leads to a 0.19 unit increase in debt financing. The coefficient of Investment in the debt financing regression is also slightly higher than that of other periods (0.12 and 0.18 for off spike and all years respectively). The result on Change-in-Working-Capital is in line with the predicted sign and is significantly lower than a unit at 0.03. The coefficients of Change-in-Working-Capital are largely the same as those of other periods. Results for Dividends and Internal-Cash-Flow are not significant during investment spikes. Dividends appear to have the opposite sign to that implied by the pecking order theory during spike-years while we observe the predicted positive and significant relationship for other periods. The pecking order theory implies that changes in components of the financing deficit should be expected to have little or no effect on equity financing. This, however, appears not to be the case, especially during spike-years. For each of the variables and all periods, we observe that the individual components of the financing deficit have significant relationships with equity financing. These relationships are relatively stronger than that of debt financing

and relatively closer to unity. It will, therefore, appear that, as suggested by Frank and Goyal (2003), equity financing follows the financing deficit closer than debt financing.

2.4.2.2 Debt versus Equity Financing

Pecking order theory holds that equity is rarely used and is only employed as a last resort, thus in general, firms prefer debt financing to equity financing. The earlier regression estimates indicate at least some levels of relationship between financing deficit and equity. We notice that the coefficient of Financing Deficit under the equity finance regression is overall stronger than estimates of the debt finance regression, especially during spikes.

Therefore, to determine the preference between debt and equity financing during spikes, we employ a probit model as per Brav (2009). The basic regression equations are as follows:

$$D_{it} = a + \beta_1 FD_{it} + e_{it} \quad (9)$$

$$E_{it} = a + \beta_1 FD_{it} + e_{it} \quad (10)$$

Where D is the probability of employing debt financing, taking the value of 1 if Change-in–Long-Term-Debt > 0 and 0 otherwise. E is the probability of employing equity financing, taking the value of 1 if Net-Equity-Finance > 0 and 0 otherwise. We present the regression estimates in Table 2.4.

The regression estimates suggest a preference of equity financing over debt financing during spikes and at all other periods. This implies that an increase in financing deficit leads to a greater increase in the probability of employing equity financing than debt financing. This is contrary to the implications of the pecking order theory and in line with results obtained by Frank and Goyal (2003) and Dudley (2012). In particular, Dudley (2012) suggests that firms prefer equity to debt during investment spikes to minimise potential bankruptcy costs that could arise if debt is issued before the investment begins to yield returns. According to him, debt is subsequently procured to take advantage of tax benefits when the projects begin to yield

returns. This is however contrary to results obtained by Mayer and Sussman (2004). Thus, our results suggest that equity financing plays a more important role than that implied by the pecking order theory, especially during spike periods.

2.4.2.3 Small versus Large Firms

2.4.2.3.1 Internal versus External Funds

According to Frank and Goyal (2003), small firms generally do not follow the pecking order theory despite having, arguably, a relatively higher level of information asymmetry. We re-examine the implications of the pecking order theory based on small firms and large firms respectively for spikes, off spikes and all periods. Small and large firms are the respective first and last quartiles of the sample sorted by total assets. Tables 2.5 shows general relations of the financing deficit with debt and equity financing and Tables 2.6 in a more granular way, reveals the extent to which firms prefer internal to external funds.

In Table 2.5, our results indicate the opposite of what is inferred by the pecking order theory and are even more amplified than results of all firms as shown in Table 2.2. For small firms, Debt financing is less responsive to the financing deficit than results obtained for all sizes of firms. The coefficient of Financing Deficit in the debt financing regression is a mere 0.03. We also notice that it is not significant and zero off spikes, while it is a mere 0.01 for all firm-years. Frank and Goyal (2003) suggest that small and possibly high growth firms have greater information asymmetry and thus follow the pecking order theory. However, this appears not to be the case even during investment spikes when the financing deficit is the highest. Equity financing responds to the financing deficit contrary to what is suggested by the pecking order theory.

Large firms are remarkably different in that the sensitivity of debt financing to Financing Deficit is much higher than that of other firms with a coefficient of 0.43 during spikes. More

importantly, the results show some difference in the magnitude of coefficients between the spike and off spike periods (0.23 and 0.28 for off spike and all years respectively). The degree is still very much lower than unity even during investment spikes. Equity financing is relatively less sensitive to the financing deficit than debt financing 0.22 during spikes (0.07 and 0.10 for off spike and all years respectively). It will, therefore, appear that, on a relative basis, the pecking order theory is more applicable to large firms experiencing investment spikes.

Table 2.6 examines the components of financing deficit on external financing. For small firms, the coefficients of the individual components of the financing deficit seem to be very far from unity implied by the pecking order theory. This is remarkable as small firms with relatively higher growth rates and information asymmetry should be expected to follow the pecking order theory the closest, especially during investment spikes. The results are however further from a unit in all cases than for all firms. Dividends, though not significant even has the opposite sign than that inferred by the pecking order theory. More than for all firms, the components of financing deficit should have had even less effect on equity financing where we have small firms experiencing investment spikes. This, however, appears not to be the case. We find that the components of financing deficit, for small firms, influence change in equity financing at a higher rate than that of all other sizes of firms contrary to what is implied by the pecking order theory.

On a relative basis, large firms experiencing investment spikes follow the pecking order theory closer, relative to all other firms and other periods. Large firms' financing deficit is highly related to debt financing than equity financing compared to small firms and all firms during spikes. Equity financing is also relatively less affected by changes in the financing deficit components as suggested by the pecking order theory.

2.4.2.3.2 Debt versus Equity Financing

The earlier analysis has pointed to the preference of equity over debt during periods of investment spikes contrary to the implications of the pecking order theory. We repeat the analysis for small and large firms separately using the same probit model as in equation 9 above. Table 2.7 presents relevant results.

For small firms, we see limited support for the implication of the pecking order theory that firms prefer debt to equity. The results indicate that increases in the financing deficit have a relatively higher probability of leading to increases in equity financing than debt financing. The coefficient of debt financing is not statistically significant during spikes. We notice as well that this applies to other periods as well when small firms are involved. This result supports the suggestions of Frank and Goyal (2003) that small firms prefer equity to debt financing. The results also suggest that this is the case during investment spikes when financing deficits are the highest. The higher risk of default for small firms can explain this. Banks would, therefore, have greater repayment concerns with small firms and are less inclined to extend facilities to them. Small firms focus, therefore, on equity financing as the primary source of their funding in spike-years.

Next, we examine the behaviour of large firms. For large firms, we notice the opposite result than that obtained for small firms. During spikes, and for all other periods for that matter, results indicate a preference of debt financing over equity financing. We can explain this finding by the fact that large firms find it easier to borrow based on their more substantial assets and stronger credit histories.

2.4.2.4 Crisis versus Non-crisis Periods

The coincidence of financial crisis and investment spikes indicates that relatively higher levels of financing deficit coincide with relatively higher levels of uncertainty. We, therefore, examine financing preferences of small and large firms and compare crisis and non-crisis periods. Tables 2.8 shows general relations of the financing deficit with debt and equity financing when there is a coincidence of investment spikes and financial crisis. Like Abreu and Gulamhussen (2013), Sun et al., 2016, Kuppuswamy and Villalonga (2016), and Chen, Chou, and Lu (2018), we define crisis periods as years 2007 to 2009. We also include years 2001 to 2002 to capture the financial crisis coinciding with that period. We define all other years within the sample period as non-crisis periods.

In Table 2.8, we find that for both crisis and non-crisis periods, equity is still more responsive to Financing Deficit than debt financing for small firms. However, the magnitude of the coefficient of equity financing is much smaller during the crisis than non-crisis periods (0.23 and 0.40 respectively). Conversely, for debt financing, the magnitude of the coefficient is much larger during the crisis than non-crisis periods (0.06 and 0.03 respectively). On the other hand, for large firms, debt is generally more responsive to changes in the Financing Deficit. However, the responsiveness of equity financing to changes in the Financing Deficit is similar during crisis and non-crisis periods (0.24 and 0.26 respectively). There is, however, a considerable contrast between coefficients of debt financing during crisis and non-crisis periods (0.79 and 0.28 respectively). This finding is in line with Doshi, Kumar and Yerramilli (2017) who, in a different context, show that uncertainty has a differing influence on firms' financing and investment decisions, depending on their size. Thus, it would appear that the most significant support for the pecking order theory lies with large firms when there is a coincidence of investment spikes (signifying a relatively higher level of financing deficit) and financial crisis. As implied by the pecking order theory, with higher levels of information asymmetry and uncertainty during the financial crisis, only firms perceived as stronger, large firms, appear to

specialise in debt financing. Figure 2.1 reveals trends in debt and equity financing as well as financing deficit for small and large UK firms while Figure 2.2 shows trends in investment spikes with a difference in pattern for large and small firms thus underscoring the need for further analysis.

2.4.2.5 Listing Duration and Growth

To investigate whether small firms enter the stock market to open a new access route for equity funding we investigate the time since IPO (see Table 2.1b). We can think of a shorter time since the IPO as a proxy for the event that the firm is opening a new access route for equity funding. We find evidence of modest differences in listing duration and growth of small and large firms. The average time since IPO for small firms is around 4 years. In contrast, the average time since IPO for large firms is 5.8 years. If we measure the time since IPO for spike-years, however (the years in which the new access route would be the most useful), we find that the average time since IPO for small years is 3.3 years and the average time since IPO for large firms is 3.5. Both small and large firms have, therefore, been listed for roughly the same amount of time when they seek funding for large investments. It is hard, therefore, to attribute the firm size effect to listing duration.

Another possibility is that smaller firms have higher growth rates than the larger ones, which makes it more likely that the firms could seek equity funding for positive net present value investments. Even if there is an information asymmetry between the firm and the investors, therefore, the net present value effect will dominate the potential issuance costs. For the larger firms, an equity issue may be signal of overvaluation that leads to negative issuance costs, which may dominate the net present value effect (see Myers and Majluf, 1984). Measuring growth rates by the growth in turnover, we find that small firms have an average growth of 1.3 times previous turnover whereas large firms have an average growth of 1.1 times, a difference that is statistically significant. Taking growth rates over spike-years only, we find a slightly

more significant difference, with small firms experiencing an average growth of 1.6 times and large firms 1.3 times.

2.5. CONCLUSION

This paper examines the funding patterns of publicly listed UK firms during investments spikes from 1996 to 2017. The study investigates the specific implications of the pecking order theory against the background of different sizes of investments and firms. The particular focus on investment spikes is due to the existence of relatively higher levels of financing deficit during these periods. The examination of crisis and non-crisis periods also leads to an investigation of the coincidence of higher financing deficits and general market uncertainty. These scenarios present some ground for extending existing studies on the pecking order theory.

Specifically, this study examines two implications of the pecking order theory. The first test is on the choice between internal funds and external funds during investment spikes. The second implication examined is that the firms prefer debt to equity during investment spikes. We find that, compared to debt financing, equity financing is relatively more sensitive to financing deficits based on our full sample. When it comes to the components of financing deficits, we find that investments are the predominant determinant for seeking external funds. In numbers, one-pound increase in investments requires 49 pence raised from equity issues, which is higher than the requirement of 18 pence from debt issues. On the implication that firms prefer debt to equity, our results, based on the probit model, suggest otherwise. This is particularly the case for the whole sample and small firms considered separately. Large firms, however, exhibit a preference for debt over equity financing.

We further examine whether the size effect matters on the funding patterns. Our main finding is that both size of firm and investment are important in explaining differences in funding patterns of firms though size of the firm dominates. Our empirical evidence shows that small firms prefer issuing equity to debt to address financing deficits even during times of large

investments. These findings are in contrast to the pecking order theory. Large firms, on their part, issue more debt than equity when there are financing deficits linked to huge investments. We can explain this result by the risk of default and repayment concerns by banks. Large firms have more capital to address potential investment opportunities. It is, therefore, more likely that banks will lend money to large firms than small firms. Furthermore, while small firms use about the same amount of external capital to fund large and regular investments, large firms use relatively more external capital to fund large investments than small investments. This state of affairs is due to small firms' higher growth levels and less tangible assets making debt less attractive.

Table 2.1a Descriptive Statistics for publicly listed UK Firms 1996-2014

Computations are based on nonfinancial firms in Standard and Poor's Compustat database. Sample period is 1996-2014. 1995 figures were used in estimating Change in Long Term Debt Financing for 1996. Size (£ Million) has been adjusted to constant 2014 Pounds using the CPI. CPI figures were obtained from Datastream. Investment Spikes are defined as investments greater than 2 times the median investment rate for each firm.

Variable	Period	N	Mean	P50	Std.Dev	Skewness	Kurtosis
Debt Financing	Spike	3688	0.00	0.00	0.11	0.06	9.14
	Off Spike	16427	0.00	0.00	0.10	-0.35	12.20
	All Years	20115	0.00	0.00	0.10	-0.22	11.42
Equity Financing	Spike	3688	0.14	0.00	0.30	2.91	12.19
	Off Spike	16427	0.08	0.00	0.23	3.83	19.26
	All Years	20115	0.09	0.00	0.25	3.61	17.47
Financing Deficit	Spike	3688	0.10	0.07	0.38	-0.22	14.78
	Off Spike	16427	0.03	0.00	0.29	0.84	20.28
	All Years	20115	0.05	0.02	0.31	0.60	18.74
Investment	Spike	3688	0.12	0.10	0.15	0.27	6.22
	Off Spike	16427	0.04	0.03	0.08	0.08	16.80
	All Years	20115	0.05	0.03	0.10	0.68	11.88
Change in Working Capital	Spike	3688	-0.01	0.01	0.27	-1.97	14.70
	Off Spike	16427	0.02	0.02	0.21	-1.62	18.19
	All Years	20115	0.01	0.02	0.22	-1.78	17.73
Internal Cash Flow	Spike	3688	0.01	0.05	0.34	-3.90	46.02
	Off Spike	16427	0.03	0.05	0.26	-6.04	88.27
	All Years	20115	0.03	0.05	0.28	-5.46	75.94
Dividends	Spike	3688	0.01	0.00	0.02	4.54	32.32
	Off Spike	16427	0.01	0.00	0.02	4.20	26.21
	All Years	20115	0.01	0.00	0.02	4.26	27.19
Size (£ Millions)	Spike	3688	323.98	31.92	1239.63	8.19	89.98
	Off Spike	16427	677.79	62.63	2032.16	5.12	34.10
	All Years	20115	612.92	55.13	1916.49	5.45	38.54

Table 2.2b Descriptive Statistics for Small and Large Publicly listed UK Firms 1996-2014

Computations are based on nonfinancial firms in Standard and Poor's Compustat database. Sample period is 1996-2014. 1995 figures were used in estimating Change in Long Term Debt Financing for 1996. Size (£ Million) has been adjusted to constant 2014 Pounds using the CPI. CPI figures were obtained from Datastream. Investment Spikes are defined as investments greater than 2 times the median investment rate for each firm.

		Small Firms						Large Firms						
Variable	**Period**	**N**	**Mean**	**P50**	**Std.Dev**	**Skew.**	**Kurt.**	**N**	**Mean**	**P50**	**Std.Dev**	**Skew.**	**Kurt.**	**Diff**
Debt Financing	Spike	1153	0.01	0.00	0.12	0.06	10.69	638	0.05	0.02	0.12	-0.14	5.98	-0.04***
	Off Spike	3670	0.00	0.00	0.10	-0.17	13.50	4662	0.00	0.00	0.10	-0.31	9.03	-0.01**
	All Years	4823	0.00	0.00	0.11	-0.09	12.70	5300	0.01	0.00	0.10	-0.20	8.36	-0.01***
Equity Financing	Spike	1153	0.29	0.04	0.43	1.69	5.11	638	0.04	0.00	0.10	4.81	36.53	0.25***
	Off Spike	3670	0.22	0.00	0.38	1.98	6.25	4662	0.01	0.00	0.07	7.93	93.33	0.20***
	All Years	4823	0.23	0.00	0.40	1.91	5.96	5300	0.02	0.00	0.07	7.23	78.18	0.22***
Financing Deficit	Spike	1153	0.15	0.10	0.60	-0.29	7.33	638	0.08	0.07	0.15	0.13	8.68	0.07***
	Off Spike	3670	0.11	0.03	0.51	0.34	8.01	4662	0.00	0.00	0.11	-1.72	27.33	0.11***
	All Years	4662	0.12	0.04	0.53	0.14	7.87	5300	0.01	0.00	0.12	-1.03	21.61	0.11***
Investment	Spike	1153	0.11	0.08	0.18	0.24	5.01	638	0.13	0.11	0.13	-0.08	7.26	-0.02**
	Off Spike	3670	0.02	0.01	0.11	0.10	12.66	4662	0.05	0.04	0.06	-0.38	18.74	-0.02***
	All Years	4823	0.04	0.02	0.14	0.52	8.83	5300	0.06	0.04	0.08	0.48	14.48	-0.01***
Change in Working Capital	Spike	1153	-0.05	0.00	0.41	-1.36	7.17	638	0.02	0.02	0.10	-1.84	30.58	-0.07***
	Off Spike	3670	0.00	0.01	0.37	-1.17	7.30	4662	0.02	0.01	0.08	-0.02	15.98	-0.02***
	All Years	4823	-0.01	0.01	0.38	-1.23	7.34	5300	0.02	0.01	0.08	-0.46	21.09	-0.03***

Variable	Period	N	Mean	P50	Std.Dev	Skew.	Kurt.	N	Mean	P50	Std.Dev	Skew.	Kurt.	Diff
Internal Cash Flow	Spike	1153	-0.10	0.02	0.55	-2.25	17.98	638	0.09	0.08	0.08	3.87	46.08	-0.19***
	Off Spike	3670	-0.09	0.02	0.50	-3.43	27.59	4662	0.08	0.06	0.08	4.39	68.14	-0.18***
	All Years	4823	-0.10	0.02	0.51	-3.09	24.69	5300	0.08	0.07	0.08	4.33	65.98	-0.18***
Dividends	Spike	1153	0.00	0.00	0.01	9.81	130.84	638	0.02	0.01	0.02	3.04	15.97	-0.01***
	Off Spike	3670	0.00	0.00	0.02	6.75	59.18	4662	0.01	0.00	0.02	3.12	16.50	-0.01***
	All Years	4823	0.00	0.00	0.01	7.27	69.40	5300	0.01	0.00	0.02	3.11	16.41	-0.01***
Size (£ Millions)	Spike	1153	5.16	4.58	3.45	0.45	2.06	638	1669.22	713.20	2586.62	3.52	18.48	-1664.05***
	Off Spike	3670	5.53	5.09	3.51	0.29	1.94	4662	2258.36	830.76	3325.30	2.60	10.41	-2252.83***
	All Years	4823	5.44	4.96	3.50	0.33	1.96	5300	2187.44	813.00	3250.74	2.69	11.01	-2182.00***
Tangibility	Spike	1153	0.17	0.09	0.20	1.75	5.67	638	0.25	0.15	0.25	1.25	3.58	-0.08***
	Off Spike	3670	0.13	0.06	0.18	2.17	7.69	4662	0.32	0.26	0.25	0.82	2.71	-0.19***
	All Years	4823	0.14	0.06	0.19	2.05	7.07	5300	0.31	0.25	0.26	0.87	2.77	-0.17***
Growth	Spike	822	1.56	1.13	1.64	4.09	26.43	605	1.26	1.13	1.00	11.36	165.95	0.30***
	Off Spike	2892	1.23	1.04	1.09	5.26	47.19	4325	1.10	1.05	0.36	9.16	148.09	0.14***
	All Years	3714	1.31	1.06	1.24	5.00	40.90	4930	1.12	1.06	0.49	15.45	404.93	0.19***
Years since IPO	Spike	328	3.29	3.00	3.90	0.63	3.75	70	3.50	3.00	6.13	-0.22	2.76	-0.21
	Off Spike	904	4.28	4.00	4.26	0.32	2.93	378	6.19	5.00	6.18	0.75	3.63	-1.91***
	All Years	1232	4.02	4.00	4.19	0.41	3.08	448	5.77	5.00	6.24	0.58	3.69	-1.75***

***, **, * represent significant at 1%, 5% and 10% respectively

Table 2.3 Debt and Equity Financing Regression Estimates for publicly listed UK firms 1996-2014

The basic regression equations are $LTD_{it} = \alpha + \beta FD_{it} + e$ for debt financing and $EQ_{it} = \alpha + \beta FD_{it} + e$ for equity financing. Investment Spikes are defined as investments greater than 2 times the median investment rate for each firm. *LTD,* change in long term debt, is defined as the ratio of change in total long-term debt to total assets. *EQ,* Net Equity Finance, is the difference between sale and purchase of equity. *FD,* Financing deficit = Investments + Change in working capital + Dividend - Internal Cash Flow. Investment = (Capital Expenditures + Increase in Investments + Acquisitions – sale of tangible fixed assets – sale of Investments – short term investments (increase) decrease – Investing Activities Other) / Total Assets. Change in working capital = (Cash and cash equivalents increase (decrease) - Accounts receivable decrease (increase) - Inventory decrease (increase) - Accounts payable and accrued liabilities increase (decrease) - Assets and Liabilities other net change - Financing activities other - current debt changes) / Total Assets. Dividends = Cash Dividends (Cash flow) / Total Assets. Internal Cash flow = (Income before extraordinary items (cash flow) + Extraordinary items and discontinued operations (cash flow) + Depreciation and amortization (cash flow) + Deferred taxes) cash flow) + Equity in Earnings after tax + Sale of property, plant and investments Gain (loss) + Funds from operations (other) + Exchange rate effect) / Total assets. Computations are based on nonfinancial firms in Standard and Poor's Compustat database. Sample period is 1996-2014. 1995 figures were used in estimating Change in Long Term Debt Financing. Size (£ Million) adjusted to constant 2014 Pounds using the CPI obtained from DataStream. Financial firms and utilities are excluded. Regressions are estimated with firm fixed effects. Standard errors are clustered by firm. Robust standard errors are in parenthesis.

	Debt Financing			**Equity Financing**		
	Spike	**Off Spike**	**All Years**	**Spike**	**Off Spike**	**All Years**
Financing Deficit	0.040***	0.026***	0.035***	0.320***	0.330***	0.321***
	(0.009)	(0.006)	(0.005)	(0.034)	(0.016)	(0.015)
Constant	0.001	0.011***	0.011***	0.145***	0.078***	0.091***
	(0.011)	(0.004)	(0.005)	(0.024)	(0.005)	(0.005)
R2	0.031	0.012	0.017	0.229	0.224	0.218
No. of Observations	3688	16427	20115	3688	16427	20115
No. Of Firms	1399	1888	1888	1399	1888	1888
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
SE Clustered by Firm	Yes	Yes	Yes	Yes	Yes	Yes

***, **, * represent significant at 1%, 5% and 10% respectively (robust standard errors in bracket)

Table 2.4 Debt and Equity Financing Regression against individual components of financing deficit for publicly listed UK firms 1996-2014

The basic regression equations are $LTD_{it} = \alpha + \beta_1 I_{it} + \beta_2 \Delta WC_{it} + \beta_3 D_{it} - \beta_4 CF_{it} + e$ for debt financing and $EQ_{it} = \alpha + \beta_1 I_{it} + \beta_2 \Delta WC_{it} + \beta_3 D_{it} - \beta_4 CF_{it} + e$ for equity financing. Investment Spike is defined as investments greater than 2 times the median investment rate for each firm. *LTD,* change in long term debt, is defined as the ratio of change in total long-term debt to total assets. *EQ*, Net Equity Finance, is the difference between sale and purchase of equity. *FD,* Financing deficit = Investments + Change in working capital + Dividend - Internal Cash Flow. Investment = (Capital Expenditures + Increase in Investments + Acquisitions – sale of tangible fixed assets – sale of Investments – short term investments (increase) decrease – Investing Activities Other) / Total Assets. Change in working capital = (Cash and cash equivalents increase (decrease) - Accounts receivable decrease (increase) - Inventory decrease (increase) - Accounts payable and accrued liabilities increase (decrease) - Assets and Liabilities other net change - Financing activities other - current debt changes) / Total Assets. Dividends = Cash Dividends (Cash flow) / Total Assets. Internal Cash flow = (Income before extraordinary items (cash flow) + Extraordinary items and discontinued operations (cash flow) + Depreciation and amortization (cash flow) + Deferred taxes) cash flow) + Equity in Earnings after tax + Sale of property, plant and investments Gain (loss) + Funds from operations (other) + Exchange rate effect) / Total assets. Computations are based on nonfinancial firms in Standard and Poor's Compustat database. Sample period is 1996-2014. 1995 figures were used in estimating Change in Long Term Debt Financing. Size (£ Million) adjusted to constant 2014 Pounds using the CPI obtained from DataStream. Financial firms and utilities are excluded. Regressions are estimated with firm fixed effects. Standard errors are clustered by firm. Robust standard errors are in parenthesis.

	Debt Financing			**Equity Financing**		
	Spike	**Off Spike**	**All Years**	**Spike**	**Off Spike**	**All Years**
Investment	0.189***	0.117***	0.178***	0.619***	0.488***	0.485***
	(0.026)	(0.017)	(0.013)	(0.058)	(0.035)	(0.025)
Change in Working Capital	0.031***	0.028***	0.031***	0.396***	0.378***	0.381***
	(0.012)	(0.007)	(0.006)	(0.034)	(0.020)	(0.017)
Dividends	-0.199	0.280***	0.219***	1.003***	0.944***	0.971***
	(0.169)	(0.064)	(0.060)	(0.375)	(0.090)	(0.093)
Internal Cash Flow	-0.019	-0.007	-0.011	-0.181***	-0.202***	-0.194***
	(0.012)	(0.009)	(0.007)	(0.048)	(0.023)	(0.021)
Constant	-0.020*	0.006**	-0.001	0.107***	0.068***	0.077***
	(0.011)	(0.004)	(0.003)	(0.023)	(0.005)	(0.005)
R2	0.068	0.019	0.039	0.276	0.230	0.236
No. of Observations	3688	16427	20115	3688	16427	20115
No. Of Firms	1399	1888	1888	1399	1888	1888
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
SE Clustered by Firm	Yes	Yes	Yes	Yes	Yes	Yes

***, **, * represent significant at 1%, 5% and 10% respectively (robust standard errors in bracket)

Table 2.5 Probit Regression of Debt and Equity Financing for publicly listed UK firms 1996-2014

The basic regression equations are $D_{it} = \alpha + \beta FD_{it} + e$ for debt financing and $E_{it} = \alpha + \beta FD_{it} + e$ for equity financing. Investment Spike is defined as investments greater than 2 times the median investment rate for each firm. D, *is the probability of employing debt financing*, it takes the value of 1 if Change in long term debt > 0 and 0 otherwise. *E, is the probability of employing equity financing*, it takes the value of 1 if Net Equity Finance > 0 and 0 otherwise. *FD,* Financing deficit = Investments + Change in working capital + Dividend - Internal Cash Flow. Investment = (Capital Expenditures + Increase in Investments + Acquisitions – sale of tangible fixed assets – sale of Investments – short term investments (increase) decrease – Investing Activities Other) / Total Assets. Change in working capital = (Cash and cash equivalents increase (decrease) - Accounts receivable decrease (increase) - Inventory decrease (increase) - Accounts payable and accrued liabilities increase (decrease) - Assets and Liabilities other net change - Financing activities other - current debt changes) / Total Assets. Dividends = Cash Dividends (Cash flow) / Total Assets. Internal Cash flow = (Income before extraordinary items (cash flow) + Extraordinary items and discontinued operations (cash flow) + Depreciation and amortization (cash flow) + Deferred taxes) cash flow) + Equity in Earnings after tax + Sale of property, plant and investments Gain (loss) + Funds from operations (other) + Exchange rate effect) / Total assets. Computations are based on nonfinancial firms in Standard and Poor's Compustat database. Sample period is 1996-2014. 1995 figures were used in estimating Change in Long Term Debt Financing. Size (£ Million) adjusted to constant 2014 Pounds using the CPI obtained from DataStream. Financial firms and utilities are excluded. Regressions are estimated with firm fixed effects. Standard errors are clustered by firm. Robust standard errors are in parenthesis.

	Debt Financing			**Equity Financing**		
	Spike	**Off Spike**	**All Years**	**Spike**	**Off Spike**	**All Years**
Financing Deficit	0.232***	0.231***	0.304***	0.883***	1.017***	0.955***
	(0.073)	(0.046)	(0.043)	(0.108)	(0.065)	(0.060)
Constant	-0.525***	-0.419***	0.419***	0.592***	0.500***	0.551***
	(0.206)	(0.063)	(0.058)	(0.176)	(0.760)	(0.070)
No. of Observations	3688	16427	20115	3688	16427	20115
No. Of Firms	1399	1888	1888	1399	1888	1888
SE Clustered by Firm	Yes	Yes	Yes	Yes	Yes	Yes

***, **, * represent significant at 1%, 5% and 10% respectively (robust standard errors in bracket)

Table 2.6 Debt and Equity Financing Regression Estimates for Small and Large publicly listed UK firms 1996-2014

The basic regression equations are $LTD_{it} = \alpha + \beta FD_{it} + e$ for debt financing and $EQ_{it} = \alpha + \beta FD_{it} + e$ for equity financing. Investment Spikes are defined as investments greater than 2 times the median investment rate for each firm. *LTD*, change in long term debt, is defined as the ratio of change in total long-term debt to total assets. *EQ*, Net Equity Finance, is the difference between sale and purchase of equity. *FD*, Financing deficit = Investments + Change in working capital + Dividend - Internal Cash Flow. Investment = (Capital Expenditures + Increase in Investments + Acquisitions – sale of tangible fixed assets – sale of Investments – short term investments (increase) decrease – Investing Activities Other) / Total Assets. Change in working capital = (Cash and cash equivalents increase (decrease) - Accounts receivable decrease (increase) - Inventory decrease (increase) - Accounts payable and accrued liabilities increase (decrease) - Assets and Liabilities other net change - Financing activities other - current debt changes) / Total Assets. Dividends = Cash Dividends (Cash flow) / Total Assets. Internal Cash flow = (Income before extraordinary items (cash flow) + Extraordinary items and discontinued operations (cash flow) + Depreciation and amortization (cash flow) + Deferred taxes) cash flow) + Equity in Earnings after tax + Sale of property, plant and investments Gain (loss) + Funds from operations (other) + Exchange rate effect) / Total assets. Computations are based on nonfinancial firms in Standard and Poor's Compustat database. Sample period is 1996-2014. 1995 figures were used in estimating Change in Long Term Debt Financing. Small firms are those with Total Assets (deflated by CPI) less than the 25th percentile of the distribution. Size (£ Million) adjusted to constant 2014 pounds using the CPI obtained from DataStream. Financial firms and utilities are excluded. Regressions are estimated with firm fixed effects. Standard errors are clustered by firm. Robust standard errors are in parenthesis.

	Small Firms						**Large Firms**					
	Debt Financing			**Equity Financing**			**Debt Financing**			**Equity Financing**		
	Spike	**Off Spike**	**All Years**	**Spike**	**Off Spike**	**All Years**	**Spike**	**Off Spike**	**All Years**	**Spike**	**Off Spike**	**All Years**
Financing Deficit	0.025**	0.000	0.012*	0.361***	0.375***	0.357***	0.425***	0.230***	0.280***	0.224***	0.072***	0.101***
	(0.012)	(0.009)	(0.006)	(0.045)	(0.022)	(0.020)	(0.091)	(0.032)	(0.030)	(0.044)	(0.019)	(0.016)
Constant	-0.023	-0.008	-0.018**	0.241***	0.149***	0.193***	-0.035	0.013	0.011	0.037**	0.023***	0.025***
	(0.029)	(0.007)	(0.006)	(0.090)	(0.040)	(0.030)	(0.031)	(0.006)	(0.006)	(0.019)	(0.004)	(0.004)
R2	0.038	0.005	0.007	0.316	0.294	0.275	0.231	0.08	0.109	0.169	0.034	0.047
No. of Observations	1116	3510	4626	1116	3510	4626	607	4483	5090	607	4483	5090
No. Of Firms	500	732	763	500	732	763	280	547	566	280	547	566
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SE Clustered by Firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

***, **, * represent significant at 1%, 5% and 10% respectively (robust standard errors in bracket)

Table 2.7 Debt and Equity Financing Regression against individual components of financing deficit for Small and Large publicly listed UK firms 1996-2014

The basic regression equations are $LTD_{it} = \alpha + \beta_1 I_{it} + \beta_2 \Delta WC_{it} + \beta_3 D_{it} - \beta_4 CF_{it} + e$ for debt financing and $EQ_{it} = \alpha + \beta_1 I_{it} + \beta_2 \Delta WC_{it} + \beta_3 D_{it} - \beta_4 CF_{it} + e$ for equity financing. Investment Spikes are defined as investments greater than 2 times the median investment rate for each firm. *LTD*, change in long term debt, is defined as the ratio of change in total long-term debt to total assets. *EQ*, Net Equity Finance, is the difference between sale and purchase of equity. *FD*, Financing deficit = Investments + Change in working capital + Dividend - Internal Cash Flow. Investment = (Capital Expenditures + Increase in Investments + Acquisitions – sale of tangible fixed assets – sale of Investments – short term investments (increase) decrease – Investing Activities Other) / Total Assets. Change in working capital = (Cash and cash equivalents increase (decrease) - Accounts receivable decrease (increase) - Inventory decrease (increase) - Accounts payable and accrued liabilities increase (decrease) - Assets and Liabilities other net change - Financing activities other - current debt changes) / Total Assets. Dividends = Cash Dividends (Cash flow) / Total Assets. Internal Cash flow = (Income before extraordinary items (cash flow) + Extraordinary items and discontinued operations (cash flow) + Depreciation and amortization (cash flow) + Deferred taxes) cash flow) + Equity in Earnings after tax + Sale of property, plant and investments Gain (loss) + Funds from operations (other) + Exchange rate effect) / Total assets. Computations are based on nonfinancial firms in Standard and Poor's Compustat database. Sample period is 1996-2014. 1995 figures were used in estimating Change in Long Term Debt Financing. Small firms are those with Total Assets (deflated by CPI) less than the 25th percentile of the distribution. Size (£ Million) adjusted to constant 2014 Pounds using the CPI obtained from DataStream. Financial firms and utilities are excluded. Regressions are estimated with firm fixed effects. Standard errors are clustered by firm. Robust standard errors are in parenthesis.

	Small Firms						**Large Firms**					
	Debt Financing			**Equity Financing**			**Debt Financing**			**Equity Financing**		
	Spike	**Off Spike**	**All Years**	**Spike**	**Off Spike**	**All Years**	**Spike**	**Off Spike**	**All Years**	**Spike**	**Off Spike**	**All Years**
Investment	0.114***	0.024	0.073***	0.751***	0.659***	0.640***	0.558***	0.448***	0.508***	0.161***	0.060**	0.113***
	(0.039)	(0.025)	(0.020)	(0.101)	(0.061)	(0.047)	(0.081)	(0.049)	(0.033)	(0.054)	(0.030)	(0.021)
Change in Working Capital	0.029*	0.008	0.018**	0.420***	0.410***	0.400***	0.008	0.201***	0.168***	0.149	0.071**	0.093***
	(0.016)	(0.010)	(0.008)	(0.045)	(0.028)	(0.023)	(0.097)	(0.034)	(0.032)	(0.094)	(0.030)	(0.030)
Dividends	-0.226	-0.078	-0.129	0.913	1.069***	1.116***	0.275	0.770***	0.703***	0.213	0.028	-0.001
	(0.203)	(0.183)	(0.193)	(0.635)	(0.281)	(0.266)	(0.544)	(0.118)	(0.119)	(0.383)	(0.065)	(0.085)
Internal Cash Flow	-0.016	0.016	-0.001	-0.235***	-0.243***	-0.227***	-0.467*	-0.125***	-0.139***	-0.166	-0.084***	-0.085***
	(0.014)	(0.012)	(0.009)	(0.053)	(0.027)	(0.024)	(0.243)	(0.050)	(0.047)	(0.280)	(0.024)	(0.025)
Constant	-0.031	-0.008	-0.021***	0.221***	0.152***	0.186***	-0.046***	-0.004	-0.008	0.047*	0.027***	0.024***
	(0.030)	(0.006)	(0.008)	(0.067)	(0.042)	(0.032)	(0.029)	(0.007)	(0.007)	(0.026)	(0.004)	(0.004)
R2	0.054	0.011	0.015	0.349	0.288	0.282	0.288	0.098	0.141	0.137	0.035	0.047
No of Observations	1116	3510	4626	1116	3510	4626	607	4483	5090	607	4483	5090
No of Companies	500	732	763	500	732	763	280	547	566	280	547	566
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Company Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SE Clustered by Firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

***, **, * represent significant at 1%, 5% and 10% respectively (robust standard errors in bracket)

Table 2.8 Probit Regression of Debt and Equity Financing for Small and Large publicly listed UK firms 1996-2014

The basic regression equations are $D_{it} = \alpha + \beta FD_{it} + e$ for debt financing and $E_{it} = \alpha + \beta FD_{it} + e$ for equity financing. Investment Spikes are defined as investments greater than 2 times the median investment rate for each firm. D, *is the probability of employing debt financing*, it takes the value of 1 if Change in long term debt > 0 and 0 otherwise. *E, is the probability of employing equity financing*, it takes the value of 1 if Net Equity Finance > 0 and 0 otherwise. *FD*, Financing deficit = Investments + Change in working capital + Dividend - Internal Cash Flow. Investment = (Capital Expenditures + Increase in Investments + Acquisitions – sale of tangible fixed assets – sale of Investments – short term investments (increase) decrease – Investing Activities Other) / Total Assets. Change in working capital = (Cash and cash equivalents increase (decrease) - Accounts receivable decrease (increase) - Inventory decrease (increase) - Accounts payable and accrued liabilities increase (decrease) - Assets and Liabilities other net change - Financing activities other - current debt changes) / Total Assets. Dividends = Cash Dividends (Cash flow) / Total Assets. Internal Cash flow = (Income before extraordinary items (cash flow) + Extraordinary items and discontinued operations (cash flow) + Depreciation and amortization (cash flow) + Deferred taxes) cash flow) + Equity in Earnings after tax + Sale of property, plant and investments Gain (loss) + Funds from operations (other) + Exchange rate effect) / Total assets. Computations are based on nonfinancial firms in Standard and Poor's Compustat database. Sample period is 1996-2014. 1995 figures were used in estimating Change in Long Term Debt Financing. Small firms are those with Total Assets in the bottom quartile of the distribution. Size (£ Million) adjusted to constant 2014 Pounds using the CPI obtained from DataStream. Financial firms and utilities are excluded. Regressions are estimated with firm fixed effects. Standard errors are clustered by firm. Robust standard errors are in parenthesis.

	Small Firms						**Large Firms**					
	Debt Financing			**Equity Financing**			**Debt Financing**			**Equity Financing**		
	Spike	**Off Spike**	**All Years**	**Spike**	**Off Spike**	**All Years**	**Spike**	**Off Spike**	**All Years**	**Spike**	**Off Spike**	**All Years**
Financing Deficit	0.100	0.120**	0.134***	0.852***	1.051***	0.930***	2.824***	2.019***	2.271***	1.859***	1.244***	1.434***
	(0.079)	(0.061)	(0.051)	(0.122)	(0.078)	(0.070)	(0.595)	(0.307)	(0.284)	(0.650)	(0.256)	(0.224)
Constant	-0.861**	-1.630***	-1.377***	0.007	0.088	0.142	-0.767**	-1.141***	-0.176**	2.194***	0.650***	0.736***
	(0.391)	(0.400)	(0.259)	(0.402)	(0.276)	(0.221)	(0.373)	(0.088)	(0.085)	(0.612)	(0.117)	(0.113)
No. of Observations	1153	3670	4823	1153	3670	4823	638	4662	5300	638	4662	5300
No. Of Firms	516	749	778	516	749	778	292	572	592	292	572	592
SE Clustered by Firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

***, **, * represent significant at 1%, 5% and 10% respectively (robust standard errors in bracket)

Table 2.9 Debt and Equity Financing Regression Estimates for Small and Large publicly listed UK firms during investment spikes 1996-2014

The basic regression equations are $LTD_{it} = \alpha + \beta FD_{it} + e$ for debt financing and $EQ_{it} = \alpha + \beta FD_{it} + e$ for equity financing. Investment Spikes are defined as investments greater than 2 times the median investment rate for each firm. *LTD*, change in long term debt, is defined as the ratio of change in total long-term debt to total assets. *EQ*, Net Equity Finance, is the difference between sale and purchase of equity. *FD*, Financing deficit = Investments + Change in working capital + Dividend - Internal Cash Flow. Investment = (Capital Expenditures + Increase in Investments + Acquisitions – sale of tangible fixed assets – sale of Investments – short term investments (increase) decrease – Investing Activities Other) / Total Assets. Change in working capital = (Cash and cash equivalents increase (decrease) - Accounts receivable decrease (increase) - Inventory decrease (increase) - Accounts payable and accrued liabilities increase (decrease) - Assets and Liabilities other net change - Financing activities other - current debt changes) / Total Assets. Dividends = Cash Dividends (Cash flow) / Total Assets. Internal Cash flow = (Income before extraordinary items (cash flow) + Extraordinary items and discontinued operations (cash flow) + Depreciation and amortization (cash flow) + Deferred taxes) cash flow) + Equity in Earnings after tax + Sale of property, plant and investments Gain (loss) + Funds from operations (other) + Exchange rate effect) / Total assets. Computations are based on nonfinancial firms in Standard and Poor's Compustat database. Sample period is 1996-2014. We define crisis periods as years 2001 to 2002 and 2007 to 2009. All other years within the sample period are defined as non-crisis periods. 1995 figures were used in estimating Change in Long Term Debt Financing. Small firms are those with Total Assets (deflated b CPI) less than the 25th percentile of the distribution. Size (£ Million) adjusted to constant 2014 pounds using the CPI obtained from DataStream. Financial firms and utilities are excluded. Regressions are estimated with firm fixed effects. Standard errors are clustered by firm. Robust standard errors are in parenthesis.

	Small Firms				**Large Firms**			
	Debt		**Equity**		**Debt**		**Equity**	
	Crisis	**Non-Crisis**	**Crisis**	**Non-Crisis**	**Crisis**	**Non-Crisis**	**Crisis**	**Non-Crisis**
Financing Deficit	0.056**	0.032*	0.228***	0.404***	0.792***	0.277**	0.244**	0.264***
	(0.028)	(0.019)	(0.086)	(0.067)	(0.133)	(0.119)	(0.100)	(0.087)
Constant	-0.003	-0.022	0.577***	0.294***	-0.136***	-0.001	-0.019	0.042**
	(0.022)	(0.031)	(0.060)	(0.056)	(0.053)	(0.033)	(0.019)	(0.019)
R2	0.0574	0.0508	0.2894	0.3311	0.5040	0.1732	0.2479	0.1723
No. of Observations	431	722	431	722	208	430	208	430
No. Of Firms	293	418	293	418	152	244	152	244

Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SE Clustered by Firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

***, **, * represent significant at 1%, 5% and 10% respectively (robust standard errors in bracket)

Figure 2.1 Debt, Equity Financing and Financing Deficit for Small and Large UK Firms 1996-2014

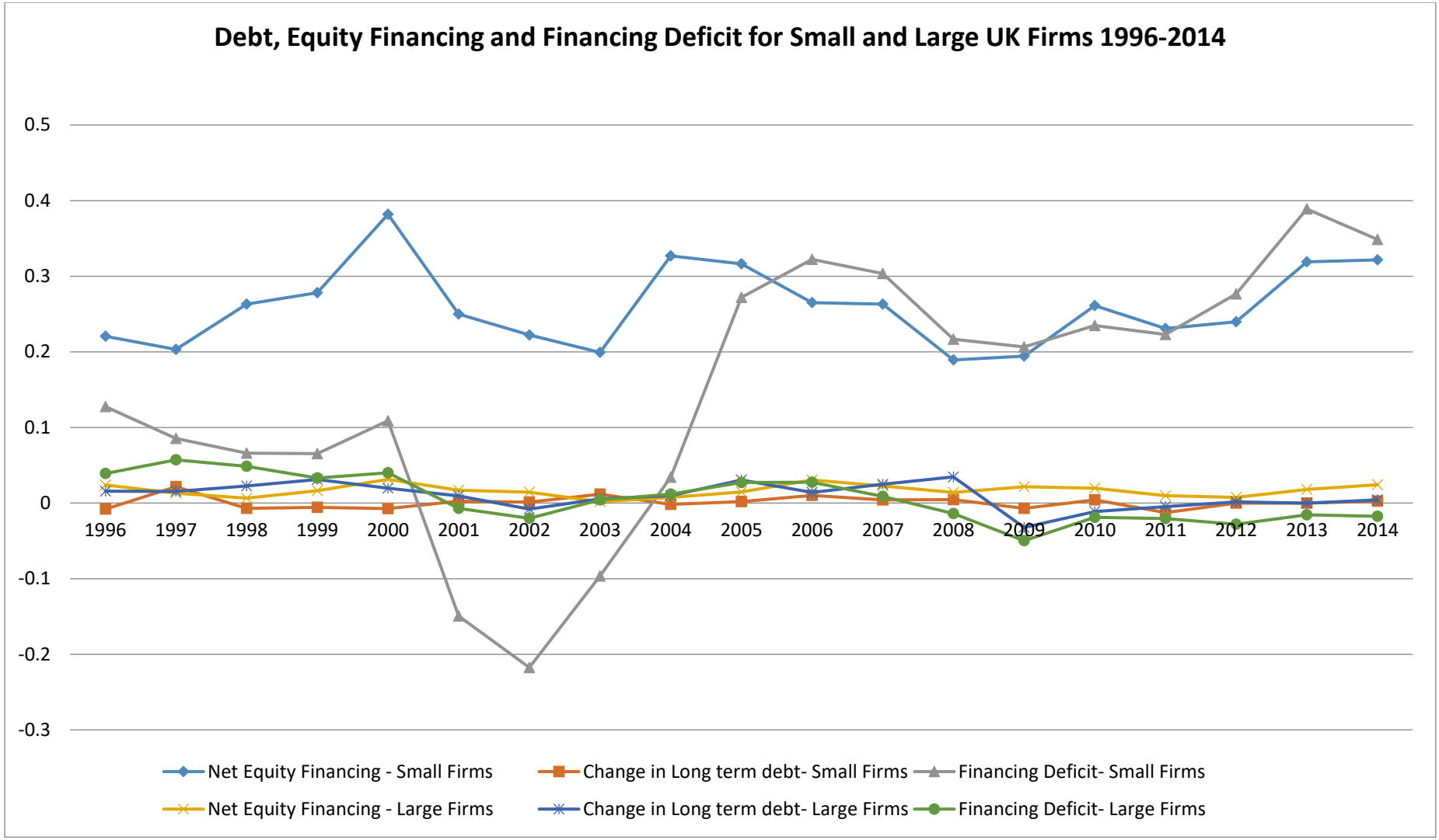
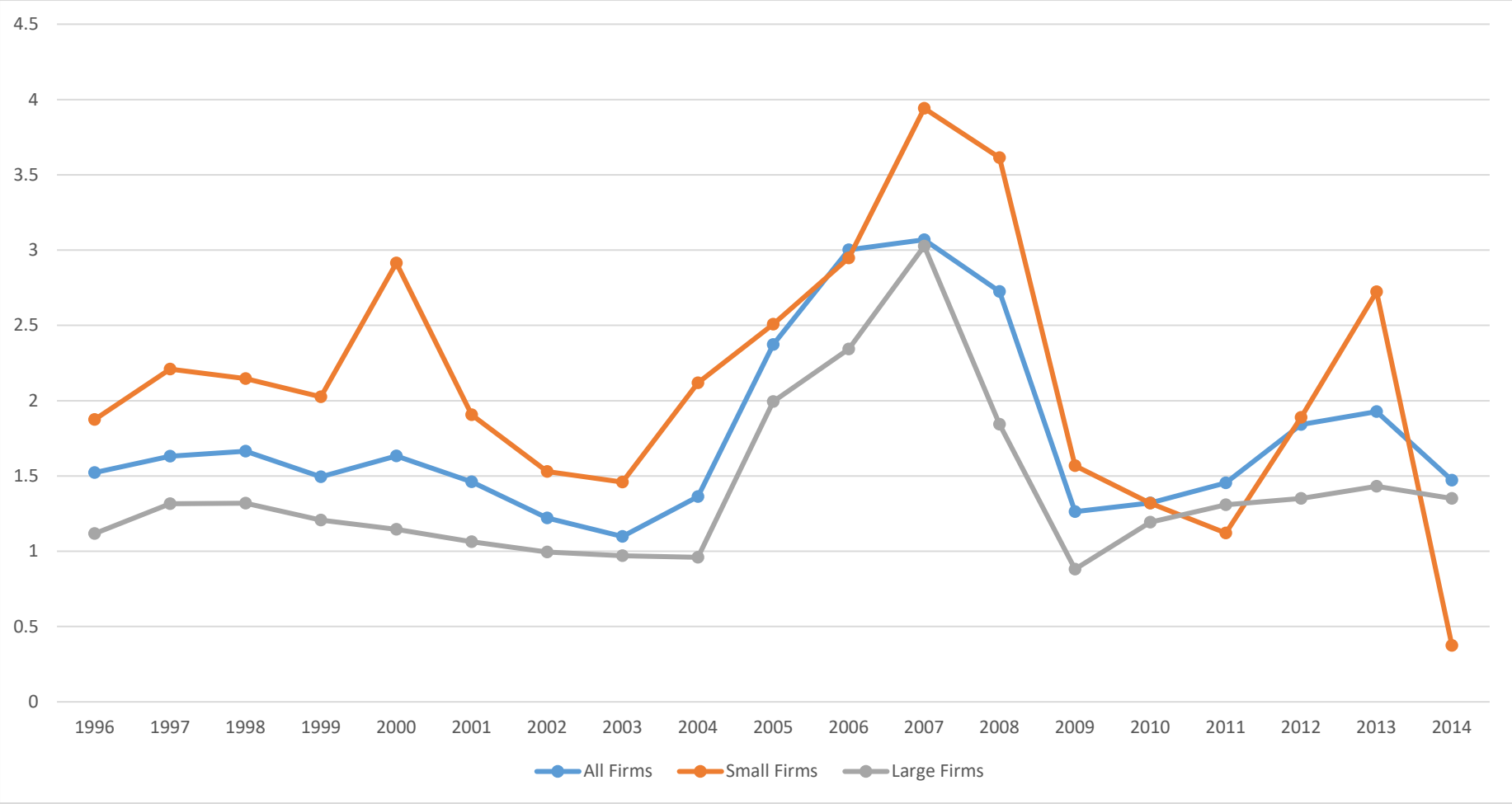


Figure 2.2 Trends in Investment Spikes for Small and Large UK Firms 1996-2014



Spike is defined as Investment / Median Investment >= 2

Table 2.10 Description of Variables

Variable	Proxy	Compustat Variables
Investment	(Capital Expenditures+ Increase in Investments + Acquisitions - Sale of Tangible Fixed Assets – Sale of Investments – Short term investments (Increase)/Decrease – Investing Activities-Other / Total Assets	CAPX: capital expenditures; IVCH -- Increase in Investments; AQC: acquisitions; STFIXA—Sale of Tangible Fixed Assets; SIV -- Sale of Investments; STINV -- Short Term Investments - (Increase)/Decrease; IVACO – Investing Activities – Other; AT: Assets - Total
Investment Spike	Investment / Median Investment > 2	
Change in Long Term Debt Finance	(Total Long-Term Debt at t - Total Long-Term Debt at t-1) / Total Assets	DLTT -- Long-Term Debt - Total
Net Equity Finance	(Sale of Common and Preferred Stock - Purchase of Common and Preferred Stock) / Total Assets	SSTK - sale of Common and Preferred Stock; PRSTKC - purchase of Common and Preferred Stock
Change in Working Capital	Cash and Cash Equivalents-Increase/(Decrease) – Accounts Receivable-Decrease (Increase) – Inventory-Decrease (Increase) – Accounts Payable and accrued liabilities-Increase/(Decrease) – Assets and Liabilities Other-Net Change – Financing Activities-Other – Current Debt Changes / Total Assets	CHECH -- Cash and Cash Equivalents - Increase/(Decrease); RECCH – Accounts Receivable – Decrease (Increase); INVCH -- Inventory – Decrease (Increase); APALCH – Accounts Payable and Accrued Liabilities – Increase/(Decrease); AOLOCH -- Assets and Liabilities - Other - Net Change; FIAO – Financing Activities – Other; DLCCH -- Current Debt - Changes
Dividends	Cash Dividends (Cash Flow) / Total Assets	DV -- Cash Dividends (Cash Flow)
Internal Cash Flow	(Income Before Extraordinary Items (Cash Flow) + Extraordinary Items and Discontinued Operations (Cash Flow) + Depreciation and Amortization (Cash Flow) + Deferred Taxes (Cash Flow) + Equity in Earnings after Tax + Sale of Property Plant and Investments-Gain(loss) + Funds from operations(other) + Exchange Rate Effect) / Total Assets	IBC -- Income Before Extraordinary Items (Cash Flow); XIDOC -- Extraordinary Items and Discontinued Operations (Cash Flow); DPC – Depreciation and Amortization (Cash Flow); TXDC – Deferred Taxes (Cash Flow); EIEA -- Equity in Earnings - After-Tax; SPPIV -- Sale of Property, Plant and Equipment and Investments - Gain (Loss); FOPO -- Funds from Operations – Other; EXRE – Exchange Rate Effect
Financing Deficit	Investment + Change in Working Capital + Dividends – Internal Cash Flow	
Growth	Sales/Turnover (Net) at t / Sales/Turnover (Net) at t-1	SALE—Sales/Turnover (Net)

Tangibility	Property, Plant and Equipment-Total (Net) / Total Assets	PPENT—Property, Plant and Equipment – Total (Net)
Years Since IPO	Current Year – IPO Year	IPODATE—Company Initial Public Offering Date; FYEAR—Data Year - Fiscal

APPENDIX 2.A

Table 2.11.A1 Pair-wise correlation matrix

(*p* values in parentheses)

	Debt Financing	Equity Financing	Financing Deficit	Investment	Change in Working Capital	Internal Cash Flow	Dividends
Debt Financing	1.00						
Equity Financing	-0.05	1.00					
	(0.00)						
Financing Deficit	0.10	0.52	1.00				
	(0.00)	(0.00)					
Investment	0.18	0.14	0.26	1.00			
	(0.00)	(0.00)	(0.00)				
Change in Working Capital	0.05	0.23	0.45	-0.07	1.00		
	(0.00)	(0.00)	(0.00)	(0.00)			
Internal Cash Flow	0.00	-0.34	-0.61	0.08	0.23	1.00	
	(0.97)	(0.00)	(0.00)	(0.00)	(0.00)		
Dividends	0.00	-0.12	-0.08	-0.00	0.00	0.18	1.00
	(0.82)	(0.00)	(0.00)	(0.79)	(0.80)	(0.00)	

Table 2.12.A2 Diagnostic Test – Hausman Test

The basic regression equation is $EQ_{it} = \alpha + \beta_1 I_{it} + \beta_2 \Delta WC_{it} + \beta_3 D_{it} - \beta_4 CF_{it} + e$ for equity financing. Investment Spike is defined as investments greater than 2 times the median investment rate for each firm. *EQ*, Net Equity Finance, is the difference between sale and purchase of equity. *FD*, Financing deficit = Investments + Change in working capital + Dividend - Internal Cash Flow. Investment = (Capital Expenditures + Increase in Investments + Acquisitions – sale of tangible fixed assets – sale of Investments – short term investments (increase) decrease – Investing Activities Other) / Total Assets. Change in working capital = (Cash and cash equivalents increase (decrease) - Accounts receivable decrease (increase) - Inventory decrease (increase) - Accounts payable and accrued liabilities increase (decrease) - Assets and Liabilities other net change - Financing activities other - current debt changes) / Total Assets. Dividends = Cash Dividends (Cash flow) / Total Assets. Internal Cash flow = (Income before extraordinary items (cash flow) + Extraordinary items and discontinued operations (cash flow) + Depreciation and amortization (cash flow) + Deferred taxes) cash flow) + Equity in Earnings after tax + Sale of property, plant and investments Gain (loss) + Funds from operations (other) + Exchange rate effect) / Total assets. Computations are based on nonfinancial firms in Standard and Poor's Compustat database. Sample period is 1996-2014. 1995 figures were used in estimating Change in Long Term Debt Financing. Size (£ Million) adjusted to constant 2014 Pounds using the CPI obtained from DataStream. Financial firms and utilities are excluded. Regressions are estimated with firm fixed effects. Standard errors are clustered by firm. Robust standard errors are in parenthesis.

	(b) fixed	**(B) random**	**(b-B) Difference**	**sqrt(diag(V_b-V_B)) S.E**
Investments	0.485	0.484	0.001	0.001
Change in Working Capital	0.381	0.384	-0.003	0.000
Dividends	0.971	0.412	0.559	0.021
Internal Cash flow	-0.194	-0.263	0.069	0.002

b = consistent under Ho and Ha; obtained from xtreg

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

Test: Ho: difference in coefficients not systematic

chi2(22) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 1387.58
Prob>chi2 = 0.0000
(V_b-V_B is not positive definite)

Table 2.13.A3 Diagnostic Test – Wooldridge test for autocorrelation in panel data

The basic regression equation is $EQ_{it} = \alpha + \beta_1 I_{it} + \beta_2 \Delta WC_{it} + \beta_3 D_{it} - \beta_4 CF_{it} + e$ for equity financing. Investment Spike is defined as investments greater than 2 times the median investment rate for each firm. *EQ*, Net Equity Finance, is the difference between sale and purchase of equity. *FD*, Financing deficit = Investments + Change in working capital + Dividend - Internal Cash Flow. Investment = (Capital Expenditures + Increase in Investments + Acquisitions – sale of tangible fixed assets – sale of Investments – short term investments (increase) decrease – Investing Activities Other) / Total Assets. Change in working capital = (Cash and cash equivalents increase (decrease) - Accounts receivable decrease (increase) - Inventory decrease (increase) - Accounts payable and accrued liabilities increase (decrease) - Assets and Liabilities other net change - Financing activities other - current debt changes) / Total Assets. Dividends = Cash Dividends (Cash flow) / Total Assets. Internal Cash flow = (Income before extraordinary items (cash flow) + Extraordinary items and discontinued operations (cash flow) + Depreciation and amortization (cash flow) + Deferred taxes) cash flow) + Equity in Earnings after tax + Sale of property, plant and investments Gain (loss) + Funds from operations (other) + Exchange rate effect) / Total assets. Computations are based on nonfinancial firms in Standard and Poor's Compustat database. Sample period is 1996-2014. 1995 figures were used in estimating Change in Long Term Debt Financing. Size (£ Million) adjusted to constant 2014 Pounds using the CPI obtained from DataStream. Financial firms and utilities are excluded. Regressions are estimated with firm fixed effects. Standard errors are clustered by firm. Robust standard errors are in parenthesis.

H0: no first-order autocorrelation
F(1, 1886) = 100.705
Prob > F = 0.0000

Table 2.14.A4 Diagnostic Test – Modified Wald test for groupwise heteroscedasticity in fixed effect regression model

The basic regression equation is $EQ_{it} = \alpha + \beta_1 I_{it} + \beta_2 \Delta WC_{it} + \beta_3 D_{it} - \beta_4 CF_{it} + e$ for equity financing. Investment Spike is defined as investments greater than 2 times the median investment rate for each firm. *EQ*, Net Equity Finance, is the difference between sale and purchase of equity. *FD*, Financing deficit = Investments + Change in working capital + Dividend - Internal Cash Flow. Investment = (Capital Expenditures + Increase in Investments + Acquisitions – sale of tangible fixed assets – sale of Investments – short term investments (increase) decrease – Investing Activities Other) / Total Assets. Change in working capital = (Cash and cash equivalents increase (decrease) - Accounts receivable decrease (increase) - Inventory decrease (increase) - Accounts payable and accrued liabilities increase (decrease) - Assets and Liabilities other net change - Financing activities other - current debt changes) / Total Assets. Dividends = Cash Dividends (Cash flow) / Total Assets. Internal Cash flow = (Income before extraordinary items (cash flow) + Extraordinary items and discontinued operations (cash flow) + Depreciation and amortization (cash flow) + Deferred taxes) cash flow) + Equity in Earnings after tax + Sale of property, plant and investments Gain (loss) + Funds from operations (other) + Exchange rate effect) / Total assets. Computations are based on nonfinancial firms in Standard and Poor's Compustat database. Sample period is 1996-2014. 1995 figures were used in estimating Change in Long Term Debt Financing. Size (£ Million) adjusted to constant 2014 Pounds using the CPI obtained from DataStream. Financial firms and utilities are excluded. Regressions are estimated with firm fixed effects. Standard errors are clustered by firm. Robust standard errors are in parenthesis.

H0: sigma(i)^2 = sigma^2 for all i

chi2 (1888) = 2.1e+07

Prob>chi2 = 0.0000

Chapter 3 Private Firms Financing Constraints and Investment Spikes

3.1 INTRODUCTION

Private firms are a significant part of the UK economy. According to Brav (2009), private firms represent about 97.5% of all incorporated UK firms with more than 66% share of all corporate assets. This point to the importance of understanding the funding dynamics of these firms based on the crucial roles they play in the overall economy of the UK.

In a comparative empirical analysis of funding patterns of public and private firms, Brav (2009) found that private firms are almost entirely debt financed. He attributed this to a relatively more costly private equity resulting from a relatively higher level of information asymmetry and the reluctance of private firms to dilute their level of control. We extend this study by distinguishing between constrained and unconstrained private firms. This is against the background of the implication of the pecking order theory that firms with the greatest level of financing deficit will specialise in equity.

In our first paper, and in line with Frank and Goyal (2007), we find that equity plays a more significant role in smaller public firms financing mix than that suggested by the pecking order theory. This is significant as smaller firms should normally have a greater level of information asymmetry. We extend this study by looking at constrained private firms who, arguably, should have the greatest level of information asymmetry compared to any type of public firm and unconstrained private firms. Our primary motivation is to see if, when new debt and equity are considered, private firms in general and constrained private firms in particular, can be said to be almost entirely financed by debt as suggested by Brav (2009).

The paper examines the determinants of leverage ratios of private UK firms distinguishing between funding dynamics of constrained and unconstrained private UK firms. Furthermore,

we examine the relationship between changes in financing deficit and/or its component and changes in new debt and equity financing for these groups of firms. We look at the differences between these relationships during periods of financial crisis versus non-crisis periods. We also examine these interactions during periods of investment spikes. We will therefore attempt to answer a number of questions. Are funding dynamics of constrained private firms any different from their unconstrained counterparts? How do constrained and unconstrained private firms raise new capital to fund huge investments? We further extend the analysis by examining changes before and after the global financial crisis. Our analysis is based on a sample of private UK firms in the FAME database from 2000 to 2017.

We find that traditional determinants of leverage have varying influences on constrained and unconstrained private firms. The widest differences relate to the influence of Growth and Size and, to a limited extent, Age. While growth has a positive and significant effect on leverage for unconstrained firms, it is negative and not statistically significant for constrained firms. The opposite is the case for size which has a negative and significant relationship for constrained firms but a positive and insignificant near zero influence on unconstrained firms. While age goes in the same direction for both types of firms, it is only in the case of unconstrained firms that it is negative and not significant. This is consistent with a limited access of constrained private firms to borrowing due to their smaller size and younger age when compared with their unconstrained counterparts. This may also limit growth opportunities constrained firms can take advantage of due to limited funds.

Furthermore, when the analysis is repeated for periods when both types of firms face huge investments, we find that leverage ratios of constrained firms are generally nonresponsive to changes in traditional determinants of leverage ratios. This contrasts with unconstrained firms who show the expected highly significant negative relationship between profitability and leverage ratios. We attribute this to a relatively higher level of information asymmetry of

constrained private firms. Our results also show that, when faced with financing deficits, constrained firms make changes to their equity holdings while unconstrained firms make changes to their debt holdings. This again points to information asymmetry limiting the ability of constrained firms to address financing deficits by changing the mix of their debt holdings.

The rest of the paper is structured as follows; Section two examines the related theoretical and empirical papers. Section three describes the data and lays out the methodology to be employed in our analysis. Section four involves a presentation and analysis of results of our empirical analysis while section five concludes the paper.

3.2 LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Private firms, by their nature have limited access to public capital markets and this greatly influences the financing mix employed in their capital structure. Studies on capital structure have generally been underpinned by the major capital structure theories; the trade-off theory (TOT) and the Pecking order theory (POT). As earlier highlighted in the introductory chapter, the TOT implies that firms continually "trade-off" benefits of debt, including its tax deductibility against costs like bankruptcy and agency costs. Firms thus have an optimal capital structure to which they revert in times of temporary deviations. (Fama and French 2002; Myers, 2001) On the other hand, the POT holds that the existence of information asymmetry results in the undervaluation of stocks based on their degree of sensitivity to information asymmetry. The POT also implies that there is no optimal capital structure and financing deficit is the key driver of the capital structure choices of firms (Fama and French 2002; Harris and Raviv, 1991; Myers and Majluf, 1984).

Brav (2009) carried out a comparative analysis of the capital structure choices of public and private firms against the background of the major capital structure theories. He concluded that private firms are almost exclusively financed by debt with greater amounts of leverage in their financing mix when compared with their public counterparts. However, when viewed from the

perspective of the POT, private firms should be expected to have relatively greater levels of information asymmetry. This is due to the less stringent reporting requirements they face and limited access to investors, especially equity investors, in participating in their financing. Private firms should therefore arguably be mostly financed by internal funds. This should especially be the case if they have to finance huge investments with relatively higher levels of financing deficits. This was partially addressed by Brav (2009) with an inclusion of a separate analysis of debt financing against financing deficits and its components. His conclusions however remained unchanged. He however excluded firms classified as small by the UK Companies Act. We include these firms in our analysis as Frank and Goyal (2003) show that excluding the smallest of firms has a non-trivial effect on results obtained in a similar analysis. Furthermore, we extend the study by examining if financing patterns are the same for constrained and unconstrained private firms and how these dynamics are affected by the occurrence of huge investments.

3.2.1 FINANCING CONSTRAINT

A number of studies have examined the capital structure of financially constrained firms mainly within the context of public firms. Firms have been grouped into constrained and unconstrained firms on a number of bases. Financing constrains has also been cited as the rationale behind some firms' zero-leverage behaviour (Bessler et. al, 2013; Dang, 2013). Different bases have included Commercial paper rating (Calomiris et. al, 1995); total assets (Gilchrist and Himmelberg, 1995); dividend payments (Fazzari et. al, 1988); Bond rating (Cummins et. al, 1999) and tangibility of assets (Almeida and Campello, 2007). Almeida and Campello (2007) found that investments of financially constrained firms are more sensitive to their internal cash flows the more tangible their assets are. Other studies have used a combination of measures to identify financially constrained firms. One such study is that of Hadlock and Pierce (2010) who used a weighted average of age and size of the company. Financially constrained firms are

defined using the HP Index (Hadlock and Pierce, 2010) as firms in the top quartile of the Index given as;

$$\text{HP} = -0.737 * SIZE + 0.043 * SIZE^2 - 0.04 * \text{age} \quad (1)$$

We adopt this measure in this study as it is more applicable to private firms and uses more than one measure.

The pecking order theory (Myers and Majluf, 1984) should imply private firms experience a reverse pecking order due to their limited access to external capital. This will be the case as they have relatively less stringent reporting requirements when compared with their publicly listed peers. Indeed, in line with Frank and Goyal (2003) we had found in paper one that the pecking order theory mainly applies to large public firms who address financing deficit by raising new debt. Smaller public firms were found to respond to financing deficit by raising relatively more equity. We should therefor expect that private firms and especially constrained private firms, will address financing deficits by raising new equity. We would next examine some implications of the pecking order theory related to our study.

3.2.2 HYPOTHESIS DEVELOPMENT

We examine some implications for constrained private firms flowing from the literature. The first implication is that constrained private firms will specialise in equity financing.

Implication 1: Constrained private firms will specialise in equity financing.

The pecking order theory (Shyam-Sunder and Myers 1999; Frank and Goyal 2003), though arguably focused on public firms could be extended to private firms in this context. It would be expected that constrained private firms will have a higher level of information asymmetry and therefore will find it more difficult to raise external capital, especially debt capital, relative to their unconstrained counterparts. Thus, constrained private firms will be expected to rely first on internal funds, followed by equity financing and then debt financing in some form of reverse pecking order. We will therefore expect that a higher level of profit will have a relatively less negative effect on levels of leverage for constrained firms when compared to their unconstrained counterparts. Furthermore, we will expect that

increases in financing deficit will have little or no effect on new debt financing for constrained firms but will have a positive effect on new equity financing which leads to the second implication we will be investigating.

Implication 2: During periods of Investment Spikes Constrained private firms will be less responsive to debt financing than their unconstrained counterparts.

Periods of investment spikes will combine a high level of information asymmetry with a high level of financing deficit for unconstrained private firms. We will therefore expect that unconstrained firms become even less responsive to debt financing at this period especially when placed alongside their unconstrained counterparts. Therefore, for constrained firms, most of the traditional determinants of leverage should be less responsive to changes in leverage at this period. We would also expect that new debt and equity will be less responsive to changes in financing deficit especially for constrained firms as they may be forced to rely on internal funds at this period.

3.3 DATA SOURCES AND METHODOLOGY

The study is based on a sample of all private UK firms in the Fame database from 2000 to 2017. This period was chosen to enable us observe funding dynamics across different crises and non-crises periods. Clustered fixed effect panel data regression is used for the analysis. We exclude firms in the financial services and utility sectors (SIC codes 6000s, 4900 – 4999 respectively) due to the peculiar nature of their financing mix (Whited 2006). Constrained firms are classified as firms in the fourth quartile of the HP index while unconstrained firms are in the first quartile. (Hadlock and Pierce, 2010). Total assets are adjusted using the UK consumer price index obtained from the World banks development indicators. Data is winsorized at the 1st and 99th percentile to adjust for outliers. Observations with missing key variables are excluded from the analysis. A number of diagnostic tests were carried out. Detailed results are in Appendix 3A. Hausman test results indicate that fixed effects panel regression was more appropriate than random effects for the regression analyses. Furthermore, this study carries out

Wooldridge test for autocorrelation in panel data and Modified Wald test for group-wise heteroscedasticity. Results indicate the presence of autocorrelation and heteroscedasticity. We, therefore, use robust standard errors, clustered by firm.

The final sample comprises 48,091 firms with 417,389 firm years of which 51,794 are for constrained firms and 149,094 are for unconstrained firms. The difference in firm years between constrained and unconstrained firms can be attributed to the relatively less data availability of constrained firms which are on the average smaller firms (Brav 2009).

3.3.1 ECONOMETRIC MODEL

The initial analysis is aimed at distinguishing the financing patterns of constrained and unconstrained private firms using traditional determinants of capital structure (Brav 2009). The basic regression equation is as follows;

$$D_{it} = a + \beta_1 P_{it} + \beta_2 G_{it} + \beta_3 T_{it} + \beta_4 S_{it} + \beta_5 A_{it} + e_{it} \quad (2)$$

Where D = Leverage ratio. P = Return on assets. G = Growth rate. S= Size and A = Number of years since incorporation. Table 3.13.B1 provides a more detailed description of variables.

Next, we follow Frank and Goyal (2003) by adding the financing deficit variable to the equation as follows;

$$D_{it} = a + \beta_1 P_{it} + \beta_2 G_{it} + \beta_3 T_{it} + \beta_4 S_{it} + \beta_5 A_{it} + \beta_6 Fd_{it} + e_{it} \quad (3)$$

Following Frank and Goyal (2013) we define Financing deficit as follows;

$$FD_{it} = I_{it} + Dv_{it} + WC_{it} - CF_{it} \quad (4)$$

Where FD = Financing Deficit, I = Investment, Dv = Dividends, WC = Working Capital and CF = Cash Flow.

We proceed with the analyses by carrying out a regression of debt and equity against financing deficit. Thus, the regression equation is as follows;

$$Df_{it} = a + \beta_1 FD_{it} + e_{it} \quad (5)$$

$$Ef_{it} = a + \beta_1 FD_{it} + e_{it} \quad (6)$$

Where Df is a dummy variable that takes the value of one if (Leverage – Lagged Leverage) / Lagged Leverage is greater than 5% and zero otherwise. Ef is a dummy variable that takes the value of one if (Issued Capital – Lagged Issued capital) / Lagged Issued Capital id greater than 5% and zero otherwise.

However, as earlier highlighted, the limitation of this approach is the possible existence of endogeneity as the debt financing is likely to be influenced by level of equity financing and vice versa.

The pecking order theory (Myers and Majluf, 1984) suggests that high quality firms will respond to increases in financing deficit unaddressed by internal funds by adjusting their debt financing while lower quality firms will address deficits with equity. We should therefore expect our results to indicate that changes in financing deficit leads to changes in equity financing for constrained private firms and debt financing for their unconstrained counterparts. Next, we present and analyse results of our regression estimates.

3.4 PRESENTATION AND ANALYSIS OF RESULTS

3.4.1 DESCRIPTIVE STATISTICS

Descriptive statistics of firms included in the sample are presented in Table 3.1. Figure 3.1 shows trends in financing deficit, debt and equity financing of constrained and unconstrained private UK firms from 2000 to 2017. Figure 3.2 shows trends in investment spikes for constrained and unconstrained firms revealing a difference in the average trends for these firms and further justifying a closer examination of their financing dynamics.

It can be observed that constrained private firms are, on the average, much more highly leveraged than their unconstrained counterparts (49% and 37% of total assets respectively). Thus, the observation made by Brav (2009) that private firms are heavily debt financed is most

relevant to constrained private firms. Furthermore, this is consistent with Joeveer (2013) that unconstrained firms are relatively less reliant on debt. Return on assets is higher among unconstrained firms at 9% of total assets to 3% for constrained firms. This could be due to the relatively heavier interest burdens that constrained firms may have to bear, given their relatively higher debt levels. Consistent with Evans (1987), constrained private firms have a higher turnover growth at 1.13 times previous turnover as compared with 1.08 times for unconstrained firms. This is possibly due to their smaller size and younger age as they are less likely to be mature firms. As should be expected, unconstrained firms are much bigger with an average of £106.47 inflation adjusted total assets. A very wide gap from their constrained counterparts with a mere £1.96 average inflation adjusted total assets. Furthermore, unconstrained firms are older with an average age of 3.54 years since date of incorporation as compared to their constrained counterparts' 2.07 years. These differences between constrained and unconstrained private firms point to possible differences in what drives their financing mix. This will be explored in our regression analysis.

We can also observe from the descriptive statistics differences related to raising new debt and equity. On the average, while unconstrained firms raise new debt of about 6% more debt than in the previous year constrained firms on the average retire debt by 6% year to year. This should be expected as unconstrained firms will normally find it much easier to raise new capital given their bigger size, tangible assets and older age. New equity issues are relatively smaller than new debt issues for unconstrained firms with about 4% increase on the average. However, constrained firms are able to raise only about 2% new equity from the previous period. Again, we would expect constrained firms to be relatively less attractive in all types of capital markets for similar reasons as with new debt issue. However, we note that constrained firms on average increase equity financing and reduce debt financing. We proceed with the analysis by running a regression of leverage against traditional determinants of capital structure.

3.4.2 ANALYSIS OF REGRESSION ESTIMATES

3.4.2.1 Leverage Regression against Traditional Capital Structure Determinants

We first run the leverage regression against traditional determinants of capital structure as seen in Appendix Table 3.12.B2.

Results indicate a negative and significant relationship between profitability and leverage ratio of private firms on the average (-0.44). However, when considered separately unconstrained firms leverage ratio are much more sensitive to profitability (-0.47) than their constrained counterparts (-0.28). This is probably due to their relatively better position in raising all types of capital. They can thus take more advantage of increased profitability to rebalance their financing mix to a greater extent than can their unconstrained counterparts. Age also has a significant positive relationship with leverage for all private firms on the average (0.03). However, when considered separately, constrained and unconstrained firms seem to borrow less the older they are (-0.03 and -0.07 respectively) Results for constrained firms are however not statistically significant. Age is thus a more important factor for unconstrained firms than their constrained counterparts.

Growth is a positive determinant of leverage ratio for private firms (0.01). However, the influence of growth on leverage ratio for constrained firms is not statistically significant. Possibly due to their relatively less capacity to employ leverage to address their growth demands. Tangibility of assets also exerts a positive influence on the leverage of private firms (0.15). However, leverage of constrained firms appears to me more sensitive to changes in tangible assets than that of their unconstrained counterparts. This should be expected as descriptive statistics indicate that constrained firms are younger with far less assets on the average. Tangibility thus becomes a necessary comfort for lenders in providing lending facilities to constrained firms. Results indicate that size has a negative influence on leverage for all private firms on the average (-0.04) for constrained firms (-0.15) results for unconstrained firms are not statistically significant.

Results are consistent with constrained private firms having relatively more limited access to borrowing due to their smaller size, less tangible assets and younger age when compared with their unconstrained counterparts. We proceed with the analysis by introducing the financing deficit variable into the equation. We also see the effect of financing deficit on new debt and equity financing for all types of private firms.

3.4.2.2 Debt and Equity Regression against Financing Deficit

Regression results are presented in Table 3.2. It can be observed that results remain qualitatively similar even with the introduction of the financing deficit variable. Thus, even though the variable is positive and significant in all instances, it does not impact the magnitude of significance of traditional variables to any reasonable extent. On average, financing deficit has a positive and significant impact (0.05) on leverage for private firms. However, when firms are split into constrained and unconstrained firms, we see a much smaller impact on constrained firms (0.04) when compared to unconstrained firms (0.06). These points to the relatively lower ability of constrained firms to increase leverage due to their smaller size, younger age and less tangible assets. We next examine the impact of financing deficit on the acquisition of new debt and equity for constrained and unconstrained firms. Results are presented in Table 3.3.

Results indicate a negative relationship between financing deficit and new debt issue for UK private firms at -0.11 on the average. However, the relationship between financing deficit and new equity issue is 0.01. Though coefficients indicate a small magnitude, it would appear that that when faced with gaps in their financing mix, UK private firms on the average raise new equity and in fact reduce new debt. When decomposed into constrained and unconstrained firms, it can be observed that while there is also a negative relationship between new debt and financing deficit for unconstrained firms, the relationship for constrained firms is not statistically significant. Conversely, the positive relationship between new equity finance and financing deficit persists for constrained firms while that of unconstrained firms, tough

positive, is not statistically significant. This seems to suggest that unconstrained firms, on average are sensitive to new debt when there are financing deficits while unconstrained firms are more sensitive to new equity. This is probably due to the fact that equity is more sensitive to information asymmetry and thus constrained firms with younger age, less tangible assets and less profitability may need to specialize in equity to address funding gaps in their financing mix. We are next interested in what happens to the financing mix when there is a higher than usual level of investment for all types of private firms.

3.4.2.3 Huge versus Regular Investments

We examine the funding pattern of constrained and unconstrained private firms when faced with larger than usual investments. Following Whited (2006) we define huge investments as follows;

$$Is_{it} = I_{it} / \text{Median } I_{it1\text{-}tn} > 2 \qquad (5)$$

Where Is = investment spike, I = investment, t is time index, and i is firm index

Results obtained from our panel regression are presented in Appendix Table 3.13.B3.

Results for periods of huge investments indicate that on the average, the effect of size and age as determinants of capital structure loses statistical significance. Suggesting that when private firms are faced with greater than usual investments, profitability, growth and tangibility of assets are the key determinants of the capital structure. This is reasonable as huge investments may coincide with an increased risk profile of the firms requiring lenders to emphasize more tangible measures over relationship. Regular investments are however closer to results derived in Appendix Table 3.12.B2 where all periods are combined except that age is also not significant at this time as well.

When private firms are spilt into constrained and unconstrained firms, we see that the effects on all the variables disappear for constrained firms implying that when faced with huge investments it may be more difficult for constrained firms to increase their leverage irrespective

of their level of profitability, growth, tangible assets, age and size. For unconstrained firms, results indicate that profitability is the key driver of changes in leverage during times of huge investments. During regular investments the influencer of the level of leverage appears to be size for constrained firms while unconstrained firms react to profitability, growth and tangibility. Again, we introduce the financing deficit variable into the mix and examine its effects on all types of private firms. Results are reported in Table 3.4.

We observe that, for all private firms on the average, there is a limited impact on all other variables when the financing deficit variable is introduced either during huge or regular investments. The financing deficit variable itself is positive and significant more so during huge investments (0.07) than during regular investments (0.06). However, for constrained firms, while effects are essentially similar to results in Appendix Table 3.13.B3, during huge investments, tangibility becomes a slightly significant determinant of leverage. For unconstrained firms, the financing deficit variable is positive and significant whether the firm is experiencing huge or regular investments. Thus, it appears that financing deficit is more of a driver of leverage for unconstrained firms than for constrained firms. We next examine the influence of financing deficit on the acquisition of new debt and equity during periods of huge and regular investments. Results are reported in Tables 3.5 and 3.6.

It can be observed form Tables 3.5 and 3.6 that during periods of huge investments financing deficits has a negative and significant impact on new debt financing for all firms considered together and for unconstrained firms considered separately. The effect on constrained firms is not significant. New equity financing is generally not significant for all categories of firms. However, during periods of regular investments, there is a positive and significant relationship between financing deficit and new equity for all firms considered together. Thus, it would appear that the effects observed Table 3.3 when all periods are aggregated do not necessarily

hold when periods of huge and regular investments are isolated except for the similarity of financing deficit having a positive and significant effect on new equity financing when all periods are considered together as well as during periods of regular investments. The next analysis looks at the behaviour of private firms during periods of financial crises.

3.4.2.4 Capital Structure and Financial Crisis.

The response of leverage ratio to changes in traditional determinants of capital structure for private UK firms during crisis and non-crisis periods are detailed in Appendix Table 3.14.B4. Periods of financial crisis in our data base are 2007 to 2009 while 2000 to 2006 and 2010 to 2017 are classified as non-crisis periods.

It can be observed that, during financial crisis, changes in profitability have a negative and significant relationship with leverage for all types of private UK firms on the average (-0.27) as well as for constrained (-0.16) and unconstrained firms (-0.31) considered separately. Similarly, during non-financial crisis periods, profitability has a negative and significant relationship with debt financing for all types of UK private firms albeit at a higher magnitude. (-0.45, -0.29 and -0.48 for all, constrained and unconstrained firms respectively). This possibly points to the relative ease of raising leverage during non-crisis periods when compared with crisis periods for UK private firms. Our results also indicate that higher growth prospects lead to higher leverage only during non-crisis periods for all private firms on the average and for unconstrained private firms. Relationship with leverage during crisis periods and for constrained firms during non-crisis periods is not statistically significant. There is a positive relationship between tangibility of assets and leverage for all UK private firms on the average during crisis. This also applies to unconstrained firms. However, relationship with unconstrained firms is positive but not statistically significant. This relationship is uniformly positive across board during non-crisis periods. The effect of size of leverage is uniformly negative during crises and non-crisis periods. However, for unconstrained firms, this effect is

positive during financial crisis and not significant during non-crisis periods. Next, we examine introduce financing deficit into the model and present results in Table 3.7.

We notice from Table 3.7 that the introduction of financing deficit has minimal impact on the magnitude and significance of the variables. Financing deficit however has a positive and significant impact on leverage across all types of private firms and all periods. This is more the case for unconstrained firms than for constrained firms. We proceed with the analysis by examining the changes in new debt and equity financing as a result of changes in the Financing deficit during crisis and non-crisis periods. We present results in Tables 3.8 and 3.9.

Tables 3.8 and 3.9 show the relationship between changes in financing deficit and changes in debt and equity financing during crisis and non-crisis periods respectively. Our figures show that while a negative and significant relationship between financing deficit and new debt during crisis periods for unconstrained firms and for all firms considered together. However, during non-crises periods while there is a negative and significant relationship between financing deficit and new debt for UK private firms, the relationship is positive and significant for new equity financing. For constrained firms, the influence of financing deficit is generally not significant for new debt or new equity either during crisis or non-crises periods.

3.5 CONCLUSION

The study has focused on how constrained UK private firms fund investments especially when there is a simultaneous incidence of financing constraint and high levels of investments. Our results indicate that determinants of leverage have differing effects on constrained and unconstrained private firms. The widest differences relate to the influence of growth and size and to a limited extent age. On the one hand, we find that growth has a positive and significant effect on leverage for unconstrained firms while it is negative and not statistically significant for constrained firms. On the other hand, size has a negative and significant relationship for constrained firms but a positive and insignificant, near zero influence on unconstrained firms.

Though age has a negative influence for both types of firms, for unconstrained firms it is not statistically significant. This is consistent with a limited access of constrained private firms to borrowing due to their smaller size and younger age when compared with their unconstrained counterparts. This may also indicate a limit to growth opportunities constrained firms can take advantage of due to limited access to external funds.

We repeat the analysis for periods of huge investments and find that leverage ratios of constrained firms are generally nonresponsive to changes in traditional determinants of leverage ratios when faced with huge investments. This contrasts with unconstrained firms who show the expected highly significant negative relationship between profitability and leverage ratios. We attribute this to a relatively higher level of information asymmetry of constrained private firms. Our results also show that, when faced with financing deficits, constrained firms make changes to their equity holdings while unconstrained firms make changes to their debt holdings. We believe this is attributable to the effects of information asymmetry which limits the ability of constrained firms to address financing deficits by changing the mix of their debt and equity holdings.

Table 3.1 Descriptive Statistics for Private UK Firms 2000-2017

Computations are based on nonfinancial, non-utility and non-public sector private firms in FAME database. Sample period is 2000-2017. Size (£ Million) adjusted to constant 2017 Pounds using the CPI from the World Banks World Development Index. Regressions are estimated using firm and year fixed effects. Standard errors are clustered by firm. Robust standard errors are in parenthesis. Constrained firms are defined as firms in the bottom quartile of inflation adjusted total assets. Unconstrained firms are in the top quartile of inflation adjusted total assets. 1999 Figures were used in calculating lagged components.

Variable	Period	N	Mean	P50	Std.Dev	Skewness	Kurt.
Leverage	All	417,389	0.39	0.26	0.48	2.62	13.00
	Constrained	51,794	0.49	0.00	0.75	1.93	6.50
	Unconstrained	149,094	0.37	0.29	0.37	2.42	14.70
Profitability	All	417,389	0.09	0.06	0.17	-0.17	7.48
	Constrained	51,794	0.03	0.00	0.24	0.20	6.08
	Unconstrained	149,094	0.09	0.08	0.13	-0.14	8.95
Growth	All	417,389	1.10	1.00	0.38	2.56	14.90
	Constrained	51,794	1.13	1.00	0.48	1.89	8.83
	Unconstrained	149,094	1.08	1.03	0.32	2.92	19.92
Tangibility	All	417,389	0.25	0.14	0.29	1.08	3.08
	Constrained	51,794	0.13	0.00	0.30	2.15	6.24
	Unconstrained	149,094	0.30	0.22	0.28	0.84	2.66
Size (£ Millions)	All	417,389	44.21	9.24	131.53	5.79	40.22
	Constrained	51,794	1.96	1.41	0.96	1.05	3.37
	Unconstrained	149,094	106.47	30.91	205.15	3.33	14.38
Age	All	417,389	2.90	2.94	0.84	-0.32	2.88
	Constrained	51,794	2.09	2.19	0.66	-0.34	2.43
	Unconstrained	149,094	3.55	3.61	0.67	-0.84	4.21
Financing Deficit	All	417,389	0.25	0.20	0.42	-0.15	3.07
	Constrained	51,794	0.23	0.00	0.56	-0.22	2.67
	Unconstrained	149,094	0.28	0.25	0.38	-0.08	2.79
Debt Issue	All	110,751	0.02	0.00	0.68	3.00	18.98
	Constrained	6,012	-0.06	0.00	0.50	0.94	10.61
	Unconstrained	48,612	0.06	0.00	0.76	3.17	17.97
Equity Issue	All	107,566	0.03	0.00	0.27	6.11	53.59
	Constrained	4,559	0.02	0.00	0.22	4.48	50.14
	Unconstrained	59,414	0.04	0.00	0.28	6.34	53.43

Table 3.2 Leverage Regression of private UK firms with Financing Deficit 2000-2017

The basic regression equations is $D_{it} = \alpha + \beta_1 P_{it} + \beta_2 G_{it} + \beta_3 T_{it} + \beta_4 S_{it} + \beta_5 A_{it} +$ e. *D, Leverage ratio,* is defined as the ratio of the sum of short-term loans and overdrafts, other short-term loans and long-term liabilities to total assets. *P, Return on Assets,* is ratio of EBITDA to the sum of Total assets and lagged total assets divided by 2. *Growth, G,* is the ratio of Turnover to lagged Turnover. Tangibility, T, is the ratio of the sum of tangible assets and Investments to Total assets. *Size, S,* is the natural logarithm of Total Assets. Age, A, is the Natural logarithm of number of years since date of incorporation. Computations are based on nonfinancial, non-utility and non-public sector private firms in FAME database. Sample period is 2008-2016. Size (£ Million) deflated to constant 2016 Pounds using the CPI from the World Banks World Development Index. Regressions are estimated using firm and year fixed effects. Standard errors are clustered by firm. Robust standard errors are in parenthesis. 1999 Figures were used in calculating lagged components.

	All	Constrained	Unconstrained
Profitability	-0.433***	-0.285***	-0.461***
	(0.008)	(0.018)	(0.016)
Growth	0.014***	-0.002	0.017***
	(0.002)	(0.005)	(0.003)
Tangibility	0. 147***	0.151***	0.096***
	(0.008)	(0.021)	(0.013)
Size	-0.038***	-0.151***	-0.002
	(0.003)	(0.013)	(0.006)
Age	-0.032***	-0.030	-0.073***
	(0.005)	(0.021)	(0.014)
Financing Deficit	0.054***	0.038***	0.058***
	(0.003)	(0.007)	(0.006)
Constant	0.512**	0.519	0.597***
	(0.014)	(0.027)	(0.050)
R2	0.0556	0.0405	0.0536
No. of Observations	417,389	51,794	149,094
No. Of Firms	48,091	15,251	16,951
Year Fixed Effects	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes
SE Clustered by Firm	Yes	Yes	Yes

***, **, * represent significant at 1%, 5% and 10% respectively (robust standard errors in bracket)

Table 3.3 Debt and Equity Financing against Financing Deficit for private UK firms 2000-2017

The basic regression equations are $Df_{it} = \alpha + \beta_1 FDv_{it} + e$ for debt financing and $Ef_{it} = \alpha + \beta_1 FDv_{it} + e$ for equity financing . Where Df is a dummy variable that takes the value of one if (Leverage – Lagged Leverage) / Lagged Leverage is greater than 5% and zero otherwise. Ef is a dummy variable that takes the value of one if (Issued Capital – Lagged Issued capital) / Lagged Issued Capital id greater than 5% and zero otherwise. Leverage is defined as the sum of short-term loans and overdrafts, other short-term loans and long-term liabilities. $FD_{it} = I_{it} + Dv_{it} + WC_{it}$ - CFit. I, Investment is the sum of Net Cash In (out) flow return on investment, Net Cash Out (In) flow investing activities, Capital expenditure and Financial Investment and Acquisitions and disposals divided by Total Assets. Dv, Dividends, is Equity dividends paid divided by Total Assets. WC, Working Capital is sum of Work in Progress, Trade Debtors, other current assets minus trade creditors divided by Total Assets. CF, Cash Flow is Cash and Cash Equivalents divided by Total assets. . Computations are based on nonfinancial, non-utility and non-public sector private firms in FAME database. Sample period is 2000-2017. Size (£ Million) deflated to constant 2016 Pounds using the CPI from the UK office of National Statistics. Regressions are estimated using firm and year fixed effects. Standard errors are clustered by firm. Robust standard errors are in parenthesis. Crisis periods are defined as 2007-2009 while non-crisis is 2000 to 2017. 2007 Figures were used in calculating lagged components.

	Debt Financing			**Equity Financing**		
	All	**Constrained**	**Unconstrained**	**All**	**Constrained**	**Unconstrained**
Financing Deficit	-0.011***	0.001	-0.012**	0.006***	0.003*	0.001
	(0.002)	(0.003)	(0.006)	(0.001)	(0.002)	(0.004)
Constant	0.223***	0.113**	0.271***	0.191***	0.039***	0.325***
	(0.003)	(0.007)	(0.006)	(0.002)	(0.005)	(0.004)
R2	0.0026	0.0050	0.0031	0.0144	0.0154	0.0111
No. of Observations	417,389	51,794	149,094	417,389	51,794	149,094
No. Of Firms	48,091	15,251	16,951	48,091	15,251	16,951
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
SE Clustered by Firm	Yes	Yes	Yes	Yes	Yes	Yes

***, **, * represent significant at 1%, 5% and 10% respectively (robust standard errors in bracket)

Table 3.4 Leverage Regression of private UK firms with Financing Deficit 2000-2017 Spike versus Off Spike Periods

The basic regression equations is $D_{it} = \alpha + \beta_1 P_{it} + \beta_2 G_{it} + \beta_3 T_{it} + \beta_4 S_{it} + \beta_5 A_{it} +$ e. *D, Leverage ratio,* is defined as the ratio of the sum of short-term loans and overdrafts, other short-term loans and long-term liabilities to total assets. *P, Return on Assets,* is ratio of EBITDA to the sum of Total assets and lagged total assets divided by 2. *Growth, G,* is the ratio of Turnover to lagged Turnover. Tangibility, T, is the ratio of the sum of tangible assets and Investments to Total assets. *Size, S,* is the natural logarithm of Total Assets. Age, A, is the Natural logarithm of number of years since date of incorporation. Computations are based on nonfinancial, non-utility and non-public sector private firms in FAME database. Sample period is 2008-2016. Size (£ Million) deflated to constant 2017 Pounds using the CPI from the World Banks World Development Index. Regressions are estimated using firm and year fixed effects. Standard errors are clustered by firm. Robust standard errors are in parenthesis. 1999 Figures were used in calculating lagged components.

	Spike			**Off-Spike**		
	All	**Constrained**	**Unconstrained**	**All**	**Constrained**	**Unconstrained**
Profitability	-0.438***	-0.557	-0.354***	-0.452***	-0.209	-0.455***
	(0.049)	(0.605)	(0.057)	(0.026)	(0.190)	(0.033)
Growth	0.020**	0.179	0.014	0.014***	0.045	0.016***
	(0.009)	(0.121)	(0.010)	(0.004)	(0.036)	(0.004)
Tangibility	0.085*	-0.946*	0.084	0.060***	-0.055	0.073***
	(0.048)	(0.501)	(0.062)	(0.021)	(0.091)	(0.025)
Size	-0.023	-0.474	0.027	-0.018**	-0.203*	0.007
	(0.018)	(0.338)	(0.020)	(0.009)	(0.117)	(0.010)
Age	0.011	-1.093	0.073	-0.018	0.020	-0.021
	(0.022)	(0.828)	(0.077)	(0.013)	(0.157)	(0.021)
Financing Deficit	0.072***	-0.600	0.045*	0.058***	0.058	0.050***
	(0.022)	(0.372)	(0.027)	(0.009)	(0.049)	(0.011)
Constant	0.490***	4.219***	0.068	0.553***	0.583***	0.443***
	(0.128)	(0.935)	(0.230)	(0.044)	(0.198)	(0.080)
R2	0.0516	0.3384	0.0342	0.0509	0.0909	0.0490
No. of Observations	9,533	178	6,910	45,818	817	31,083
No. Of Firms	2,499	104	1,760	4,973	371	3,327
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
SE Clustered by Firm	Yes	Yes	Yes	Yes	Yes	Yes

***, **, * represent significant at 1%, 5% and 10% respectively (robust standard errors in bracket)

Table 3.5 Debt and Equity Financing against Financing Deficit for private UK Huge Investments

The basic regression equations are $Df_{it} = \alpha + \beta_1 FDv_{it} + e$ for debt financing and $Ef_{it} = \alpha + \beta_1 FDv_{it} + e$ for equity financing . Where Df is a dummy variable that takes the value of one if (Leverage – Lagged Leverage) / Lagged Leverage is greater than 5% and zero otherwise. Ef is a dummy variable that takes the value of one if (Issued Capital – Lagged Issued capital) / Lagged Issued Capital id greater than 5% and zero otherwise. Leverage is defined as the sum of short-term loans and overdrafts, other short-term loans and long-term liabilities. $FD_{it} = I_{it} + Dv_{it} + WC_{it} - CFit$. I, Investment is the sum of Net Cash In (out) flow return on investment, Net Cash Out (In) flow investing activities, Capital expenditure and Financial Investment and Acquisitions and disposals divided by Total Assets. Dv, Dividends, is Equity dividends paid divided by Total Assets. WC, Working Capital is sum of Work in Progress, Trade Debtors, other current assets minus trade creditors divided by Total Assets. CF, Cash Flow is Cash and Cash Equivalents divided by Total assets. . Computations are based on nonfinancial, non-utility and non-public sector private firms in FAME database. Sample period is 2008-2016. Size (£ Million) deflated to constant 2016 Pounds using the CPI from the UK office of National Statistics. Regressions are estimated using firm and year fixed effects. Standard errors are clustered by firm. Robust standard errors are in parenthesis. We defined huge investments as any Investment more than twice the historical median investment for each firm.

	Debt Financing			**Equity Financing**		
	All	**Constrained**	**Unconstrained**	**All**	**Constrained**	**Unconstrained**
Financing Deficit	-0.093***	-0.055	-0.078**	-0.007	-0.001	0.004
	(0.027)	(0.150)	(0.033)	(0.022)	(0.008)	(0.028)
Constant	0.280***	0.572***	0.259***	0.371***	0.193***	0.432***
	(0.035)	(0.218)	(0.041)	(0.022)	(0.003)	(0.026)
R2	0.0060	0.3287	0.0054	0.0124	0.0048	0.0120
No. of Observations	9,533	178	6,910	9,533	10,780	6,910
No. Of Firms	2,499	104	1,760	2,499	6,979	1,760
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
SE Clustered by Firm	Yes	Yes	Yes	Yes	Yes	Yes

***, **, * represent significant at 1%, 5% and 10% respectively (robust standard errors in bracket)

Table 3.6 Debt and Equity Financing against Financing Deficit for private UK Regular Investments

The basic regression equations are $Df_{it} = \alpha + \beta_1 FDv_{it} + e$ for debt financing and $Ef_{it} = \alpha + \beta_1 FDv_{it} + e$ for equity financing . Where Df is a dummy variable that takes the value of one if (Leverage – Lagged Leverage) / Lagged Leverage is greater than 5% and zero otherwise. Ef is a dummy variable that takes the value of one if (Issued Capital – Lagged Issued capital) / Lagged Issued Capital id greater than 5% and zero otherwise. Leverage is defined as the sum of short-term loans and overdrafts, other short-term loans and long-term liabilities. $FD_{it} = I_{it} + Dv_{it} + WC_{it}$ - CFit. I, Investment is the sum of Net Cash In (out) flow return on investment, Net Cash Out (In) flow investing activities, Capital expenditure and Financial Investment and Acquisitions and disposals divided by Total Assets. Dv, Dividends, is Equity dividends paid divided by Total Assets. WC, Working Capital is sum of Work in Progress, Trade Debtors, other current assets minus trade creditors divided by Total Assets. CF, Cash Flow is Cash and Cash Equivalents divided by Total assets. . Computations are based on nonfinancial, non-utility and non-public sector private firms in FAME database. Sample period is 2008-2016. Size (£ Million) deflated to constant 2016 Pounds using the CPI from the UK office of National Statistics. Regressions are estimated using firm and year fixed effects. Standard errors are clustered by firm. Robust standard errors are in parenthesis. We defined huge investments as any Investment more than twice the historical median investment for each firm.

	Debt Financing			**Equity Financing**		
	All	**Constrained**	**Unconstrained**	**All**	**Constrained**	**Unconstrained**
Financing Deficit	0.000	-0.033	-0.021	0.013**	-0.023	0.011
	(0.009)	(0.032)	(0.014)	(0.007)	(0.019)	(0.009)
Constant	0.294***	0.255***	0.297***	0.394***	0.048***	0.482***
	(0.010)	(0.069)	(0.013)	(0.007)	(0.049)	(0.009)
R2	0.0053	0.0245	0.0047	0.0162	0.0638	0.0129
No. of Observations	45,818	817	31,083	45,818	817	31,083
No. Of Firms	4,973	371	3,327	4,973	371	3,327
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
SE Clustered by Firm	Yes	Yes	Yes	Yes	Yes	Yes

***, **, * represent significant at 1%, 5% and 10% respectively (robust standard errors in bracket)

Table 3.7 Leverage Regression of private UK firms with Financing Deficit: Crisis versus Non- Crisis periods 2000-2017

The basic regression equations is $D_{it} = \alpha + \beta_1 P_{it} + \beta_2 G_{it} + \beta_3 T_{it} + \beta_4 S_{it} + \beta_5 A_{it} +$ e. *D, Leverage ratio,* is defined as the ratio of the sum of short-term loans and overdrafts, other short-term loans and long-term liabilities to total assets. *P, Return on Assets*, is ratio of EBITDA to the sum of Total assets and lagged total assets divided by 2. *Growth, G*, is the ratio of Turnover to lagged Turnover. Tangibility, T, is the ratio of the sum of tangible assets and Investments to Total assets. *Size, S,* is the natural logarithm of Total Assets. Age, A, is the Natural logarithm of number of years since date of incorporation. Computations are based on nonfinancial, non-utility and non-public sector private firms in FAME database. Sample period is 2008-2016. Size (£ Million) deflated to constant 2017 Pounds using the CPI from the UK office of National Statistics. Regressions are estimated using firm and year fixed effects. Standard errors are clustered by firm. Robust standard errors are in parenthesis. Crisis periods are defined as 2007-2009 while non-crisis is 2000-2006 and 2010 to 2017.

	Financial Crisis			**Non -Financial Crisis**		
	All	**Constrained**	**Unconstrained**	**All**	**Constrained**	**Unconstrained**
Profitability	-0.265***	-0.161***	-0.304***	-0.443***	-0.289***	-0.470***
	(0.017)	(0.046)	(0.030)	(0.009)	(0.021)	(0.018)
Growth	0.005	0.005	0.003	0.015***	-0.002	0.018***
	(0.004)	(0.013)	(0.005)	(0.002)	(0.006)	(0.003)
Tangibility	0.106***	0.040	0.065**	0.147***	0.145***	0.095***
	(0.020)	(0.046)	(0.031)	(0.009)	(0.023)	(0.014)
Size	-0.028***	-0.196***	0.043***	-0.036***	-0.148***	-0.004
	(0.008)	(0.031)	(0.013)	(0.003)	(0.015)	(0.006)
Age	0.348*	0.067	0.007	-0.034***	-0.037	-0.072***
	(0.020)	(0.069)	(0.040)	(0.006)	(0.024)	(0.015)
Financing Deficit	0.046***	0.039***	0.052***	0.057***	0.038***	0.059***
	(0.007)	(0.015)	(0.011)	(0.003)	(0.008)	(0.006)
Constant	0.358***	0.045***	0.188	0.510***	0.519***	0.595***
	(0.057)	(0.132)	(0.148)	(0.015)	(0.030)	(0.053)
R2	0.0338	0.0322	0.0458	0.0562	0.0411	0.0533
No. of Observations	63,596	8,858	22,878	353,793	42,936	126,216
No. Of Firms	25,278	4,783	8,880	47,588	14,431	16,830
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
SE Clustered by Firm	Yes	Yes	Yes	Yes	Yes	Yes

***, **, * represent significant at 1%, 5% and 10% respectively (robust standard errors in bracket)

Table 3.8 Debt and Equity Financing against Financing Deficit for private UK firms during Crisis Periods

The basic regression equations are $Df_{it} = \alpha + \beta_1 FDv_{it} + e$ for debt financing and $Ef_{it} = \alpha + \beta_1 FDv_{it} + e$ for equity financing . Where Df is a dummy variable that takes the value of one if (Leverage – Lagged Leverage) / Lagged Leverage is greater than 5% and zero otherwise. Ef is a dummy variable that takes the value of one if (Issued Capital – Lagged Issued capital) / Lagged Issued Capital id greater than 5% and zero otherwise. Leverage is defined as the sum of short-term loans and overdrafts, other short-term loans and long-term liabilities. $FD_{it} = I_{it} + Dv_{it} + WC_{it}$ - CFit. I, Investment is the sum of Net Cash In (out) flow return on investment, Net Cash Out (In) flow investing activities, Capital expenditure and Financial Investment and Acquisitions and disposals divided by Total Assets. Dv, Dividends, is Equity dividends paid divided by Total Assets. WC, Working Capital is sum of Work in Progress, Trade Debtors, other current assets minus trade creditors divided by Total Assets. CF, Cash Flow is Cash and Cash Equivalents divided by Total assets. . Computations are based on nonfinancial, non-utility and non-public sector private firms in FAME database. Sample period is 2008-2016. Size (£ Million) deflated to constant 2016 Pounds using the CPI from the UK office of National Statistics. Regressions are estimated using firm and year fixed effects. Standard errors are clustered by firm. Robust standard errors are in parenthesis. Crisis periods are defined as 2007-2009 while non-crisis periods are 2000-2006 and 2010 to 2017.

	Debt Financing			**Equity Financing**		
	All	**Constrained**	**Unconstrained**	**All**	**Constrained**	**Unconstrained**
Financing Deficit	-0.013***	-0.000	-0.028**	0.002	-0.000	0.007
	(0.005)	(0.007)	(0.013)	(0.003)	(0.005)	(0.007)
Constant	0.210***	0.113***	0.250***	0.259***	0.077***	0.398***
	(0.002)	(0.004)	(0.005)	(0.001)	(0.002)	(0.002)
R2	0.0015	0.0019	0.0027	0.0028	0.0071	0.0032
No. of Observations	63,596	8,858	22,878	63,596	8,858	22,878
No. Of Firms	25,278	4,783	8,880	25,278	4,783	8,880
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
SE Clustered by Firm	Yes	Yes	Yes	Yes	Yes	Yes

***, **, * represent significant at 1%, 5% and 10% respectively (robust standard errors in bracket)

Table 3.9 Debt and Equity Financing against Financing Deficit for private UK firms during Non-Crisis Periods

The basic regression equations are $Df_{it} = \alpha + \beta_1 FDv_{it} + e$ for debt financing and $Ef_{it} = \alpha + \beta_1 FDv_{it} + e$ for equity financing . Where Df is a dummy variable that takes the value of one if (Leverage – Lagged Leverage) / Lagged Leverage is greater than 5% and zero otherwise. Ef is a dummy variable that takes the value of one if (Issued Capital – Lagged Issued capital) / Lagged Issued Capital id greater than 5% and zero otherwise. Leverage is defined as the sum of short-term loans and overdrafts, other short-term loans and long-term liabilities. $FD_{it} = I_{it} + Dv_{it} + WC_{it}$ - CFit. I, Investment is the sum of Net Cash In (out) flow return on investment, Net Cash Out (In) flow investing activities, Capital expenditure and Financial Investment and Acquisitions and disposals divided by Total Assets. Dv, Dividends, is Equity dividends paid divided by Total Assets. WC, Working Capital is sum of Work in Progress, Trade Debtors, other current assets minus trade creditors divided by Total Assets. CF, Cash Flow is Cash and Cash Equivalents divided by Total assets. . Computations are based on nonfinancial, non-utility and non-public sector private firms in FAME database. Sample period is 2008-2016. Size (£ Million) deflated to constant 2016 Pounds using the CPI from the UK office of National Statistics. Regressions are estimated using firm and year fixed effects. Standard errors are clustered by firm. Robust standard errors are in parenthesis. Crisis periods are defined as 2007-2009 while non-crisis periods are 2000-2006 and 2010 to 2017.

	Debt Financing			**Equity Financing**		
	All	**Constrained**	**Unconstrained**	**All**	**Constrained**	**Unconstrained**
Financing Deficit	-0.010***	0.000	-0.010	0.006***	0.003	0.001
	(0. 002)	(0.003)	(0.006)	(0.002)	(0.002)	(0.004)
Constant	0.224***	0.111***	0.272***	0.186***	0.039***	0.319***
	(0.003)	(0.007)	(0.006)	(0.002)	(0.005)	(0.004)
R2	0.0030	0.0059	0.0035	0.0156	0.0161	0.0118
No. of Observations	353,793	42,936	126,216	353,793	42,936	126,216
No. Of Firms	47,588	14,431	16,830	47,588	14,431	16,830
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
SE Clustered by Firm	Yes	Yes	Yes	Yes	Yes	Yes

***, **, * represent significant at 1%, 5% and 10% respectively (robust standard errors in bracket)

Figure 3.1 Financing Deficit, Debt and Equity Financing of Constrained and Unconstrained Private UK Firms 2000-2017

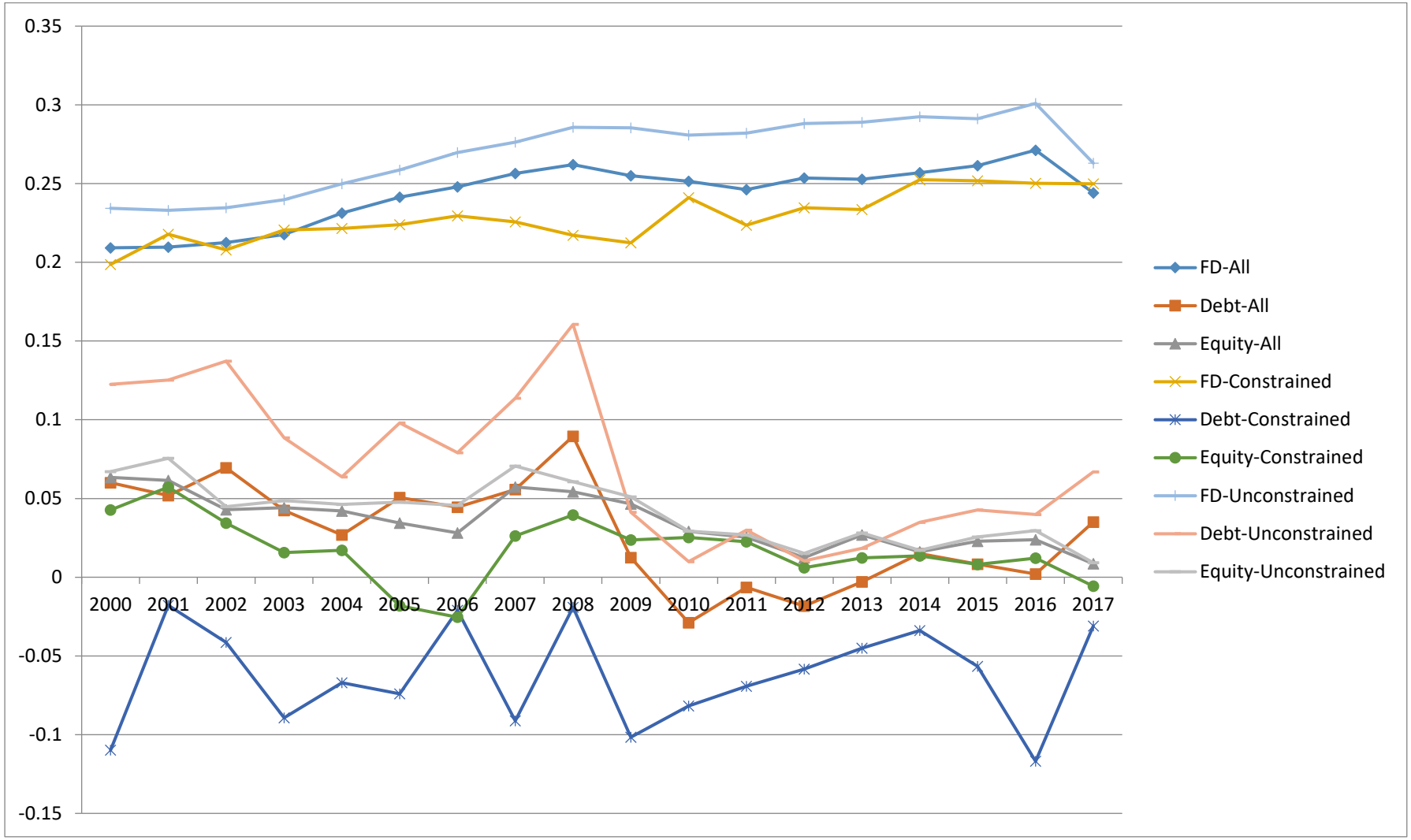
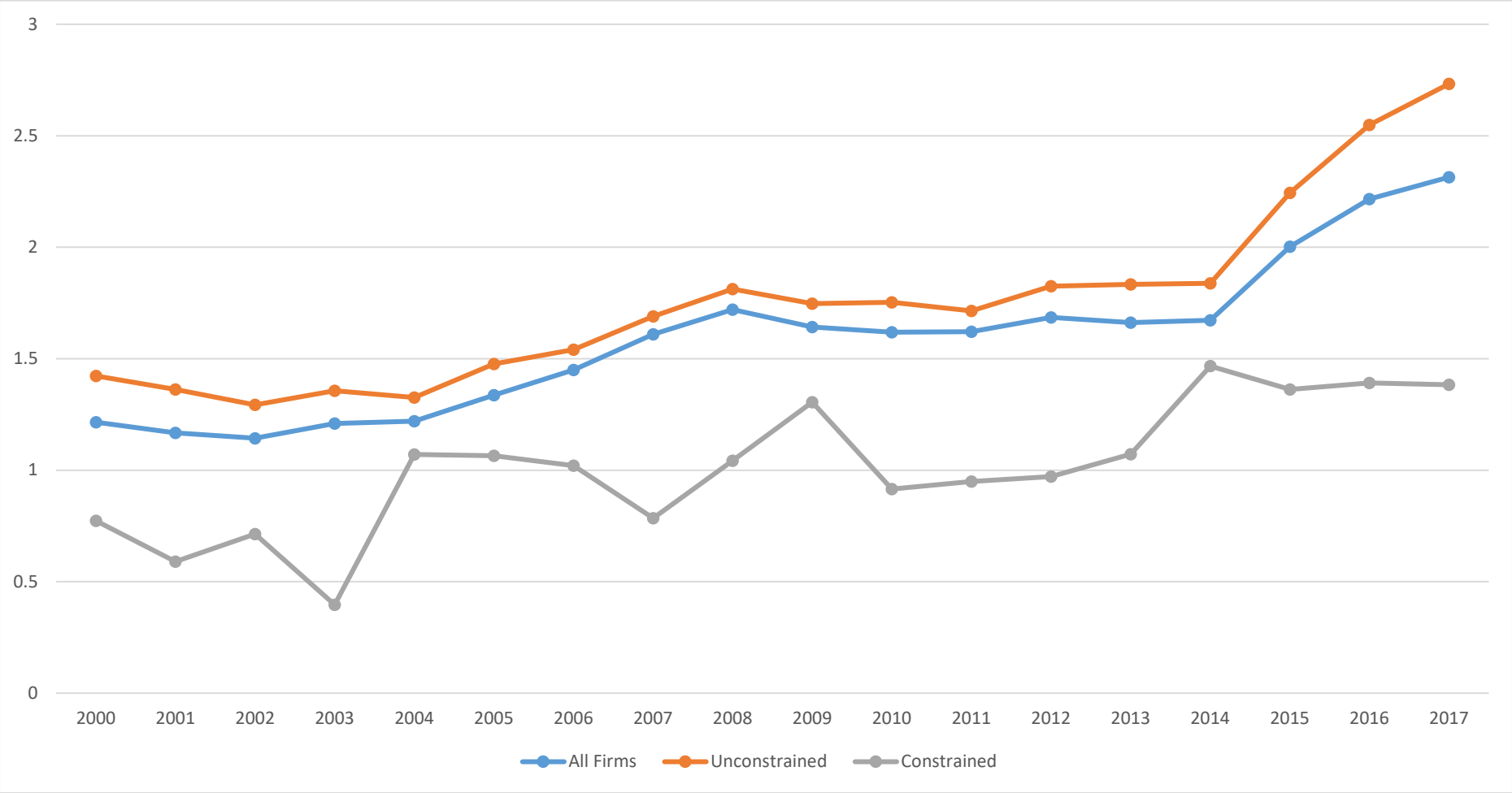


Figure 3.2 Trends in Investment Spikes for Constrained and Unconstrained Private UK Firms 2000-2017



Spike is defined as Investment / Median Investment >= 2

Table 3.10 Description of Variables

Variable	Proxy	FAME Variables
Leverage	(Short Term Loans & Overdrafts + Other Short-Term Loans + Long Term Liabilities) / Total Assets	Short Term Loans & Overdrafts (LOAN), Other Short-Term Loans (OSTL), Long Term Liabilities (NCLI), Total Assets (TOTA)
Profitability	EBITDA / ((Total Assets + lagged Total Assets)/2)	EBITDA (EBTA), Total Assets (TOTA)
Growth	Turnover / lagged Turnover	Turnover (Profit & Loss account) (TURN)
Tangibility	(Tangible Assets + Investments) / Total Assets	Tangible Assets (TASS), Investments (Fixed Assets) (INVT), Investments (Current Assets) (IOCA), Total Assets (TOTA)
Size	Natural log of Total Assets	Total Assets (TOTA)
Age	Natural log of Number of Years since incorporation	Date of incorporation (INCORDATE)
Debt Issue	Dummy variable = 1 if (Leverage – Lagged Leverage) / Lagged Leverage is greater than 5%, 0 otherwise.	As in Leverage above
Equity Issue	Dummy variable = 1 if (Issued Capital – Lagged Issued capital) / Lagged Issued Capital is greater than 5%, 0 otherwise	Issued Capital (CAPI)
Investment	(Net Cash In (Out) flow Ret. On Invest. + Net Cash Out (In) flow Investing Activ. + Capital Expenditure & Financ. Invest. + Acquisition & Disposal) / Total Assets	Net Cash In (Out) flow Ret. On Invest. (CF02), Net Cash Out (In) flow Investing Activ (CF04), Capital Expenditure & Financ. Invest. (CF07), Acquisition & Disposal (CF08), Total Assets (TOTA)
Dividend	Equity Dividends Paid / Total Assets	Equity Dividends Paid (CF09), Total Assets (TOTA)
Working Capital	(W.I.P. + Trade Debtors + Other Current Assets - Trade Creditors) / Total Assets	W.I.P. (WIPE), Trade Debtors (DEBT), Other Current Assets (OCAS), Trade Creditors (CRED), Total Assets (TOTA)
Cash Flow	Increase (Decrease) Cash & Equiv. / Total Assets	Increase (Decrease) Cash & Equiv. (CF06), Total Assets (TOTA)
Financing Deficit	Investment + Dividend + Working Capital – Cash Flow	Please see above

APPENDIX 3.B

Table 3.11.B1 Pair-wise correlation matrix

	D	P	G	T	S	A	Df	Ef	I	Dv	WC	CF	FD
D	1.00												
P	-0.31 (0.00)	1.00											
G	0.02 (0.00)	0.11 (0.00)	1.00										
T	0.14 (0.00)	0.02 (0.00)	-0.03 (0.00)	1.00									
S	0.05 (0.00)	0.07 (0.00)	0.03 (0.00)	0.21 (0.00)	1.00								
A	-0.16 (0.00)	0.03 (0.00)	-0.16 (0.00)	0.04 (0.00)	0.16 (0.00)	1.00							
Df	0.12 (0.00)	-0.07 (0.00)	0.10 (0.00)	0.05 (0.00)	0.12 (0.00)	-0.02 (0.00)	1.00						
Ef	0.01 (0.09)	-0.10 (0.00)	0.06 (0.00)	0.02 (0.00)	0.06 (0.00)	-0.03 (0.00)	0.00 (0.01)	1.00					
I	0.07 (0.00)	-0.07 (0.00)	-0.03 (0.00)	0.33 (0.00)	0.23 (0.00)	0.00 (0.01)	0.03 (0.00)	0.03 (0.00)	1.00				
Dv	-0.06 (0.00)	0.35 (0.00)	-0.03 (0.00)	-0.15 (0.00)	-0.00 (0.36)	-0.06 (0.00)	-0.03 (0.00)	-0.06 (0.00)	-0.00 (0.89)	1.00			
WC	0.06 (0.00)	0.01 (0.00)	-0.01 (0.00)	-0.41 (0.00)	0.04 (0.00)	-0.03 (0.00)	-0.00 (0.41)	-0.01 (0.00)	-0.10 (0.00)	0.15 (0.00)	1.00		
CF	-0.14 (0.00)	0.11 (0.00)	0.01 (0.00)	-0.02 (0.00)	-0.06 (0.00)	-0.00 (0.01)	-0.02 (0.00)	-0.02 (0.00)	-0.07 (0.00)	0.19 (0.00)	-0.16 (0.00)	1.00	
FD	0.12 (0.00)	-0.04 (0.00)	-0.03 (0.00)	-0.10 (0.00)	0.14 (0.00)	-0.02 (0.00)	0.02 (0.00)	0.01 (0.03)	0.29 (0.00)	0.32 (0.00)	0.82 (0.00)	-0.59 (0.00)	1.00

P values in parenthesis

Table 3.12.B2 Leverage Regression of private UK firms 2000-2017

The basic regression equations is $D_{it} = \alpha + \beta_1 P_{it} + \beta_2 G_{it} + \beta_3 T_{it} + \beta_4 S_{it} + \beta_5 A_{it} +$ e. *D, Leverage ratio,* is defined as the ratio of the sum of short-term loans and overdrafts, other short-term loans and long-term liabilities to total assets. *P, Return on Assets*, is ratio of EBITDA to the sum of Total assets and lagged total assets divided by 2. *Growth, G,* is the ratio of Turnover to lagged Turnover. Tangibility, T, is the ratio of the sum of tangible assets and Investments to Total assets. *Size, S,* is the natural logarithm of Total Assets. Age, A, is the Natural logarithm of number of years since date of incorporation. Computations are based on nonfinancial, non-utility and non-public sector private firms in FAME database. Sample period is 2008-2016. Size (£ Million) deflated to constant 2016 Pounds using the CPI from the World Banks World Development Index. Regressions are estimated using firm and year fixed effects. Standard errors are clustered by firm. Robust standard errors are in parenthesis. 1999 Figures were used in calculating lagged components.

	All	Constrained	Unconstrained
Profitability	-0.438***	-0.284***	-0.471***
	(0. 008)	(0.018)	(0.016)
Growth	0.013***	-0.001	0.015***
	(0.002)	(0.005)	(0.003)
Tangibility	0. 145***	0.151***	0.093***
	(0.008)	(0.021)	(0.013)
Size	-0.036***	-0.152***	0.000
	(0.003)	(0.013)	(0.006)
Age	-0.029***	-0.028	-0.066***
	(0.005)	(0.021)	(0.014)
Constant	0.516**	0.522	0.583***
	(0.014)	(0.027)	(0.050)
R2	0.0529	0.0390	0.0503
No. of Observations	417,389	51,794	149,094
No. Of Firms	48,091	15,251	16,951
Year Fixed Effects	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes
SE Clustered by Firm	Yes	Yes	Yes

***, **, * represent significant at 1%, 5% and 10% respectively (robust standard errors in bracket)

Table 3.13.B3 Leverage Regression of private UK firms 2000-2017 Spike versus Off Spike Periods

The basic regression equations is $D_{it} = \alpha + \beta_1 P_{it} + \beta_2 G_{it} + \beta_3 T_{it} + \beta_4 S_{it} + \beta_5 A_{it} +$ e. *D, Leverage ratio,* is defined as the ratio of the sum of short-term loans and overdrafts, other short-term loans and long-term liabilities to total assets. *P, Return on Assets,* is ratio of EBITDA to the sum of Total assets and lagged total assets divided by 2. *Growth, G,* is the ratio of Turnover to lagged Turnover. Tangibility, T, is the ratio of the sum of tangible assets and Investments to Total assets. *Size, S,* is the natural logarithm of Total Assets. Age, A, is the Natural logarithm of number of years since date of incorporation. Computations are based on nonfinancial, non-utility and non-public sector private firms in FAME database. Sample period is 2008-2016. Size (£ Million) deflated to constant 2017 Pounds using the CPI from the World Banks World Development Index. Regressions are estimated using firm and year fixed effects. Standard errors are clustered by firm. Robust standard errors are in parenthesis. 1999 Figures were used in calculating lagged components.

	Spike			**Off-Spike**		
	All	**Constrained**	**Unconstrained**	**All**	**Constrained**	**Unconstrained**
Profitability	-0.442***	-0.418	-0.354***	-0.462***	-0.203	-0.466***
	(0.049)	(0.574)	(0.057)	(0.026)	(0.190)	(0.033)
Growth	0.019**	0.120	0.013	0.012***	0.047	0.015***
	(0.009)	(0.115)	(0.010)	(0.004)	(0.036)	(0.004)
Tangibility	0.100**	-0.741	0.091	0.069***	-0.027	0.073***
	(0.048)	(0.542)	(0.064)	(0.021)	(0.088)	(0.025)
Size	-0.023	-0.354	0.028	-0.017**	-0.204*	0.009
	(0.018)	(0.378)	(0.020)	(0.009)	(0.017)	(0.010)
Age	0.014	-0.934	0.076	-0.013	0.033	-0.015
	(0.047)	(0.839)	(0.077)	(0.013)	(0.156)	(0.021)
Constant	0.511***	3.477***	0.068	0.551***	0.571***	0.438***
	(0.128)	(0.955)	(0.230)	(0.044)	(0.197)	(0.080)
R2	0.0485	0.3141	0.0342	0.0478	0.0870	0.0466
No. of Observations	9,533	178	6,910	45,818	817	31,083
No. Of Firms	2,499	104	1,760	4,973	371	3,327
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
SE Clustered by Firm	Yes	Yes	Yes	Yes	Yes	Yes

***, **, * represent significant at 1%, 5% and 10% respectively (robust standard errors in bracket)

Table 3.14.B4 Leverage Regression of private UK firms: Crisis versus Non- Crisis periods 2000-2017

The basic regression equations is $D_{it} = \alpha + \beta_1 P_{it} + \beta_2 G_{it} + \beta_3 T_{it} + \beta_4 S_{it} + \beta_5 A_{it} +$ e. *D, Leverage ratio,* is defined as the ratio of the sum of short-term loans and overdrafts, other short-term loans and long-term liabilities to total assets. *P, Return on Assets,* is ratio of EBITDA to the sum of Total assets and lagged total assets divided by 2. *Growth, G,* is the ratio of Turnover to lagged Turnover. Tangibility, T, is the ratio of the sum of tangible assets and Investments to Total assets. *Size, S,* is the natural logarithm of Total Assets. Age, A, is the Natural logarithm of number of years since date of incorporation. Computations are based on nonfinancial, non-utility and non-public sector private firms in FAME database. Sample period is 2008-2016. Size (£ Million) deflated to constant 2017 Pounds using the CPI from the UK office of National Statistics. Regressions are estimated using firm and year fixed effects. Standard errors are clustered by firm. Robust standard errors are in parenthesis. Crisis periods are defined as 2007-2009 while non-crisis is 2000-2006 and 2010 to 2017.

	Financial Crisis			**Non -Financial Crisis**		
	All	**Constrained**	**Unconstrained**	**All**	**Constrained**	**Unconstrained**
Profitability	-0.266*** (0. 017)	-0.159*** (0.046)	-0.307*** (0.030)	-0.448*** (0. 009)	-0.288*** (0.021)	-0.480*** (0.018)
Growth	0.004 (0.004)	0.005 (0.013)	0.002 (0.005)	0.013*** (0.002)	-0.001 (0.006)	0.017*** (0.003)
Tangibility	0.108*** (0.020)	0.043 (0.046)	0.065** (0.031)	0.144*** (0.009)	0.145*** (0.023)	0.092*** (0.014)
Size	-0.028*** (0.008)	-0.197*** (0.031)	0.044*** (0.013)	-0.035*** (0.003)	-0.149*** (0.015)	-0.001 (0.006)
Age	0.362* (0.020)	0.066 (0.069)	0.010 (0.040)	0.031*** (0.006)	0.034 (0.024)	-0.065*** (0.015)
Constant	0.366** (0.057)	0.045*** (0.132)	0.186*** (0.148)	0.514*** (0.015)	0.522*** (0.030)	0.580*** (0.053)
R2	0.0311	0.0301	0.0422	0.0532	0.0395	0.0499
No. of Observations	63,596	8,858	22,878	353,793	42,936	126,216
No. Of Firms	25,278	4,783	8,880	47,588	14,431	16,830
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
SE Clustered by Firm	Yes	Yes	Yes	Yes	Yes	Yes

***, **, * represent significant at 1%, 5% and 10% respectively (robust standard errors in bracket)

Table 3.15.B5 Diagnostic Test – Hausman Test

The basic regression equations is $D_{it} = \alpha + \beta_1 P_{it} + \beta_2 G_{it} + \beta_3 T_{it} + \beta_4 S_{it} + \beta_5 A_{it} +$ e. *D, Leverage ratio,* is defined as the ratio of the sum of short-term loans and overdrafts, other short-term loans and long-term liabilities to total assets. *P, Return on Assets*, is ratio of EBITDA to the sum of Total assets and lagged total assets divided by 2. *Growth, G*, is the ratio of Turnover to lagged Turnover. Tangibility, T, is the ratio of the sum of tangible assets and Investments to Total assets. *Size, S,* is the natural logarithm of Total Assets. Age, A, is the Natural logarithm of number of years since date of incorporation. Computations are based on nonfinancial, non-utility and non-public sector private firms in FAME database. Sample period is 2008-2016. Size (£ Million) deflated to constant 2016 Pounds using the CPI from the World Banks World Development Index. Regressions are estimated using firm and year fixed effects. Standard errors are clustered by firm. Robust standard errors are in parenthesis. 1999 Figures were used in calculating lagged components.

	(b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E
Profitability	-0.43369	-0.49421	0.060525	0.000822
Growth	0.013545	0.013864	-0.00032	0.000188
Tangibility	0.147175	0.181566	-0.03439	0.001651
Size	-0.0377	-0.01517	-0.02253	0.000616
Age	-0.03189	-0.07477	0.042873	0.001879
Financing Deficit	0.05426	0.066852	-0.01259	0.00049

b = consistent under Ho and Ha; obtained from xtreg

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

Test: Ho: difference in coefficients not systematic

chi2(23) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 8297.99

Prob>chi2 = 0.0000
(V_b-V_B is not positive definite)

Table 3.16.B6 Diagnostic Test – Wooldridge test for autocorrelation in panel data

The basic regression equations is $D_{it} = \alpha + \beta_1 P_{it} + \beta_2 G_{it} + \beta_3 T_{it} + \beta_4 S_{it} + \beta_5 A_{it} +$ e. *D, Leverage ratio,* is defined as the ratio of the sum of short-term loans and overdrafts, other short-term loans and long-term liabilities to total assets. *P, Return on Assets*, is ratio of EBITDA to the sum of Total assets and lagged total assets divided by 2. *Growth, G*, is the ratio of Turnover to lagged Turnover. Tangibility, T, is the ratio of the sum of tangible assets and Investments to Total assets. *Size, S,* is the natural logarithm of Total Assets. Age, A, is the Natural logarithm of number of years since date of incorporation. Computations are based on nonfinancial, non-utility and non-public sector private firms in FAME database. Sample period is 2008-2016. Size (£ Million) deflated to constant 2016 Pounds using the CPI from the World Banks World Development Index. Regressions are estimated using firm and year fixed effects. Standard errors are clustered by firm. Robust standard errors are in parenthesis. 1999 Figures were used in calculating lagged components.

H0: no first-order autocorrelation

F(1, 39061) = 5379.262

Prob > F = 0.0000

Table 3.17.B7 Diagnostic Test – Modified Wald test for groupwise heteroscedasticity in fixed effect regression model

The basic regression equations is $D_{it} = \alpha + \beta_1 P_{it} + \beta_2 G_{it} + \beta_3 T_{it} + \beta_4 S_{it} + \beta_5 A_{it} +$ e. *D, Leverage ratio,* is defined as the ratio of the sum of short-term loans and overdrafts, other short-term loans and long-term liabilities to total assets. *P*, *Return on Assets*, is ratio of EBITDA to the sum of Total assets and lagged total assets divided by 2. *Growth, G*, is the ratio of Turnover to lagged Turnover. Tangibility, T, is the ratio of the sum of tangible assets and Investments to Total assets. *Size, S*, is the natural logarithm of Total Assets. Age, A, is the Natural logarithm of number of years since date of incorporation. Computations are based on nonfinancial, non-utility and non-public sector private firms in FAME database. Sample period is 2008-2016. Size (£ Million) deflated to constant 2016 Pounds using the CPI from the World Banks World Development Index. Regressions are estimated using firm and year fixed effects. Standard errors are clustered by firm. Robust standard errors are in parenthesis. 1999 Figures were used in calculating lagged components.

H0: sigma(i)^2 = sigma^2 for all i

chi2 (48091) = 3.7e+39
Prob>chi2 = 0.0000

Chapter 4 Excess Cash Holdings and Corporate Firms in major European Economies

4.1 INTRODUCTION

The issue of firms holding seemingly more cash than is thought to be required has been a subject of interest to many scholars. Iskandar-Datta and Jia (2012) carrying out a cross country analysis of trends in cash holdings, found that there is a near systemic uptrend in cash holdings. J.P. Morgan Corporate Finance Advisory, (2015) also suggested that high cash balances are mainly attributable to large profitable firms, the slow economic growth, the recent financial crisis and tax considerations and concluded that more efforts should be geared towards effective management of excess cash. On the other hand, Azar, Kagy and Schmalz, (2016) argue that, when costs of holding cash are adjusted for, the cash holdings of firms in their sample are not unusually larger than previously concluding that cost of holding cash was a major determinant of level of liquid assets that firms hold.

In the light of the above conflicting results, the paper will attempt an empirical analysis of the cash holding patterns of EU firms. We test empirically some aspects of the theoretical analysis by Harris and Raviv (2017) and further extend the analysis to examine scenarios where a combination of high levels of excess cash and high debt levels occur simultaneously as per Huang, Instefjord and Shen (2016). We will also examine different quartiles of excess cash holdings and compare the major determinants of excess cash across quartiles of excess cash and turnover growth.

Harris and Raviv (2017) suggested that huge cash holdings are more associated with firms in the middle brackets of growth opportunities as firms in the top and bottom brackets will normally not keep excess cash. We carry out an empirical analysis of their theoretical model by regressing excess cash holdings against relevant proxies for information asymmetry, growth, asset value, costs of holding cash, current levels of investment and other control

variables. Our analysis is carried out in a number of groupings. We first combine all EU firms together and then analyse the five largest EU economies separately. We then consider all EU high technology firms in a separate analysis. This is due to a greater likelihood that they hold more cash than firms in other industries.

Our findings indicate that uniform determinates of excess cash holdings across all groupings are Size and earnings (negative). Other determinants, which are economically less so, are Research and Development Expense – our proxy for information asymmetry (positive), Market to Book Ratio – our proxy for growth opportunities and Cost of Carry (negative). The fact that results for cost of carry and debt vary across groupings points to the influence of the existing interest rate regimes in particular countries on the excess cash holdings of firms in those countries.

We also analyse all firms in various quartiles of excess cash and find that, across all quartiles, size and debt are a negative and significant determinant of excess cash. This is similar to results for all firms considered together. Cost of carry is uniformly negative and significant except for the first quartile which is not statistically significant. Market to book ratio is uniformly negative but only significant at the second and third quartile of excess cash holdings. Research and development expense is only positive and significant at the top quartile of excess cash suggesting the influence of group of firms with the highest levels of excess cash when all firms are considered together. It will thus appear that, apart from size, the key determinants of excess cash depend on the quartile of excess cash holdings a firm falls in any given year.

When terciles of turnover growth are considered, it appears that, size and earnings (negative) and research and development (positive) are fairly consistent across terciles of turnover growth as key determinants of excess cash. However, the significance of other variables considered depends on the tercile of turnover growth a firm falls in any given year. We show that the

middle tercile has the greatest number of significant variables and greatest explanatory power. This is consistent with Harris and Raviv (2017) who alluded to this when they showed that only firms in the middle range of opportunities will hold excess cash.

Finally, when different combinations of relative high debt and high excess cash are considered, it appears that High Debt-High Excess cash firms are quite different from High Debt-Low Excess cash firms. While Research and development expense is a positive determinant of excess cash for High debt low excess cash firms it is negative and not a significant determinant for high debt low excess cash firms. CAPEX is a highly significant determinant of excess cash for high debt high excess cash firms, statistically and economically. This is however not the case for High debt low excess cash firms. This suggests that High Debt High excess cash firms invest heavily in research and development and CAPEX which accounts for the unusual combination of a simultaneous high level of debt and excess cash.

The rest of the paper will start with an examination of related studies. This will be followed by a brief outline of methodological approach of the paper. Subsequently, we will carry out an analysis of empirical estimates followed by an interim conclusion to the paper.

4.2 LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

A number of studies have related cash holdings and or excess cash holdings to a number of factors with mixed results. Identified factors include Financing Constraints and Hedging (Acharya, Almeida & Campello, 2007); Business cycles and volume of long-term debt (Anderson and Carverhill, 2012); Cost of carry (Azar, Kagy and Schmalz, 2016); Level of variation in cash flows (Bates, Kahle and Stulz, 2009) and Financing Frictions (Decamps et al (2011).

Bigelli and Sanchez-Vidal (2012) examined cash holding in Italian private firms based on the AIDA database. According to them, cash holdings is related with smaller size, higher risk and lower effective tax rate (TOT), longer cash conversion cycles and lower financing deficits

(POT). Furthermore, they held that more dividends resulted in more cash holdings and that Bank debt and net working capital are good substitutes for cash. Cash rich firms are more profitable, pay more dividends and have medium term investment horizon. Our analysis will go beyond examining determinants of cash to key drivers of determinants of excess cash across different groupings of firms.

Chen and Chuang (2009) examined the link between corporate governance and cash holdings with a special focus on growing firms. Their sample was High tech firms on the NASDAQ exchange. According to them CEO ownership, directorship of venture capitalists and independent directors play crucial roles in cash policy. They found that effect of corporate governance on cash holdings was more significant in younger firms while effect of firm specific economic variables in older firms. Like Chen and Chuang (2009), we include a number of firm specific variables while at the same time extending the analysis to cover all non-financial, non-utility firms in our selected database.

Davidson (2016), writing in a New York Times Article argued that the possible reasons for firms holding huge cash including, precautionary motives, tax benefits and funding acquisitions do not adequately explain current levels of cash holdings. He therefore examined other reasons including Agency problems which could be restricted by market discipline. This, according to him, is however industry specific. We carry out our analysis clustering by industry to partly address industry specific characteristics in our sample.

Harris and Raviv (2017), examined various motives for holding cash in prior literature and concluded that the agency theory was inaccurate in explaining cash holdings. They held that the precautionary motive was a better rationale and that asymmetric information was the key driver of this motive. In their theory paper, they argued that Excess cash is held mainly by firms in the middle range of growth opportunities and not so much by firms on either extreme.

Furthermore, Excess cash is a function of level of information asymmetry, growth opportunities, assets value, and cost of holding cash. Our paper will attempt an empirical analysis by carrying out a regression of excess cash against the identified key variables based on our selected sample. Furthermore, we will carry out our analysis by comparing results across terciles of turnover growth in order to see if the middle group dominates.

Huang-Meier, Lambertides and Steeley (2016) examined effects of CEO optimism on cash holdings. According to them optimistic managers are reluctant to hold external funds. Furthermore, they found no evidence of a connection between optimistic managers' cash hoarding and debt conservatism. Thus, the concluded that Optimistic managers hold relatively more cash in periods of economic downturn.

Iskandar-Datta and Jia (2012), in carrying out a cross country analysis of trends in cash holdings, found that there is a near systemic uptrend in cash holdings. According to them, different factors are responsible for this uptrend. In countries like Canada, France, UK and US time varying firm characteristics were the driving force while. Agency problems accounted for that of Germany, while Shallow private credit markets explained Australia. We will therefore be including a number of time varying firm characteristics in carrying out our analysis.

Opler et al (1999) in examining determinants of corporate cash holdings found evidence supportive of a static trade-off model of cash holdings. According to them, High Cash to total non-cash assets led to strong growth opportunities and riskier Cash Flows. They also found that increased profitability led to a more than proportionate level of cash holdings. They found limited evidence of impact on capex, acquisitions and pay-outs and concluded that changes in cash mainly caused by losses. We will adopt that method of calculating excess cash in our analysis the same method used by Huang and Mazouz (2018).

Ferreira and Vilela (2004) attempted an analysis of firms' cash holding choices. According to them Cash Holding was positively related to Investment opportunities and Cash flows and negatively related to asset liquidity, leverage, size, Bank debt, investor protection and capital market development. We extend the analyses by examining the determinants of excess cash holdings across different for all firms and across different combinations of high debt and excess cash.

4.2.1 HYPOTHESIS DEVELOPMENT

We examine a couple of implications following from the literature. The first one is based on the theoretical study of Harris and Raviv (2017).

Implication 1: Firms in the middle tier of investment opportunities will have more excess cash holdings than their other counterparts

Harris and Raviv (2017) argued that firms in the lower rung of investment opportunities will hold relatively less excess cash when compared to their counterparts in the middle tier of excess cash holdings. According to them, one of the major reasons to hold excess cash is to take advantage of impending investment opportunities. Similarly, firms in the upper levels of investment opportunities will also hold relatively less excess cash compared to their middle tier counterparts as cash will be immediately expended to execute the high levels of investment opportunities as they arise. Thus, we will expect that in a regression of excess cash against a number of variables, as detailed in our methodology section, middle tier firms will dominate the others in terms of the significance and/or magnitude of these variables as determinants of excess cash holdings.

Implication 2: Firms with a simultaneous combination of high debt and high excess cash will differ from other firms with high debt and low excess cash in terms of major factors affecting excess cash holdings.

The existence of firms that simultaneously hold high levels of debt and excess cash is somewhat puzzling as one should expect that, given the relative costs of holding debts and excess cash, this should normally not occur (Huang, Instefjord and Shen 2016). We will therefore expect that such firms will differ in some respects to firms who do the more logical alternative of holding high debt and low excess cash. Thus we will expect that in a regression of excess cash against a number of variables, as detailed in our methodology section, firms who simultaneously hold high levels of debt and excess cash will differ from firms who hold high debt and low excess cash in terms of the significance and/or magnitude of these variables as determinants of excess cash holdings.

4.3 METHODOLOGY

Our data is sourced from all publicly listed non-financial and non-utility firms in the Compustat database from 2002 to 2016. This period was chosen to enable us observe dynamics across different interest rate regimes. To calculate cost of carry we source 3-month short term interest rates from the UK Data Service International aggregate data while stock prices are sourced from Compustat Securities Daily. We exclude all Financial (SIC 6000-6999) and Utility (4900-4999) firms based on the peculiar nature of their financing mix (Opler et all, 1999). Variables are winsorized at the 1st and 99th percentile to take care of outliers.

We begin the analysis by running a regression of Cash against determinants identified in literature as follows;

$$CH_{it} = a + \beta_1 E_{it} + \beta_2 D_{it} + \beta_3 M_{it} + \beta_4 S_{it} + \beta_5 W_{it} + \beta_6 C_{it} + \beta_7 Dv_{it} + \beta_8 R_{it} + e_{it} \qquad (1)$$

Where, *CH*, Cash Holdings, is defined as Natural Log of ratio of Cash and Short-Term Investments to Net Assets. E, Net Earnings = (Earnings before Interest – Interest and related expenses – Income Taxes – Dividends) / Net Assets. D, Debt = (Long Term Debt + Debt in Current Liabilities) / Net Assets. M, Market to Book Ratio = [(Total Assets – Total Common and Ordinary Equity) + (Common Shares Outstanding * Market Price)] / Total Assets. S, Size

is the natural log of CPI adjusted Net Assets. W, Net Working Capital = (Working Capital – Cash) / Net Assets. C, CAPEX, is ratio of Capital Expenditure to Net Assets. Dv, Dividend, is a dummy variable that takes the value of 1 if Dividend > 0 and 0 otherwise.

We then designate the residual of this regression as excess cash and run a regression as follows;

$$ECH_{it} = a + \beta_1 R_{it-1} + \beta_2 M_{it-1} + \beta_3 S_{it-1} + \beta_4 CC_{it-1} + \beta_5 E_{it-1} + \beta_6 D_{it-1} + \beta_7 W_{it-1} + \beta_8 C_{it-1} + \beta_9 Dv_{it-1} + e_{it} \quad (2)$$

Where, CC, Cost of Carry = (Cash and Short-Term Investments * 3 Month Short Term Interest Rates) / Net Assets. (Azar, Kagy and Schmalz, 2016). Other Variables are lags of variables defined in Equation 1 above. Table 4.9.C1 provides a more detailed description of variables.

We repeat the analysis for firms in various terciles of turnover growth, quartiles of Excess Cash Holdings and across various combinations of High Debt and High Excess cash and compare results. High Tech Firms are classified using optimal SIC code classifications by Kile and Phillips (2009).

4.4 PRESENTATION AND ANALYSIS OF RESULTS

4.4.1 Descriptive Statistics

An analysis of Descriptive statistics and results of regression estimates will be carried out in this section. Table 4.1 show descriptive statistics related to cash holdings of publicly listed EU firms while Figure 4.1 shows the level of excess cash holdings of firms across different countries of the EU.

Table 4.1, shows that the ratio of Cash to Net Assets is on average 0.41. This varies across major European economies from 0.13 in Spain to 0.58 in the UK. On average, High Technology Firms have a higher ratio of 0.69. The average earnings ratio is -0.06 of net assets probably due to the negative skewness of earnings. Median earnings are however a positive 7% of net assets. Excess cash is 0.24 on the Average ranging from 0.14 for Italy to a much higher 0.38 for UK

firms with High Technology firms having a 0.41 average. Figure 4.1 shows trends in Excess cash holdings across the different groupings. Earnings ratio varies across the major economies from -0.17 in UK to 0.05 in Spain. High Tech Firms on the Average have -0.19 earnings ratio. Debt to Net Assets ratio is on the Average 0.22 ranging from 0.19 in the UK to 0.34 in Spain with High Technology firms averaging 0.18. It will thus appear that, amongst the major economies, countries with the lowest level of debt also have the highest level of cash on the average. Working Capital ranges from -0.03 in Spain to 0.07 in Germany with an average of 0.02 for all EU countries included in the sample. The figure for High Technology companies is on the average -0.02. CAPEX is fairly similar across the major economies and is on the average 0.05 of Net Assets. The ratio of Research and Development Expenses to Net Assets is on the average 0.44 ranging from 0.04 in Italy to 1.09 in France. High Technology Companies have a ratio double that of the average at 0.88. The Cost of holding Cash is on the average 0.72 within the sample. However, this is largely due to the high cost of 1.56 of the UK compared to 0.06 of Spain and 1.18 for High Technology firms across the region. The High Average cost for the UK is directly related to the relatively higher levels of cash holding. Market to Book Ratio is an average of 1.92 ranking from 1.40 in Italy to 2.32 in the UK with All High Technology Firms being 2.40. It is thus not surprising that UK firms in our sample appear to hold more cash to take advantage of their higher levels of investment opportunities during the period. Net assets of firms are $2,910.27 on the average. While it is $1,525.28 for UK firms the amount is $5,571.27 for Italian Firms. We will attempt to examine the effects of high leverage on the determinants of excess cash by running a separate regression of firms in the top quartile of debt to net asset ratios. We will proceed by carrying out a preliminary analysis of regression estimates.

4.4.2 Analysis of Regression Estimates.

As per Opler et al (1999) and Huang and Mazouz (2018) we begin the analysis by running a regression of cash again a number of independent variables as per equation 1 and the results are presented in Table 4.2. Based on our sample, it can be observed that the key determinants of cash are earnings, debt, Size, Working Capital, Capex and Research and Developments Expenses. While Earnings, Debt, Size and Working Capital are negative and significant determinants of cash. CAPEX and Research and development expense is a positive and significant determinant. This is exactly mirrored by EU High Tech Firms and UK firms included in the sample. However, for UK firms Market to Book ratio is also slightly significant. The strongest uniform determinant across the major EU countries is Size. Working Capital is uniformly negative and significant except for Spain and Italy. Our key interest is in analysing excess cash and therefore we proceed with the analysis by obtaining the residual of the above regressions and running a separate regression against determinants of excess cash as per equation 2. Results are presented from Table 4.3 onwards.

4.4.2.1 Excess Cash Holdings

We run a series of estimates, first with lags of key variables identified by Harris and Raviv (2017) as in our earlier equation to minimize endogeneity issues as doing otherwise will mean the same set of variables are used in both regression estimates. In Table 4.3, Column 1 details regression estimates for all countries combined. It can be observed that while Research and development expense and Cost of carry are positive and significant determinant of Excess cash, Size, Earnings and Debt are negative determinants. We carry out separate regressions for the five major European Economies as well as for all European High Technology firms combined. A uniform result across all groupings is Size which is negative and significant across the board. Earnings are generally negative and significant except for Italy and Spain where it is not statistically significant. While Research and development is uniformly positive across all groups, it is not statistically significant for France, Spain and High-Tech Companies. Results

for the other variables are mixed. The closest approximation to the combined results presented in Column 1 are for the UK and High Technology firms. These are also the two groups with relatively higher cash and excess cash holdings which probably explains the difference with other groups in our study. We proceed with the analysis by carrying out the same regression on various quartiles of Excess cash and comparing determinants across quartiles as presented in Table 4.4. We present results for all countries combined together.

A common determinant across all quartiles is Size which is a negative and significant determinant of Excess cash across all four quartiles of excess cash as well as for all firms considered together. Research and development Expense is positive and significant at the 4th quartile and for all firms combined. Market to Book ratio is negative across all quartiles but only significant at the 2nd and 3rd quartiles of excess cash when all firms are considered together. Economic significance at all levels is however small. Cost of Carry is positive and significant at the 4th quartile of excess cash and when all firms are considered together. It is however, slightly negative at the 2nd and 3rd Quartiles. Earnings is negative and significant only at the 4th quartiles and for all firms combined. It is however positive at the 2nd quartile. Except for the 4th quartile, working capital is uniformly negative but is only significant at the 2nd quartile of excess cash.

Thus, apart from size and debt, which are uniformly negative and significant across all quartiles of excess cash, the results indicate varying influences of the key determinants across quartiles. For the first quartile key determinants are size and debt which are both negative and significant. While Market to Book Ratio, Size, Cost of Carry, Debt and Working Capital are negative determinants of excess cash in the 2nd quartile, Earnings is positive. For the 3rd quartile, key determinants are Market to Book Ratio, Size, Cost of carry and Debt which are all negative and significant determinants of excess cash. Finally, the 4th quartile has research and development expense and cost of carry as positive determinants while size, earnings and debt

are negative determinant. It will thus appear that, apart from size, the key determinants of excess cash depend on the quartile of excess cash holdings a firm falls in in any given year. Next, we examine the influence of different levels of turnover growth on excess cash holdings.

4.4.2.2 Excess Cash and Turnover Growth

One of our key areas of interest is how levels of growth opportunities affect the amount of Excess cash held. We use turnover growth over the previous year to demarcate into three groups of growth and examine the behaviour of determinants of excess cash under these scenarios. According to Harris and Raviv (2017), we would expect that the changes in variables in the middle group, determine the level of excess cash holdings to a larger extent than the other two groupings. The Results are presented in Table 4.5.

Again, we see that across all groups size is a negative and significant determinant of Excess cash as well as for all firms considered together. Earnings is similarly negative and significant across all groupings. Research and development Expense is uniformly positive and significant except for the first group. However, the economic magnitude is greatest for the middle group. Cost of Carry is uniformly positive and significant for all but the first group of firms, the magnitude of the second group is again slightly more than the others. Debt is negative and significant only at the middle group. This is also the case when all firms are combined together. Like debt, working capital is a negative and significant determinant of excess cash holdings only at the middle tercile of the groupings.

Thus, apart from size and earnings which are uniformly negative and significant across all terciles of turnover growth, the results indicate varying key determinants across terciles. For the first tercile, key determinants are Size and Earnings which are both negative and significant. While Size, Earnings, Debt and Working Capital are negative determinants of excess cash in middle tercile, Research and Development and Cost of Carry are positive. For the third tercile, key determinants of excess cash are Research and Development Expense and Cost of Carry

which are positive while Size, and Earnings are negative. It will thus appear that, apart from size and earnings which are fairly consistent across all groups, the key determinants of excess cash also depend on the group of turnover growth a firm falls in in any given year. As indicated by Harris and Raviv (2017) results suggest that changes in variables in the middle group, determine the level of excess cash holdings to a larger extent than the other two groupings.[2] We isolate High Technology and UK firms for further examination as our descriptive statistics indicate a higher level of excess cash holdings for these two groupings. Results are presented in Tables 4.6 and 4.7 below.

Results are somewhat similar to those for all firms. For the first tercile, key determinants are Size and Earnings which are both negative and significant. In this case, dividends are also positive and slightly significant. For High Technology firms, as with all firms combined, Size, Earnings, Debt and Working Capital are negative determinants of excess cash in middle tercile of Firms. However, in this instance, CAPEX and is positive and significant determinant while Research and Development and Cost of Carry, though positive are not significant. For the third tercile, key determinants of excess cash are Research and Development Expense and Cost of Carry which are positive while Size and Earnings are negative. Again, we see an indication that results suggest that changes in variables in the middle group, determine the level of excess cash holdings to a larger extent than the other two groupings.

When UK firms are considered in isolation, for the first group of firms, key determinants are Size and Earnings which are both negative and significant. However, in this instance CAPEX is also negative and significant while Research and Development is positive. For UK firms in the middle group, while Size, CAPEX, Earnings and Debt are negative determinants of excess

[2] This analysis was repeated by classifying firms into three different groupings using other criteria suggested by Harris and Raviv (2017). Criteria used include amount of CAPEX, Assets, Market to Book ratio and research and development expenses. Results are presented in Appendix C3 to C6. It appears that the clearest support for the dominance of variables in the middle grouping as determinants of Excess Cash holdings of Firms is when Turnover is used as the separator.

cash, Research and Development is positive. For the 3rd group, key determinants of excess cash are Research and Development Expense and Cost of Carry which are positive while Size is negative. This also points to the suggestion by Harris and Raviv (2017) that changes in variables in the middle group, determine the level of excess cash holdings to a larger extent than the other two groupings. We are also interested in why firms will hold a high level of Excess Cash and Debt at the same time. We therefore proceed with the analysis by examining various combinations of Debt and Excess Cash holdings.

4.4.2.3 High Debt Levels and Excess Cash

We proceed with the analysis by examining the simultaneous occurrence of relatively high debt levels and high Excess Cash. We do this by examining firms who are simultaneously in the Top Quartile of Debt to Net Assets ratio as well as the Top Quartile of Excess Cash Holdings. We compare this with firms with varying combinations of debt and excess. Results are presented in Table 4.8.

Results indicate that key determinants of excess cash holdings for High Debt-High Excess cash Firms are Research and Development, Size and CAPEX. These are all negative and significant except for Research and Development expenses. CAPEX has the highest level of economic magnitude for this group of firms. When firms with High Debt-Low Excess Cash are considered, Size and Earnings appears to be negative and significant determinants. For Firms with Low Debt-Low Excess Cash, Research and Development is a positive determinant while size, cost of carry and debt are negative determinants of level of Excess cash holdings for firms included in our sample. Finally, for firms Low Debt-High Excess Cash, research and development and cost of carry are positive determinants while size and earnings are negative. When these different groups are compared, research and development is generally a positive and significant determinant except for High Debt Low-Excess cash firms. Size is uniformly negative and significant across all groups with the highest magnitude being for Low Debt-Low

Excess Cash Firms. Earnings is also a uniformly negative determinant. However, it is not statistically significant for High Debt – High Excess Cash and Low Debt – Low Excess Cash Firms. Other variables have mixed results across the groupings. While cost of carry is a slightly negative determinant for Low Debt- Low Excess Cash Firms. It is positive and highly significant for Low Debt- High Excess Cash Firms. It is not significant for the other groups. CAPEX is only significant for High Debt and High Excess Cash firms with a relatively high economic magnitude. Debt is only significant for Low Debt – Low Excess Cash Firms but only slightly so. Thus, it appears that there are differences in the magnitude and significance of variables determining the level of Excess cash holdings in these different groupings with key similarities being the influence of size and to lesser extent earnings. Results from our key group of interest, High Debt High Excess Cash firms, suggests that Research and Development Expenses and CAPEX are the key drivers for holding the unusual combination of high debt and high excess cash simultaneously.

4.5 CONCLUSION

This paper has examined excess cash holdings of corporate firms in major European Economies. Results indicate that key determinants of Excess cash when all EU firms are considered together are, Earnings (negative), Size (negative), Debt (negative), Cost of Carry (positive) and Research and Development Expenses (positive). However, when considered separately, High Technology Firms across the sample and UK firms in isolation most closely approximate to the combined EU results. This is probably due to the relatively high levels of excess cash holdings of these two groupings.

However, where all firms are analysed by quartiles of excess cash, a uniform result is that Size and Debt are negative and significant determinant of Excess cash across all four quartiles of excess cash. This is also the case when all firms are considered together. It will thus appear

that, apart from size and debt, the key determinants of excess cash depend on the quartile of excess cash holdings a firm falls in any given period.

As suggested by Harris and Raviv (2017), when terciles of turnover growth are considered, apart from size and earnings, which are fairly consistent across groups, the key determinants of excess cash depend on level of Turnover growth a firm falls in any given year. The middle group however dominates whenever there is a difference between groupings.

Finally, when different combinations of relative high debt and high excess cash are considered, there are differences in the magnitude and significance of variables determining the level of Excess cash holdings in these different groupings especially as it relates to the influence of Research and Development and CAPEX on Excess cash holdings. The key similarities are the influence of Size and, to lesser extent Earnings. Our results suggest that CAPEX and Research and Development expenses are the major reasons why firms have the unusual combination of High Debt and High Excess cash.

Table 4.1 Descriptive Statistics of Cash Holdings for Publicly listed EU Firms 1990-2017

Computations are based on nonfinancial firms in Standard and Poor's Compustat database. Sample period is 1991-2017.Size ($ Million) has been adjusted to constant 2017 Dollars using the CPI. CPI figures were obtained from the UK Data Service International aggregate. Market Prices obtained from Compustat Securities Daily.

Variable		N	Mean	P50	Std.Dev	Min	Max	Skewness	Kurtosis
Cash	**All**	23,605	0.41	0.12	1.04	0.00	13.77	5.96	45.96
	France	3,015	0.39	0.14	0.86	0.00	9.52	5.72	44.47
	Germany	3,868	0.34	0.14	0.66	0.00	7.71	4.97	34.18
	Italy	826	0.15	0.10	0.20	0.00	2.72	5.86	57.26
	Spain	426	0.13	0.09	0.14	0.00	1.15	3.06	16.75
	UK	7,898	0.58	0.14	1.66	0.00	24.69	6.73	60.52
	All Tech	10,077	0.69	0.22	1.42	0.00	13.77	4.20	23.68
Earnings	**All**	23,605	-0.06	0.07	0.56	-7.56	0.57	-5.75	44.14
	France	3,015	-0.01	0.07	0.38	-3.54	0.52	-4.71	30.10
	Germany	3,868	0.01	0.07	0.31	-3.87	0.81	-5.22	40.82
	Italy	826	0.05	0.06	0.12	-1.21	0.27	-5.45	44.40
	Spain	426	0.04	0.05	0.96	-0.62	0.29	-1.99	11.14
	UK	7,898	-0.17	0.07	0.94	-17.75	0.63	-7.50	88.45
	All Tech	10,077	-0.19	0.06	0.78	-7.56	0.56	-4.01	22.28
Size	**All**	23,605	5.45	5.21	2.59	-2.17	15.34	0.25	2.68
	France	3,015	5.78	5.28	2.73	-0.51	12.63	0.41	2.18
	Germany	3,868	5.73	5.30	2.46	-0.57	11.72	0.45	2.65
	Italy	826	6.26	5.92	2.07	2.00	16.66	0.88	4.31
	Spain	426	6.53	6.49	2.10	0.95	11.17	0.08	2.89
	UK	7,898	4.25	4.11	2.41	-2.83	10.75	0.21	2.62
	All Tech	10,077	4.33	4.05	2.39	-2.17	14.91	0.69	3.69
Debt	**All**	23,605	0.22	0.19	0.22	0.00	11.95	6.75	69.00
	France	3,015	0.25	0.22	0.21	0.00	3.58	3.99	49.35
	Germany	3,868	0.20	0.16	0.21	0.00	2.51	2.80	20.26
	Italy	826	0.29	0.28	0.18	0.00	1.90	1.82	15.72
	Spain	426	0.34	0.32	0.22	0.00	2.43	2.33	19.90
	UK	7,898	0.19	0.14	0.29	0.00	7.57	7.99	122.79
	All Tech	10,077	0.18	0.11	0.25	0.00	2.57	3.46	22.14
Working Cap	**All**	23,605	0.02	0.05	0.29	-3.73	0.70	-3.89	34.98
	France	3,015	0.02	0.04	0.22	-2.97	0.74	-2.37	22.50
	Germany	3,868	0.07	0.09	0.28	-4.63	0.83	-3.18	34.85
	Italy	826	0.02	0.01	0.18	0.00	2.82	11.32	144.54
	Spain	426	-0.03	-0.01	0.21	-2.16	0.61	-2.82	27.65
	UK	7,898	-0.01	0.04	0.40	-8.44	0.71	-7.18	98.77

	All Tech	10,077	-0.02	0.02	0.35	-3.73	0.69	-3.72	28.40
CAPEX	**All**	23,605	0.05	0.04	0.06	0.00	0.55	3.15	18.44
	France	3,015	0.05	0.04	0.05	0.00	0.56	3.33	19.81
	Germany	3,868	0.06	0.04	0.05	0.00	0.60	3.10	20.89
	Italy	826	0.04	0.03	0.03	0.00	0.29	2.68	14.42
	Spain	426	0.04	0.03	0.03	0.00	0.22	1.77	8.17
	UK	7,898	0.06	0.04	0.07	0.00	0.73	3.65	23.11
	All Tech	10,077	0.05	0.03	0.07	0.00	0.55	3.04	15.73
R&D	**All**	23,605	0.44	0.03	2.43	0.00	34.15	8.93	92.40
	France	3,015	1.09	0.04	11.47	-0.04	298.86	20.35	483.37
	Germany	3,868	0.19	0.04	1.43	0.00	47.78	23.19	682.05
	Italy	826	0.04	0.02	0.18	0.00	2.82	11.32	144.54
	Spain	426	0.05	0.00	0.17	-0.01	1.80	5.94	45.65
	UK	7,898	0.97	0.31	6.94	-0.00	227.50	16.57	393.08
	All Tech	10,077	0.88	0.09	3.47	0.00	34.19	6.14	44.47
Carry Cost	**All**	23,605	0.72	0.13	2.51	-2.81	38.94	8.56	95.49
	France	3,015	0.29	0.09	0.82	-2.70	13.49	7.62	91.40
	Germany	3,868	0.48	0.12	1.45	-1.37	21.60	7.80	83.87
	Italy	826	0.12	0.03	0.33	-0.90	4.48	6.12	59.21
	Spain	426	0.06	0.01	0.21	-0.16	2.50	6.33	57.65
	UK	7,898	1.56	0.30	5.89	0.00	117.79	10.36	141.87
	All Tech	10,077	1.18	0.22	3.45	-2.81	38.94	6.27	51.60
MB	**All**	23,605	1.92	1.38	1.75	0.35	26.31	4.48	34.99
	France	3,015	1.69	1.31	1.40	0.54	29.92	7.69	117.26
	Germany	3,868	1.69	1.29	1.91	0.23	88.44	25.62	1103.56
	Italy	826	1.40	1.15	0.90	0.40	10.07	4.00	25.77
	Spain	426	1.56	1.26	0.93	0.42	7.47	2.82	13.68
	UK	7,898	2.32	1.61	2.47	0.27	36.32	5.24	45.39
	All Tech	10,007	2.40	1.66	2.24	0.35	26.31	3.54	22.47
Net Assets ($ Million)	**All**	23,605	2,910.27	182.54	8091.53	0.07	52,979.20	3.93	18.67
	France	3,015	6,083.85	228.36	14,520.58	0.78	97,235.20	3.10	12.61
	Germany	3,868	6,575.81	240.03	20,659.42	0.68	147,559.50	4.45	23.94
	Italy	826	5,571.27	481.68	16,465.45	8.84	103,832.50	4.10	20.03
	Spain	426	6,750.88	842.95	17,918.05	2.73	91,774.27	3.50	14.20
	UK	7,898	1,525.28	97.79	5,057.71	0.50	53,650.75	5.80	42.10
	All Tech	10,077	1,419.27	55.25	6,059.94	0.07	52,979.20	5.81	37.90
Total Assets ($ Million)	**All**	23,605	3,251.85	220.91	8999.60	0.11	57,775.96	3.93	18.59
	France	3,015	6,715.22	273.51	15,915.45	2.18	103,410.40	3.12	12.81
	Germany	3,868	7,249.31	298.14	22,551.18	1.29	147,559.50	4.45	23.94
	Italy	826	6,240.15	526.47	18,585.52	11.98	114,765.90	4.21	21.06
	Spain	426	7,419.91	930.70	19,501.39	3.28	97,941.42	3.46	13.90
	UK	7,898	1,702.49	121.38	5,579.28	0.19	60,617.54	5.72	40.94
	All Tech	10,077	1,628.63	80.98	6,832.29	0.11	57,775.96	5.72	36.55
Excess Cash	**All**	23,591	0.24	0.14	0.32	0.01	3.18	3.46	18.96
	France	3,015	0.37	0.20	0.45	0.01	4.25	2.36	11.66

Germany	3,868	0.28	0.17	0.00	3.99	0.36	3.28	19.94
Italy	823	0.14	0.11	0.13	0.01	1.13	2.84	16.03
Spain	426	0.15	0.07	0.00	2.52	0.25	5.09	35.58
UK	7,884	0.38	0.16	0.00	7.03	0.65	4.21	26.96
All Tech	10,077	0.41	0.25	0.54	0.00	5.41	3.92	24.38

Table 4.2 Cash Holdings of publicly listed EU firms 1990-2017

The basic regression equations are $CHit = \alpha + \beta_1 E_{it} + \beta_2 D_{it} + \beta_3 M_{it} + \beta_4 S_{it} + \beta_5 W_{it} + \beta_6 C_{it} + \beta_7 Dv_{it} + \beta_8 R_{it} + e$ *CH*, Cash Holdings, is defined as Natural Log of ratio of Cash and Short-Term Investments to Net Assets. E, Net Earnings = (Earnings before Interest – Interest and related expenses – Income Taxes – Dividends) / Net Assets. D, Debt = (Long Term Debt + Debt in Current Liabilities) / Net Assets. M, Market to Book Ratio = [(Total Assets – Total Common and Ordinary Equity) + (Common Shares Outstanding * Market Price)] / Total Assets. S, Size is the natural log of CPI adjusted Net Assets. W, Net Working Capital = (Working Capital – Cash and Short-Term Securities) / Net Assets. C, CAPEX, is ratio of Capital Expenditure to Net Assets. Dv, Dividend, is a dummy variable that takes the value of 1 if Dividend > 0 and 0 otherwise. R, Research and Development, is the ratio of research and developments Expense to Sales Turnover. Computations are based on nonfinancial firms in Standard and Poor's Compustat database. Sample period is 1991-2017. Size ($ Million) adjusted to constant 2017 Dollars. CPI figures were obtained from International aggregate Data from the UK Data Service. Market Prices obtained from Compustat Securities Daily. High Tech Firms are classified using optimal SIC code classifications by Kile and Phillips (2009). Financial firms and utilities are excluded. Regressions are estimated with firm fixed effects. Standard errors are clustered by Industry. Robust standard errors are in parenthesis.

	All	**France**	**Germany**	**Italy**	**Spain**	**UK**	**AllTech**
Earnings	-0.127***	0.063	0.093	1.533*	1.580	-0.073**	-0.109***
	(0.031)	(0.131)	(0.136)	(0.834)	(1.188)	(0.031)	(0.033)
Debt	-0.436***	0.048	-0.659**	0.750**	0.724	-0.330***	-0.546***
	(0.081)	(0.173)	(0.277)	(0.373)	(0.628)	(0.110)	(0.099)
MB	0.000	-0.003	-0.010	0.028	0.155	-0.019*	-0.012
	(0.001)	(0.018)	(0.010)	(0.051)	(0.126)	(0.010)	(0.009)
Size	-0.424***	-0.542***	-0.541***	-0.424***	-0.557**	-0.581***	-0.456***
	(0.028)	(0.064)	(0.088)	(0.103)	(0.256)	(0.040)	(0.041)
Net WCap	-0.211***	-0.377**	-0.273*	-0.056	0.108	-0.227**	-0.225***
	(0.058)	(0.168)	(0.156)	(0.319)	(0.587)	(0.098)	(0.069)
CAPEX	1.450***	2.555***	2.142***	0.844	-1.511	1.223***	1.727***
	(0.178)	(0.501)	(0.482)	(1.415)	(2.596)	(0.270)	(0.236)
Dividend	-0.032	-0.068	0.184	0.533	0.000	0.056	-0.033
	(0.055)	(0.146)	(0.131)	(0.429)	(0.000)	(0.092)	(0.066)
RD	0.011**	-0.002	-0.003	0.857***	-0.098	0.004*	0.012**
	(0.005)	(0.002)	(0.014)	(0.213)	(0.413)	(0.002)	(0.006)
Constant	-1.454***	1.810***	1.368**	2.868**	-1.231	-1.152***	0.468*
	(0.146)	(0.450)	(0.569)	(1.451)	(1.665)	(0.186)	(0.262)
R2	0.1209	0.1647	0.1382	0.1845	0.0931	0.1719	0.1912
No. of Observations	23,591	3,015	3,868	826	426	7,884	10,077
No. Of Firms	3,389	436	500	162	82	1,082	1,455
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SE Clustered by Firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes

***, **, * represent significant at 1%, 5% and 10% respectively (robust standard errors in bracket)

Table 4.3 Excess Cash Holdings of publicly listed EU firms 1990-2017

The basic regression equations are $ECH_{it} = \alpha + \beta_1 R_{it-1} + \beta_2 M_{it-1} + \beta_4 V_{it-1} + \beta_5 CC_{it-1} + e$ E*CH*, Excess Cash Holdings, is defined as the residual of regression $CH_{it} = \alpha + \beta_1 E_{it} + \beta_2 D_{it} + \beta_3 M_{it} + \beta_4 S_{it} + \beta_5 W_{it} + \beta_6 C_{it} + \beta_7 Dv_{it} + \beta_8 R_{it} + e$. R, Research and Development, is the ratio of research and developments Expense to Sales Turnover. M, Market to Book Ratio = [(Total Assets – Total Common and Ordinary Equity) + (Common Shares Outstanding * Market Price)] / Total Assets. V, Asset Value, is the Natural Log of CPI adjusted Total assets. CC, Cost of Carry = (Cash and Short-Term Investments * 3 Month Short Term Interest Rates) / Net Assets. *CH*, Cash Holdings, is defined as Natural Log of ratio of Cash and Short-Term Investments to Net Assets. E, Net Earnings = (Earnings before Interest – Interest and related expenses – Income Taxes – Dividends) / Net Assets. D, Debt = (Long Term Debt + Debt in Current Liabilities) / Net Assets. S, Size is the natural log of CPI adjusted Net Assets. W, Net Working Capital = (Working Capital – Cash) / Net Assets. C, CAPEX, is ratio of Capital Expenditure to Net Assets. Dv, Dividend, is a dummy variable that takes the value of 1 if Dividend > 0 and 0 otherwise. Computations are based on nonfinancial firms in Standard and Poor's Compustat database. Sample period is 1991-2017. Size ($ Million) adjusted to constant 2017 Dollars. CPI and Short-Term Interest Rate figures were obtained from International aggregate Data from the UK Data Service. Market Prices obtained from Compustat Securities Daily. High Tech Firms are classified using optimal SIC code classifications by Kile and Phillips (2009). Financial firms and utilities are excluded. Regressions are estimated with firm fixed effects. Standard errors are clustered by Industry. Robust standard errors are in parenthesis.

	All	**France**	**Germany**	**Italy**	**Spain**	**UK**	**Tech**
R&D	0.005**	0.000	0.008*	0.098***	0.034	0.008***	0.007
	(0.002)	(0.001)	(0.005)	(0.023)	(0.059)	(0.003)	(0.004)
MB	-0.000	-0.011**	-0.001	-0.018	0.004	-0.003	-0.002
	(0.002)	(0.005)	(0.001)	(0.015)	(0.004)	(0.005)	(0.004)
Size	-0.078***	-0.159***	-0.178***	-0.042***	-0.037***	-0.135***	-0.105***
	(0.005)	(0.018)	(0.017)	(0.017)	(0.007)	(0.013)	(0.010)
Carry	0.005***	0.009*	0.000	-0.018	-0.033**	0.006*	0.010***
	(0.002)	(0.005)	(0.008)	(0.011)	(0.015)	(0.003)	(0.004)
CAPEX	0.053	-0.011	0.043	-0.098	0.078	-0.075	0.108
	(0.045)	(0.137)	(0.082)	(0.152)	(0.078)	(0.213)	(0.099)
Earnings	-0.083***	-0.113**	-0.081*	-0.078	-0.008	-0.084***	-0.105***
	(0.013)	(0.046)	(0.048)	(0.134)	(0.078)	(0.031)	(0.023)
Debt	-0.047***	0.091	-0.131***	0.067*	0.053	-0.062	-0.076***
	(0.019)	(0.075)	(0.052)	(0.040)	(0.034)	(0.046)	(0.030)
Net WCap	-0.025	0.088	-0.187***	-0.001	0.031*	-0.054	-0.026
	(0.021)	(0.142)	(0.061)	(0.039)	(0.017)	(0.059)	(0.040)
Dividend	0.009	-0.038	-0.007	0.087***	0.000	0.021	0.034*
	(0.009)	(0.029)	(0.035)	(0.017)	(0.000)	(0.044)	(0.019)
Constant	0.645***	1.393***	1.342***	0.694***	0.360***	0.820***	0.764***
	(0.028)	(0.129)	(0.118)	(0.207)	(0.019)	(0.069)	(0.056)
R2	0.2661	0.2461	0.3349	0.3401	0.3205	0.1969	0.2546
No. of Observations	18,995	2,385	3,164	603	324	6,478	8,130
No. Of Firms	2,820	265	426	113	67	950	1,225
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SE Clustered by Firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes

***, **, * represent significant at 1%, 5% and 10% respectively (robust standard errors in bracket)

Table 4.4 Excess Cash Holdings of publicly listed EU firms 1990-2017 – Quartiles of Excess Cash

The basic regression equations are $ECH_{it} = \alpha + \beta_1 R_{it-1} + \beta_2 M_{it-1} + \beta_4 V_{it-1} + \beta_5 CC_{it-1} + e$ E*CH*, Excess Cash Holdings, is defined as the residual of regression $CH_{it} = \alpha + \beta_1 E_{it} + \beta_2 D_{it} + \beta_3 M_{it} + \beta_4 S_{it} + \beta_5 W_{it} + \beta_6 C_{it} + \beta_7 Dv_{it} + \beta_8 R_{it} + e$. R, Research and Development, is the ratio of research and developments Expense to Sales Turnover. M, Market to Book Ratio = [(Total Assets – Total Common and Ordinary Equity) + (Common Shares Outstanding * Market Price)] / Total Assets. V, Asset Value, is the Natural Log of CPI adjusted Total assets. CC, Cost of Carry = (Cash and Short-Term Investments * 3 Month Short Term Interest Rates) / Net Assets. *CH*, Cash Holdings, is defined as Natural Log of ratio of Cash and Short-Term Investments to Net Assets. E, Net Earnings = (Earnings before Interest – Interest and related expenses – Income Taxes – Dividends) / Net Assets. D, Debt = (Long Term Debt + Debt in Current Liabilities) / Net Assets. S, Size is the natural log of CPI adjusted Net Assets. W, Net Working Capital = (Working Capital – Cash) / Net Assets. C, CAPEX, is ratio of Capital Expenditure to Net Assets. Dv, Dividend, is a dummy variable that takes the value of 1 if Dividend > 0 and 0 otherwise. Computations are based on nonfinancial firms in Standard and Poor's Compustat database. Sample period is 1991-2017. Size ($ Million) adjusted to constant 2017 Dollars. CPI and Short-Term Interest Rate figures were obtained from International aggregate Data from the UK Data Service. Market Prices obtained from Compustat Securities Daily. Financial firms and utilities are excluded. Regressions are estimated with firm fixed effects. Standard errors are clustered by Industry. Robust standard errors are in parenthesis.

	1st	2nd	3rd	4th	All
R&D	-0.000	0.000	0.007	0.006**	0.005**
	(0.004)	(0.000)	(0.001)	(0.003)	(0.002)
MB	-0.000	-0.002***	-0.003***	-0.003	-0.000
	(0.196)	(0.000)	(0.001)	(0.003)	(0.002)
Size	-0.008***	-0.020***	-0.045***	-0.185***	-0.078***
	(0.000)	(0.018)	(0.002)	(0.013)	(0.005)
Carry	-0.000	-0.001**	-0.001**	0.005***	0.005***
	(0.000)	(0.001)	(0.001)	(0.002)	(0.002)
CAPEX	0.001	0.010	0.003	0.060	0.053
	(0.004)	(0.008)	(0.011)	(0.087)	(0.045)
Earnings	-0.002	0.011***	0.001	-0.048***	-0.083***
	(0.001)	(0.003)	(0.005)	(0.016)	(0.013)
Debt	-0.008***	-0.014***	-0.028***	-0.116***	-0.047***
	(0.001)	(0.002)	(0.005)	(0.035)	(0.019)
Net WCap	-0.001	-0.006***	-0.007	0.004	-0.025
	(0.001)	(0.002)	(0.005)	(0.034)	(0.021)
Dividend	-0.001	-0.001	-0.002	0.032	0.009
	(0.001)	(0.001)	(0.003)	(0.024)	(0.009)
Constant	0.113***	0.241***	0.422***	1.062***	0.645***
	(0.005)	(0.011)	(0.012)	(0.044)	(0.028)
R2	0.5712	0.4519	0.4263	0.3058	0.2661
No. of Observations	5,079	4,776	4,697	4,443	18,995
No. Of Firms	658	987	1,078	1,030	2,820
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes

Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes
SE Clustered by Firm	Yes	Yes	Yes	Yes	Yes

***, **, * represent significant at 1%, 5% and 10% respectively (robust standard errors in bracket)

Table 4.5 Excess Cash Holdings of publicly listed EU firms 1990-2017 – Level of Turnover Growth

The basic regression equations are $ECH_{it} = \alpha + \beta_1 R_{it-1} + \beta_2 M_{it-1} + \beta_4 V_{it-1} + \beta_5 CC_{it-1} + e$ E*CH*, Excess Cash Holdings, is defined as the residual of regression $CH_{it} = \alpha + \beta_1 E_{it} + \beta_2 D_{it} + \beta_3 M_{it} + \beta_4 S_{it} + \beta_5 W_{it} + \beta_6 C_{it} + \beta_7 Dv_{it} + \beta_8 R_{it} + e$. R, Research and Development, is the ratio of research and developments Expense to Sales Turnover. M, Market to Book Ratio = [(Total Assets – Total Common and Ordinary Equity) + (Common Shares Outstanding * Market Price)] / Total Assets. V, Asset Value, is the Natural Log of CPI adjusted Total assets. CC, Cost of Carry = (Cash and Short-Term Investments * 3 Month Short Term Interest Rates) / Net Assets. *CH*, Cash Holdings, is defined as Natural Log of ratio of Cash and Short-Term Investments to Net Assets. E, Net Earnings = (Earnings before Interest – Interest and related expenses – Income Taxes – Dividends) / Net Assets. D, Debt = (Long Term Debt + Debt in Current Liabilities) / Net Assets. S, Size is the natural log of CPI adjusted Net Assets. W, Net Working Capital = (Working Capital – Cash) / Net Assets. C, CAPEX, is ratio of Capital Expenditure to Net Assets. Dv, Dividend, is a dummy variable that takes the value of 1 if Dividend > 0 and 0 otherwise. Computations are based on nonfinancial firms in Standard and Poor's Compustat database. Sample period is 1991-2017. Size ($ Million) adjusted to constant 2017 Dollars. CPI and Short-Term Interest Rate figures were obtained from International aggregate Data from the UK Data Service. Market Prices obtained from Compustat Securities Daily. Financial firms and utilities are excluded. Regressions are estimated with firm fixed effects. Standard errors are clustered by Industry. Robust standard errors are in parenthesis.

	1st	2nd	3rd	All
R&D	0.002	0.039**	0.007***	0.005**
	(0.003)	(0.017)	(0.003)	(0.002)
MB	0.004	0.004	-0.001	-0.000
	(0.004)	(0.003)	(0.002)	(0.002)
Size	-0.099***	-0.056***	-0.075***	-0.078***
	(0.009)	(0.006)	(0.007)	(0.005)
Carry	0.002	0.006**	0.005*	0.005***
	(0.003)	(0.003)	(0.003)	(0.002)
CAPEX	-0.070	-0.042	0.111	0.053
	(0.075)	(0.043)	(0.091)	(0.045)
Earnings	-0.092***	-0.088**	-0.073***	-0.083***
	(0.023)	(0.039)	(0.016)	(0.013)
Debt	-0.051	-0.068***	-0.028	-0.047***
	(0.039)	(0.022)	(0.021)	(0.019)
Net WCap	-0.016	-0.085**	-0.027	-0.025
	(0.028)	(0.035)	(0.029)	(0.021)
Dividend	0.022	0.007	0.012	0.009
	(0.018)	(0.015)	(0.014)	(0.009)
Constant	0.786***	0.541***	0.592***	0.645***
	(0.049)	(0.041)	(0.040)	(0.028)
R2	0.2642	0.4133	0.3068	0.2661
No. of Observations	6,405	6,588	6,002	18,995
No. Of Firms	2,062	1,945	2,074	2,820

Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
SE Clustered by Firm	Yes	Yes	Yes	Yes

***, **, * represent significant at 1%, 5% and 10% respectively (robust standard errors in bracket)

Table 4.6 Excess Cash Holdings of publicly listed EU High Tech firms 1990-2017 – Level of Turnover Growth

The basic regression equations are $ECH_{it} = \alpha + \beta_1 R_{it-1} + \beta_2 M_{it-1} + \beta_4 V_{it-1} + \beta_5 CC_{it-1} + e$ E*CH*, Excess Cash Holdings, is defined as the residual of regression $CH_{it} = \alpha + \beta_1 E_{it} + \beta_2 D_{it} + \beta_3 M_{it} + \beta_4 S_{it} + \beta_5 W_{it} + \beta_6 C_{it} + \beta_7 Dv_{it} + \beta_8 R_{it} + e$. R, Research and Development, is the ratio of research and developments Expense to Sales Turnover. M, Market to Book Ratio = [(Total Assets – Total Common and Ordinary Equity) + (Common Shares Outstanding * Market Price)] / Total Assets. V, Asset Value, is the Natural Log of CPI adjusted Total assets. CC, Cost of Carry = (Cash and Short-Term Investments * 3 Month Short Term Interest Rates) / Net Assets. *CH*, Cash Holdings, is defined as Natural Log of ratio of Cash and Short-Term Investments to Net Assets. E, Net Earnings = (Earnings before Interest – Interest and related expenses – Income Taxes – Dividends) / Net Assets. D, Debt = (Long Term Debt + Debt in Current Liabilities) / Net Assets. S, Size is the natural log of CPI adjusted Net Assets. W, Net Working Capital = (Working Capital – Cash) / Net Assets. C, CAPEX, is ratio of Capital Expenditure to Net Assets. Dv, Dividend, is a dummy variable that takes the value of 1 if Dividend > 0 and 0 otherwise. Computations are based on nonfinancial firms in Standard and Poor's Compustat database. Sample period is 1991-2017. Size ($ Million) adjusted to constant 2017 Dollars. CPI and Short-Term Interest Rate figures were obtained from International aggregate Data from the UK Data Service. Market Prices obtained from Compustat Securities Daily. High Tech Firms are classified using optimal SIC code classifications by Kile and Phillips (2009). Financial firms and utilities are excluded. Regressions are estimated with firm fixed effects. Standard errors are clustered by Industry. Robust standard errors are in parenthesis.

	1st	2nd	3rd	All Tech	All Firms
R&D	0.011	0.006	0.010**	0.007	0.005**
	(0.009)	(0.010)	(0.004)	(0.004)	(0.002)
MB	-0.000	0.006	-0.000	-0.002	-0.000
	(0.011)	(0.004)	(0.005)	(0.004)	(0.002)
Size	-0.150***	-0.080***	-0.079***	-0.105***	-0.078***
	(0.022)	(0.014)	(0.013)	(0.010)	(0.005)
Carry	0.006	0.005	0.011**	0.010***	0.005***
	(0.007)	(0.004)	(0.005)	(0.004)	(0.002)
CAPEX	-0.090	0.175**	0.070	0.108	0.053
	(0.197)	(0.079)	(0.174)	(0.099)	(0.045)
Earnings	-0.134***	-0.084**	-0.082***	-0.105***	-0.083***
	(0.046)	(0.039)	(0.026)	(0.023)	(0.013)
Debt	-0.087	-0.100***	-0.019	-0.076***	-0.047***
	(0.055)	(0.032)	(0.037)	(0.030)	(0.019)
Net WCap	-0.036	-0.072**	-0.035	-0.026	-0.025
	(0.048)	(0.035)	(0.055)	(0.040)	(0.021)
Dividend	0.075*	-0.020	0.040	0.034*	0.009
	(0.041)	(0.023)	(0.027)	(0.019)	(0.009)
Constant	1.014***	0.582***	0.747***	0.764***	0.645***
	(0.105)	(0.154)	(0.078)	(0.056)	(0.028)
R2	0.2944	0.4020	0.2945	0.2546	0.2661
No. of Observations	2,747	2,850	2,533	8,130	18,995
No. Of Firms	879	802	2893	1,225	2,820
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes

Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes
SE Clustered by Firm	Yes	Yes	Yes	Yes	Yes

***, **, * represent significant at 1%, 5% and 10% respectively (robust standard errors in bracket)

Table 4.7 Excess Cash Holdings of publicly listed UK firms 1990-2017 – Level of Turnover Growth

The basic regression equations are $ECH_{it} = \alpha + \beta_1 R_{it-1} + \beta_2 M_{it-1} + \beta_4 V_{it-1} + \beta_5 CC_{it-1} + e$ E*CH*, Excess Cash Holdings, is defined as the residual of regression $CH_{it} = \alpha + \beta_1 E_{it} + \beta_2 D_{it} + \beta_3 M_{it} + \beta_4 S_{it} + \beta_5 W_{it} + \beta_6 C_{it} + \beta_7 Dv_{it} + \beta_8 R_{it} + e$. R, Research and Development, is the ratio of research and developments Expense to Sales Turnover. M, Market to Book Ratio = [(Total Assets – Total Common and Ordinary Equity) + (Common Shares Outstanding * Market Price)] / Total Assets. V, Asset Value, is the Natural Log of CPI adjusted Total assets. CC, Cost of Carry = (Cash and Short-Term Investments * 3 Month Short Term Interest Rates) / Net Assets. *CH*, Cash Holdings, is defined as Natural Log of ratio of Cash and Short-Term Investments to Net Assets. E, Net Earnings = (Earnings before Interest – Interest and related expenses – Income Taxes – Dividends) / Net Assets. D, Debt = (Long Term Debt + Debt in Current Liabilities) / Net Assets. S, Size is the natural log of CPI adjusted Net Assets. W, Net Working Capital = (Working Capital – Cash) / Net Assets. C, CAPEX, is ratio of Capital Expenditure to Net Assets. Dv, Dividend, is a dummy variable that takes the value of 1 if Dividend > 0 and 0 otherwise. Computations are based on nonfinancial firms in Standard and Poor's Compustat database. Sample period is 1991-2017. Size ($ Million) adjusted to constant 2017 Dollars. CPI and Short-Term Interest Rate figures were obtained from International aggregate Data from the UK Data Service. Market Prices obtained from Compustat Securities Daily. Financial firms and utilities are excluded. Regressions are estimated with firm fixed effects. Standard errors are clustered by Industry. Robust standard errors are in parenthesis.

	1st	2nd	3rd	UK	All Firms
R&D	0.010***	-0.003	0.006***	0.008***	0.005**
	(0.003)	(0.003)	(0.002)	(0.003)	(0.002)
MB	-0.010	0.010*	0.009	-0.003	-0.000
	(0.008)	(0.006)	(0.007)	(0.005)	(0.002)
Size	-0.183***	-0.126***	-0.097***	-0.135***	-0.078***
	(0.023)	(0.023)	(0.014)	(0.013)	(0.005)
Carry	0.006	0.004	0.008**	0.006*	0.005***
	(0.006)	(0.005)	(0.004)	(0.003)	(0.002)
CAPEX	-0.439*	-0.190**	0.428	-0.075	0.053
	(0.241)	(0.095)	(0.483)	(0.213)	(0.045)
Earnings	-0.111*	-0.186**	-0.049	-0.084***	-0.083***
	(0.062)	(0.091)	(0.033)	(0.031)	(0.013)
Debt	-0.063	-0.150*	-0.001	-0.062	-0.047***
	(0.041)	(0.082)	(0.052)	(0.046)	(0.019)
Net WCap	-0.056	-0.059	-0.056	-0.054	-0.025
	(0.070)	(0.086)	(0.058)	(0.059)	(0.021)
Dividend	0.032	-0.011	-0.011	0.021	0.009
	(0.094)	(0.040)	(0.041)	(0.044)	(0.009)
Constant	1.135***	0.782***	0.606***	0.820***	0.645***
	(0.135)	(0.095)	(0.064)	(0.069)	(0.028)
R2	0.2405	0.3413	0.2208	0.1969	0.2661
No. of Observations	2,231	2,210	2,037	6,478	18,995

No. Of Firms	691	630	716	950	2,820
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes
SE Clustered by Firm	Yes	Yes	Yes	Yes	Yes

***, **, * represent significant at 1%, 5% and 10% respectively (robust standard errors in bracket)

Table 4.8 Excess Cash Holdings of publicly listed UK firms 1990-2017 – Debt and Excess Cash Combinations

The basic regression equations are $ECH_{it} = \alpha + \beta_1 R_{it-1} + \beta_2 M_{it-1} + \beta_4 V_{it-1} + \beta_5 CC_{it-1} + e$ E*CH*, Excess Cash Holdings, is defined as the residual of regression $CH_{it} = \alpha + \beta_1 E_{it} + \beta_2 D_{it} + \beta_3 M_{it} + \beta_4 S_{it} + \beta_5 W_{it} + \beta_6 C_{it} + \beta_7 Dv_{it} + \beta_8 R_{it} + e$. R, Research and Development, is the ratio of research and developments Expense to Sales Turnover. M, Market to Book Ratio = [(Total Assets – Total Common and Ordinary Equity) + (Common Shares Outstanding * Market Price)] / Total Assets. V, Asset Value, is the Natural Log of CPI adjusted Total assets. CC, Cost of Carry = (Cash and Short-Term Investments * 3 Month Short Term Interest Rates) / Net Assets. *CH*, Cash Holdings, is defined as Natural Log of ratio of Cash and Short-Term Investments to Net Assets. E, Net Earnings = (Earnings before Interest – Interest and related expenses – Income Taxes – Dividends) / Net Assets. D, Debt = (Long Term Debt + Debt in Current Liabilities) / Net Assets. S, Size is the natural log of CPI adjusted Net Assets. W, Net Working Capital = (Working Capital – Cash) / Net Assets. C, CAPEX, is ratio of Capital Expenditure to Net Assets. Dv, Dividend, is a dummy variable that takes the value of 1 if Dividend > 0 and 0 otherwise. Computations are based on nonfinancial firms in Standard and Poor's Compustat database. Sample period is 1991-2017. Size ($ Million) adjusted to constant 2017 Dollars. CPI and Short-Term Interest Rate figures were obtained from International aggregate Data from the UK Data Service. Market Prices obtained from Compustat Securities Daily. Financial firms and utilities are excluded. Regressions are estimated with firm fixed effects. Standard errors are clustered by Industry. Robust standard errors are in parenthesis.

	HighDebt HighExCash	HighDebt LowExCash	LowDebt LowExCash	LowDebt LowExCash	All
R&D	0.010*	-0.004	0.012*	0.009**	0.005**
	(0.005)	(0.009)	(0.007)	(0.004)	(0.002)
MB	0.003	-0.000	0.000	-0.005	-0.000
	(0.010)	(0.000)	(0.000)	(0.005)	(0.002)
Size	-0.107*	-0.008***	-0.008***	-0.198***	-0.078***
	(0.058)	(0.001)	(0.001)	(0.021)	(0.005)
Carry	0.008	-0.001	-0.001*	0.006***	0.005***
	(0.006)	(0.001)	(0.000)	(0.002)	(0.002)
CAPEX	-0.919***	0.002	-0.006	0.161	0.053
	(0.262)	(0.005)	(0.015)	(0.188)	(0.045)
Earnings	-0.016	-0.006***	-0.001	-0.037*	-0.083***
	(0.047)	(0.002)	(0.001)	(0.019)	(0.013)
Debt	-0.051	-0.001	-0.007*	0.002	-0.047***
	(0.047)	(0.002)	(0.004)	(0.063)	(0.019)
Net WCap	-0.043	0.000	0.000	0.030	-0.025
	(0.052)	(0.001)	(0.003)	(0.050)	(0.021)
Dividend	-0.005	-0.001	0.002	0.038	0.009
	(0.121)	(0.001)	(0.002)	(0.039)	(0.009)
Constant	1.002***	0.109***	0.112***	0.918***	0.645***
	(0.212)	(0.007)	(0.012)	(0.159)	(0.028)
R2	0.2329	0.5311	0.5722	0.3190	0.2661
No. of Observations	582	1,798	275	2,335	18,995
No. Of Firms	273	399	84	643	2,820

Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes
SE Clustered by Firm	Yes	Yes	Yes	Yes	Yes

***, **, * represent significant at 1%, 5% and 10% respectively (robust standard errors in bracket)

Figure 4.1 Excess Cash Holdings of publicly listed EU firms 1990-2017

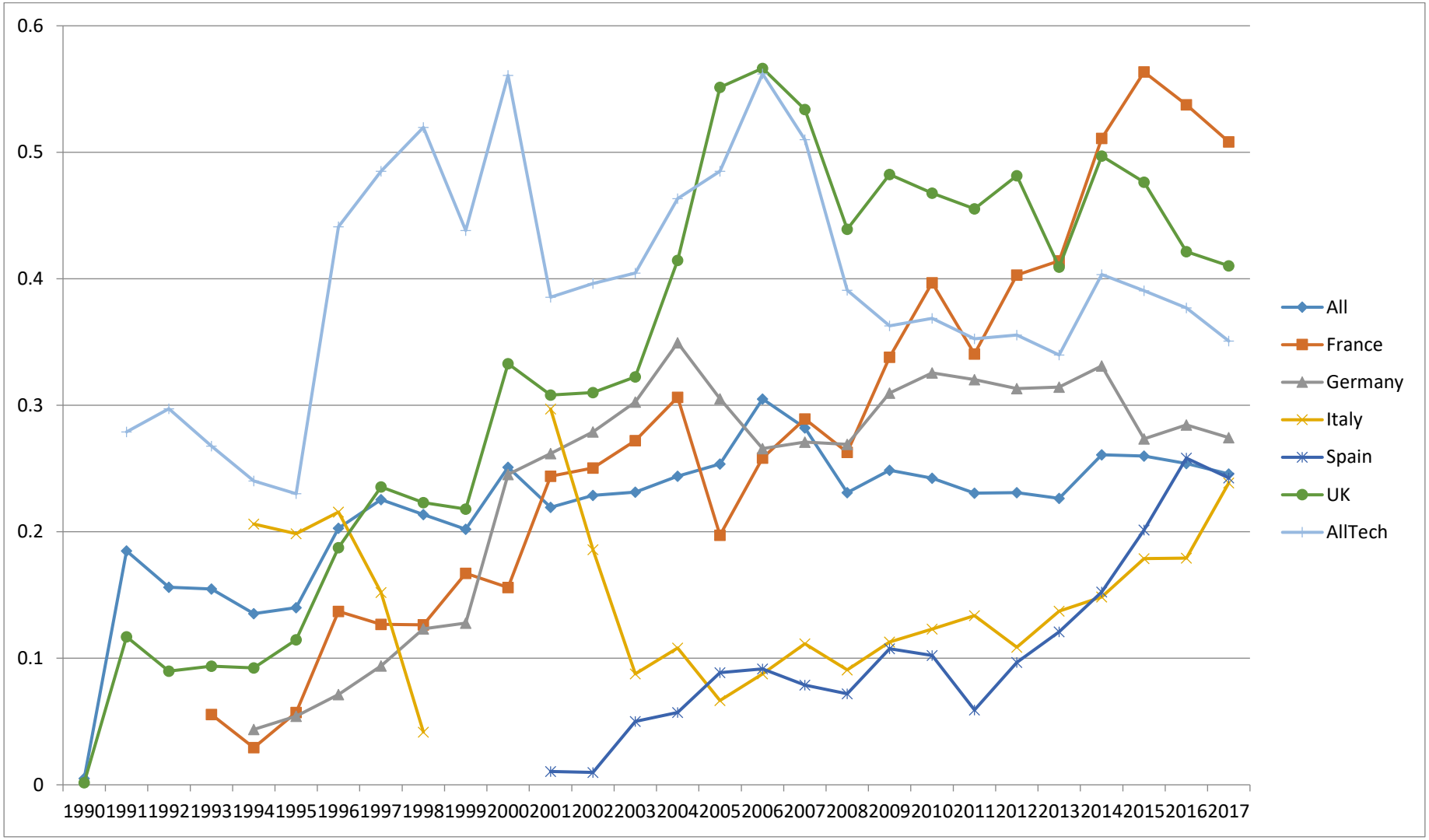


Table 4.9. Description of Variables

Variable	Proxy	Variables	Source
Excess Cash	Residual of panel regression of cash against a number of independent variables as per equation 1.	See below.	See below.
R&D	Research and Development Expense / Sales Turnover	XRD - Research and Development Expense. SALE – Sales/ Turnover (Net)	Compustat
MB	Market to Book Ratio = [(Total Assets – Total Common and Ordinary Equity) + (Common Shares Outstanding * Market Price)] / Total Assets.	AT- Assets – Total. CEQ – Common/Ordinary Equity – Total. CSHOI – Com Shares Outstanding – Issue Market price	Compustat Compustat
Cost of Carry	(Cash * 3 Month Short Term Interest Rates) / Net Assets. (Total Assets – Cash and Short-Term Securities)	CH – Cash. AT- Assets – Total. CHE – Cash and Short-Term Investments. UK 3 Months Treasury Bill Rates	Compustat UK Data Service
Cash Holdings	Natural Log of Cash and Short-Term Investments / Net Assets. (Total Assets – Cash and Short-Term Securities)	CHE – Cash and Short-Term Investments. AT- Assets – Total	Compustat
Earnings	(Earnings before Interest – Interest and related expenses – Income Taxes – Dividends) / Net Assets. (Total Assets – Cash and Short-Term Securities)	EBITDA – Earnings Before Interest. XINT – Interest and Related Expense – Total. TXT – Income Taxes – Total. DVC- Dividends Common / Ordinary.	Compustat
Total Debt	(Long Term Debt + Debt in Current Liabilities) / Net Assets. (Total Assets – Cash and Short-Term Securities)	DLTT- Long Term Debt – Total. DLC – Debt in Current Liabilities – Total	Compustat
Size	Natural log of CPI adjusted Net Assets. (Total Assets – Cash and Short-Term Securities)	CHE – Cash and Short-Term Investments. AT- Assets – Total	Compustat UK Data Service

Net Working Capital	(Working Capital – Cash and Short-Term Investments) / Net Assets. (Total Assets – Cash and Short-Term Securities)	WCAP- Working Capital (Balance Sheet). CHE – Cash and Short-Term Investments	Compustat
CAPEX	Capital Expenditure / Net Assets (Total Assets – Cash and Short-Term Securities)	CAPX – Capital Expenditures. CHE – Cash and Short-Term Investments. AT- Assets – Total	Compustat
Dividend	Dummy variable that takes the value of 1 if Dividend > 0 and 0 otherwise.	DVC- Dividends Common / Ordinary.	Compustat
Turnover Growth	Sales/Turnover (Net) at t / Sales/Turnover (Net) at t-1	SALE – Sales/ Turnover (Net)	Compustat

APPENDIX 4.C

Table 4.10.C1 Pair-wise correlation matrix (p values in parenthesis)

	Cash	**Earnings**	**Debt**	**MB**	**Size**	**Net WCap**	**CAP**	**Div**	**RD**
Cash	1.00								
Earnings	-0.38	1.00							
	(0.00)								
Debt	-0.20	-0.07	1.00						
	(0.00)	(0.00)							
MB	0.32	-0.28	-0.01	1.00					
	(0.00)	(0.00)	(0.30)						
Size	-0.35	-0.35	0.16	-0.25	1.00				
	(0.00)	(0.00)	(0.00)	(0.00)					
Net WCap	-0.19	0.35	-0.32	-0.17	0.11	1.00			
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)				
CAPEX	0.14	-0.12	-0.02	-0.15	-0.05	-0.05	1.00		
	(0.00)	(0.00)	(0.02)	(0.65)	(0.00)	(0.00)			
Div	-0.08	0.10	0.01	0.02	0.08	0.00	-0.01	1.00	
	(0.00)	(0.01)	(0.24)	(0.00)	(0.00)	(0.00)	(0.05)		
RD	0.28	-0.52	-0.02	0.20	-0.20	-0.14	0.06	-0.04	1.00
	(0.00)	(0.00)	(0.00)	(0.34)	(0.00)	(0.00)	(0.00)	(0.00)	

Table 4.11.C2 Excess Cash Holdings of publicly listed UK firms 1990-2017 – Level of CAPEX

The basic regression equations are $ECH_{it} = \alpha + \beta_1 R_{it-1} + \beta_2 M_{it-1} + \beta_4 V_{it-1} + \beta_5 CC_{it-1} + e$ E*CH*, Excess Cash Holdings, is defined as the residual of regression $CH_{it} = \alpha + \beta_1 E_{it} + \beta_2 D_{it} + \beta_3 M_{it} + \beta_4 S_{it} + \beta_5 W_{it} + \beta_6 C_{it} + \beta_7 Dv_{it} + \beta_8 R_{it} + e$. R, Research and Development, is the ratio of research and developments Expense to Sales Turnover. M, Market to Book Ratio = [(Total Assets – Total Common and Ordinary Equity) + (Common Shares Outstanding * Market Price)] / Total Assets. V, Asset Value, is the Natural Log of CPI adjusted Total assets. CC, Cost of Carry = (Cash and Short-Term Investments * 3 Month Treasury Bill Rates) / Net Assets. *CH*, Cash Holdings, is defined as Natural Log of ratio of Cash and Short-Term Investments to Net Assets. E, Net Earnings = (Earnings before Interest – Interest and related expenses – Income Taxes – Dividends) / Net Assets. D, Debt = (Long Term Debt + Debt in Current Liabilities) / Net Assets. S, Size is the natural log of CPI adjusted Net Assets. W, Net Working Capital = (Working Capital – Cash) / Net Assets. C, CAPEX, is ratio of Capital Expenditure to Net Assets. Dv, Dividend, is a dummy variable that takes the value of 1 if Dividend > 0 and 0 otherwise. Computations are based on nonfinancial firms in Standard and Poor's Compustat database. Sample period is 1991-2017. Size ($ Million) adjusted to constant 2017 Dollars. CPI figures were obtained from International aggregate Data from the UK Data Service. Market Prices obtained from Compustat Securities Daily. Financial firms and utilities are excluded. Regressions are estimated with firm fixed effects. Standard errors are clustered by Industry. Robust standard errors are in parenthesis.

	1st	2nd	3rd	All
R&D	0.000	0.008	0.013**	0.005**
	(0.002)	(0.005)	(0.006)	(0.002)
MB	0.004	-0.003	-0.003	-0.000
	(0.003)	(0.003)	(0.003)	(0.002)
Size	-0.077***	-0.062***	-0.086***	-0.078***
	(0.007)	(0.006)	(0.009)	(0.005)
Carry	0.009***	-0.002	0.003	0.005***
	(0.003)	(0.006)	(0.003)	(0.002)
CAPEX	-0.231*	-0.148**	0.036	0.053
	(0.131)	(0.065)	(0.056)	(0.045)
Earnings	-0.053***	-0.108***	-0.061**	-0.083***
	(0.015)	(0.023)	(0.026)	(0.013)
Debt	-0.040*	-0.042	-0.046	-0.047***
	(0.031)	(0.029)	(0.030)	(0.019)
Net WCap	-0.041	-0.023	-0.018	-0.025
	(0.032)	(0.023)	(0.050)	(0.021)
Dividend	0.018	0.007	0.004	0.009
	(0.012)	(0.012)	(0.021)	(0.009)
Constant	0.656***	0.579***	0.720***	0.645***
	(0.041)	(0.046)	(0.051)	(0.028)
R2	0.2986	0.2265	0.2471	0.2661
No. of Observations	6,477	6,480	6,038	18,995
No. Of Firms	1,659	1,836	1,615	2,820
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
SE Clustered by Firm	Yes	Yes	Yes	Yes

***, **, * represent significant at 1%, 5% and 10% respectively (robust standard errors in bracket)

Table 4.12.C3 Excess Cash Holdings of publicly listed UK firms 1990-2017 – Level of Assets

The basic regression equations are $ECH_{it} = \alpha + \beta_1 R_{it-1} + \beta_2 M_{it-1} + \beta_4 V_{it-1} + \beta_5 CC_{it-1} + e$ E*CH*, Excess Cash Holdings, is defined as the residual of regression $CH_{it} = \alpha + \beta_1 E_{it} + \beta_2 D_{it} + \beta_3 M_{it} + \beta_4 S_{it} + \beta_5 W_{it} + \beta_6 C_{it} + \beta_7 Dv_{it} + \beta_8 R_{it} + e$. R, Research and Development, is the ratio of research and developments Expense to Sales Turnover. M, Market to Book Ratio = [(Total Assets – Total Common and Ordinary Equity) + (Common Shares Outstanding * Market Price)] / Total Assets. V, Asset Value, is the Natural Log of CPI adjusted Total assets. CC, Cost of Carry = (Cash and Short-Term Investments * 3 Month Treasury Bill Rates) / Net Assets. *CH*, Cash Holdings, is defined as Natural Log of ratio of Cash and Short-Term Investments to Net Assets. E, Net Earnings = (Earnings before Interest – Interest and related expenses – Income Taxes – Dividends) / Net Assets. D, Debt = (Long Term Debt + Debt in Current Liabilities) / Net Assets. S, Size is the natural log of CPI adjusted Net Assets. W, Net Working Capital = (Working Capital – Cash) / Net Assets. C, CAPEX, is ratio of Capital Expenditure to Net Assets. Dv, Dividend, is a dummy variable that takes the value of 1 if Dividend > 0 and 0 otherwise. Computations are based on nonfinancial firms in Standard and Poor's Compustat database. Sample period is 1991-2017. Size ($ Million) adjusted to constant 2017 Dollars. CPI figures were obtained from International aggregate Data from the UK Data Service. Market Prices obtained from Compustat Securities Daily. Financial firms and utilities are excluded. Regressions are estimated with firm fixed effects. Standard errors are clustered by Industry. Robust standard errors are in parenthesis.

	1st	2nd	3rd	All
R&D	0.007***	0.003	0.003	0.005**
	(0.003)	(0.003)	(0.005)	(0.002)
MB	-0.003	-0.004***	-0.001	-0.000
	(0.003)	(0.001)	(0.001)	(0.002)
Size	-0.164***	-0.045***	-0.012***	-0.078***
	(0.009)	(0.005)	(0.001)	(0.005)
Carry	0.004	0.004	0.000	0.005***
	(0.003)	(0.003)	(0.001)	(0.002)
CAPEX	0.080	0.051*	0.017	0.053
	(0.074)	(0.030)	(0.011)	(0.045)
Earnings	-0.065***	-0.041**	-0.020***	-0.083***
	(0.016)	(0.018)	(0.007)	(0.013)
Debt	-0.103***	-0.072***	-0.017***	-0.047***
	(0.028)	(0.018)	(0.003)	(0.019)
Net WCap	-0.017	-0.035	-0.010*	-0.025
	(0.032)	(0.022)	(0.006)	(0.021)
Dividend	0.012	0.004	-0.006**	0.009
	(0.019)	(0.008)	(0.003)	(0.009)
Constant	0.969***	0.422***	0.164***	0.645***
	(0.034)	(0.031)	(0.011)	(0.028)
R2	0.3248	0.2729	0.4090	0.2661
No. of Observations	5,985	6,314	6,696	18,995
No. Of Firms	1,248	1,217	882	2,820
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
SE Clustered by Firm	Yes	Yes	Yes	Yes

***, **, * represent significant at 1%, 5% and 10% respectively (robust standard errors in bracket)

Table 4.13.C4 Excess Cash Holdings of publicly listed UK firms 1990-2017 – Levels of Market to Book Ratio

The basic regression equations are $ECH_{it} = \alpha + \beta_1 R_{it-1} + \beta_2 M_{it-1} + \beta_4 V_{it-1} + \beta_5 CC_{it-1} + e$ E*CH*, Excess Cash Holdings, is defined as the residual of regression $CH_{it} = \alpha + \beta_1 E_{it} + \beta_2 D_{it} + \beta_3 M_{it} + \beta_4 S_{it} + \beta_5 W_{it} + \beta_6 C_{it} + \beta_7 Dv_{it} + \beta_8 R_{it} + e$. R, Research and Development, is the ratio of research and developments Expense to Sales Turnover. M, Market to Book Ratio = [(Total Assets – Total Common and Ordinary Equity) + (Common Shares Outstanding * Market Price)] / Total Assets. V, Asset Value, is the Natural Log of CPI adjusted Total assets. CC, Cost of Carry = (Cash and Short-Term Investments * 3 Month Treasury Bill Rates) / Net Assets. *CH*, Cash Holdings, is defined as Natural Log of ratio of Cash and Short-Term Investments to Net Assets. E, Net Earnings = (Earnings before Interest – Interest and related expenses – Income Taxes – Dividends) / Net Assets. D, Debt = (Long Term Debt + Debt in Current Liabilities) / Net Assets. S, Size is the natural log of CPI adjusted Net Assets. W, Net Working Capital = (Working Capital – Cash) / Net Assets. C, CAPEX, is ratio of Capital Expenditure to Net Assets. Dv, Dividend, is a dummy variable that takes the value of 1 if Dividend > 0 and 0 otherwise. Computations are based on nonfinancial firms in Standard and Poor's Compustat database. Sample period is 1991-2017. Size ($ Million) adjusted to constant 2017 Dollars. CPI figures were obtained from International aggregate Data from the UK Data Service. Market Prices obtained from Compustat Securities Daily. Financial firms and utilities are excluded. Regressions are estimated with firm fixed effects. Standard errors are clustered by Industry. Robust standard errors are in parenthesis.

	1st	2nd	3rd	All
R&D	0.006*	0.003	0.005**	0.005**
	(0.003)	(0.004)	(0.002)	(0.002)
MB	0.006	-0.000	-0.002	-0.000
	(0.007)	(0.006)	(0.002)	(0.002)
Size	-0.060***	-0.051***	-0.119***	-0.078***
	(0.006)	(0.005)	(0.009)	(0.005)
Carry	-0.002	0.006	0.010***	0.005***
	(0.004)	(0.004)	(0.002)	(0.002)
CAPEX	-0.018	0.014	-0.009	0.053
	(0.049)	(0.082)	(0.084)	(0.045)
Earnings	-0.037	-0.141***	-0.055***	-0.083***
	(0.039)	(0.030)	(0.015)	(0.013)
Debt	-0.031*	-0.034**	-0.058**	-0.047***
	(0.018)	(0.014)	(0.026)	(0.019)
Net WCap	0.009	0.007	0.002	-0.025
	(0.015)	(0.029)	(0.027)	(0.021)
Dividend	-0.011	0.001	0.021	0.009
	(0.015)	(0.014)	(0.017)	(0.009)
Constant	0.577***	0.482***	0.802***	0.645***
	(0.042)	(0.036)	(0.041)	(0.028)
R2	0.1887	0.3145	0.2820	0.2661
No. of Observations	6,404	6,386	6,205	18,995
No. Of Firms	1,609	1,794	1,507	2,820
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
SE Clustered by Firm	Yes	Yes	Yes	Yes

***, **, * represent significant at 1%, 5% and 10% respectively (robust standard errors in bracket)

Table 4.14.C5 Excess Cash Holdings of publicly listed UK firms 2002-2016 – Level of R & D

The basic regression equations are $ECH_{it} = \alpha + \beta_1 R_{it-1} + \beta_2 M_{it-1} + \beta_4 V_{it-1} + \beta_5 CC_{it-1} + e$ E*CH*, Excess Cash Holdings, is defined as the residual of regression $CH_{it} = \alpha + \beta_1 E_{it} + \beta_2 D_{it} + \beta_3 M_{it} + \beta_4 S_{it} + \beta_5 W_{it} + \beta_6 C_{it} + \beta_7 Dv_{it} + \beta_8 R_{it} + e$. R, Research and Development, is the ratio of research and developments Expense to Sales Turnover. M, Market to Book Ratio = [(Total Assets – Total Common and Ordinary Equity) + (Common Shares Outstanding * Market Price)] / Total Assets. V, Asset Value, is the Natural Log of CPI adjusted Total assets. CC, Cost of Carry = (Cash and Short-Term Investments * 3 Month Treasury Bill Rates) / Net Assets. *CH*, Cash Holdings, is defined as Natural Log of ratio of Cash and Short-Term Investments to Net Assets. E, Net Earnings = (Earnings before Interest – Interest and related expenses – Income Taxes – Dividends) / Net Assets. D, Debt = (Long Term Debt + Debt in Current Liabilities) / Net Assets. S, Size is the natural log of CPI adjusted Net Assets. W, Net Working Capital = (Working Capital – Cash) / Net Assets. C, CAPEX, is ratio of Capital Expenditure to Net Assets. Dv, Dividend, is a dummy variable that takes the value of 1 if Dividend > 0 and 0 otherwise. Computations are based on nonfinancial firms in Standard and Poor's Compustat database. Sample period is 1991-2017. Size ($ Million) adjusted to constant 2017 Dollars. CPI figures were obtained from International aggregate Data from the UK Data Service. Market Prices obtained from Compustat Securities Daily. Financial firms and utilities are excluded. Regressions are estimated with firm fixed effects. Standard errors are clustered by Industry. Robust standard errors are in parenthesis.

	1st	2nd	3rd	All
R&D	-0.092***	-0.034	0.005**	0.005**
	(0.019)	(0.023)	(0.002)	(0.002)
MB	-0.004**	0.000	-0.002	-0.000
	(0.002)	(0.002)	(0.002)	(0.002)
Size	-0.037***	-0.054***	-0.109***	-0.078***
	(0.004)	(0.005)	(0.010)	(0.005)
Carry	0.008***	-0.004	0.004**	0.005***
	(0.001)	(0.005)	(0.002)	(0.002)
CAPEX	-0.027	-0.032	0.088	0.053
	(0.024)	(0.038)	(0.075)	(0.045)
Earnings	-0.049*	-0.072*	-0.065***	-0.083***
	(0.027)	(0.039)	(0.015)	(0.013)
Debt	-0.019***	-0.042**	-0.062**	-0.047***
	(0.007)	(0.017)	(0.027)	(0.019)
Net WCap	0.016*	-0.020	-0.033	-0.025
	(0.010)	(0.021)	(0.026)	(0.021)
Dividend	-0.004	-0.001	0.019	0.009
	(0.008)	(0.016)	(0.013)	(0.009)
Constant	0.387***	0.548***	0.774***	0.645***
	(0.029)	(0.044)	(0.039)	(0.028)
R2	0.2489	0.2239	0.2825	0.2661
No. of Observations	6,001	6,506	6,488	18,995
No. Of Firms	1,336	1,247	1,128	2,820
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
SE Clustered by Firm	Yes	Yes	Yes	Yes

***, **, * represent significant at 1%, 5% and 10% respectively (robust standard errors in bracket)

Chapter 5 Concluding Remarks

This thesis presents three studies related to the influence of information asymmetry on capital structure and cash holding decisions of firms especially when they experience unusual events. The first examines the funding patterns of publicly listed UK firms during investments spikes from 1996 to 2017. The study investigates the specific implications of the pecking order theory against the background of different sizes of investments and firms. The particular focus on investment spikes is due to the existence of relatively higher levels of financing deficit during these periods. The examination of crisis and non-crisis periods also leads to an investigation of the coincidence of higher financing deficits and general market uncertainty. These scenarios present some ground for extending existing studies on the pecking order theory.

Specifically, this study examines two implications of the pecking order theory. The first test is on the choice between internal funds and external funds during investment spikes. The second implication examined is that the firms prefer debt to equity during investment spikes. We find that, on average, firms prefer external funds to internal funds. More importantly, compared to debt financing, equity financing is relatively more sensitive to financing deficits based on our full sample. When it comes to the components of financing deficits, we find that investments are the predominant determinant for seeking external funds. In numbers, £1 increase in investments requires 49 pence raised from equity issues, which is higher than the corresponding requirement of 18 pence from debt issues. On the implication that firms prefer debt to equity, our results, based on the probit model, suggests otherwise. This is particularly the case for the whole sample and small firms considered separately. Large firms, however, exhibit a preference for debt over equity financing.

We examine whether the size effect matters on the funding patterns. Our main finding is that both size of firm and investment are important in explaining differences in funding patterns of

firms, though size of the firm dominates. Our empirical evidence shows that small firms prefer issuing equity to debt to address financing deficits even during times of large investments. These findings contrast with the pecking order theory. Large firms, on their part, issue more debt than equity when there are financing deficits linked to huge investments. We can explain this result by the risk of default and repayment concerns by banks. Large firms have more capital to address potential investment opportunities. It is, therefore, more likely that banks will lend money to large firms than small firms. Furthermore, while small firms use about the same amount of external capital to fund large and regular investments, large firms use relatively more external capital to fund large investments than small investments. This state of affairs is due to small firms' higher growth levels and less tangible assets making debt less attractive.

The second paper explored the funding patterns of constrained UK private firms especially when they must fund a larger than usual level of investment. Our analysis reveals differing effects determinants of leverage have on constrained and unconstrained private firms. The greatest differences being the influence of growth and size and, to a limited extent, age on leverage. On the one hand, we find that growth has a positive and significant effect on leverage for unconstrained firms while it is negative and not statistically significant for constrained firms. On the other hand, size has a negative and significant relationship for constrained firms but a positive and insignificant, near zero influence on unconstrained firms. Though age has a negative influence for both types of firms, for unconstrained firms it is not statistically significant. This is consistent with a limited access of constrained private firms to borrowing due to their smaller size and younger age when compared with their unconstrained counterparts. This may also limit growth opportunities constrained firms can take advantage of due to limited access to external funds.

Our key interest is in how constrained firms' fund huge investments. Under such scenarios, our results indicate that leverage ratios of constrained firms are generally nonresponsive to changes

in traditional determinants of leverage during periods of huge investments. This is quite different from what obtains for unconstrained firms who show the expected highly significant negative relationship between profitability and leverage ratios. We attribute this to a relatively higher level of information asymmetry of constrained private firms. When faced with financing deficits, we find that constrained firms make changes to their equity holdings while unconstrained firms make changes to their debt holdings. We believe this is attributable to the effects of information asymmetry which limits the ability of constrained firms to address financing deficits by changing the mix of their debt and equity holdings.

Chapter 4 examines excess cash holdings of corporate firms in major European economies. Results indicate that key determinants of Excess cash when all EU firms are considered together are, Earnings (negative), Size (negative), Debt (negative), Cost of Carry (positive) and Research and Development Expenses (positive). However, when considered separately, High Technology Firms across the Sample and UK firms in isolation are the closest to the combined EU results. This is probably due to the relatively high levels of excess cash holdings of these two groupings.

However, where all firms are analysed in various quartiles of excess cash, size and debt are uniformly negative and significant determinants of Excess cash across all four quartiles as well as for all firms considered together. Thus, apart from size and debt, the key determinants of excess cash depend on the quartile of excess cash holdings a firm falls in any given period.

As suggested by Harris and Raviv (2017), when terciles of turnover growth are considered, apart from size and earnings, which are consistent across groups, the key determinants of excess cash depend on level of turnover growth for a firm in any given year. The middle tercile however dominates whenever there is a difference between groupings suggesting that the

middle group reacts the most to changes in excess cash holdings as this tercile tends to hold excess cash.

Finally, when different combinations of relative high debt and high excess cash are considered, there are differences in the magnitude and significance of variables determining the level of Excess cash holdings in these different groupings especially in relation to the influence of Research and Development and CAPEX on Excess cash holdings. The key similarities being the influence of size. This suggests that high debt high excess cash firms are different mainly because of their relatively larger investments in research and development and CAPEX.

5.1 Limitations and Further Research

The papers have been set against the background of the pecking order theory and the influence of information asymmetry on the capital structure and cash holding decisions of firms. These theories inherently imply that interest rates are positive and thus there will be a positive financial cost to holding debt and / or excess cash. However, it will be interesting to see what obtains in a negative interest rate regime against the background of relevant interest rate theories.

The papers have also been examined within the context of more traditional financing instruments like internal cash, debt and equity. It would be interesting to see how the financing and investing dynamics change when non-traditional funding sources like equity crowd funding, peer to peer lending, venture capital financing and angel financing are brought into the mix for private firms.

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